

Cornell University Library

The original of this book is in
the Cornell University Library.

There are no known copyright restrictions in
the United States on the use of the text.

Cornell University Library

UA24 .A15 Index

v.2

Index to the reports of the chief of eng



3 1924 032 521 589

olin

INDEX

TO THE

Reports of The Chief of Engineers, U. S. Army (Including the Reports of the Isthmian Canal Commissions, 1899-1914)

1866-1912

VOLUME I—RIVERS AND HARBORS
VOLUME II—FORTIFICATIONS, BRIDGES
PANAMA CANAL, ETC.



Completed under the direction of
BRIG. GEN. DAN C. KINGMAN, Chief of Engineers, U. S. Army
By COLONEL GEORGE A. ZINN, Corps of Engineers
John McClure, Compiler

VOLUME II

FORTIFICATIONS, BRIDGES
PANAMA CANAL, ETC.

FEBRUARY 16, 1914.—Referred to the Committee on Rivers and Harbors
and ordered to be printed, with illustrations

WASHINGTON
GOVERNMENT PRINTING OFFICE

1916

De

UA
24

A15

Index

V.2



Transferred from Constable

X- C.3221

RD

CONTENTS.

VOLUME I.

| | Page. |
|--|--------------|
| Map, United States River and Harbor Districts (in colors)..... | Frontispiece |
| Letter of transmittal by Secretary of War..... | 5 |
| Letter of submittal by the Chief of Engineers, United States Army..... | 7 |
| Preface and guide to use of index..... | 9-22 |

PART I. RIVERS AND HARBORS.

NORTH ATLANTIC COAST.

District:

| | |
|--------------------------------|-----|
| A. Portland, Me..... | 23 |
| B. Boston, Mass..... | 67 |
| C. Newport, R. I..... | 105 |
| D. New London, Conn..... | 139 |
| E. New York, N. Y., No. 1..... | 175 |
| F. New York, N. Y., No. 2..... | 213 |
| G. New York, N. Y., No. 3..... | 245 |
| H. Philadelphia, Pa..... | 269 |
| I. Wilmington, Del..... | 295 |

SOUTH ATLANTIC COAST.

| | |
|--------------------------|-----|
| J. Baltimore, Md..... | 329 |
| K. Washington, D. C..... | 371 |
| L. Norfolk, Va..... | 409 |
| M. Wilmington, N. C..... | 451 |
| N. Charleston, S. C..... | 497 |
| O. Savannah, Ga..... | 531 |

GULF OF MEXICO COAST.

| | |
|---------------------------|-----|
| P. Jacksonville, Fla..... | 567 |
| Q. Montgomery, Ala..... | 609 |
| R. Mobile, Ala..... | 643 |
| S. New Orleans, La..... | 679 |
| T. Dallas, Tex..... | 715 |
| U. Galveston, Tex..... | 731 |

LOWER MISSISSIPPI SYSTEM.

| | |
|--|-----|
| V. New Orleans, La. (4th M. R. C.)..... | 779 |
| W. Vicksburg, Miss. (3d M. R. C.)..... | 781 |
| X. Vicksburg, Miss..... | 783 |
| Y. Little Rock, Ark..... | 815 |
| Z. Memphis, Tenn. (1st and 2d M. R. C.)..... | 841 |

OHIO RIVER SYSTEM.

| | |
|--|-------|
| District: | Page. |
| AA. Chattanooga and Nashville, Tenn..... | 843 |
| BB. Louisville, Ky..... | 889 |
| CC. Cincinnati, Ohio (Ohio River)..... | 905 |
| DD. Cincinnati, Ohio, No. 2..... | 957 |
| EE. Wheeling, W. Va..... | 981 |
| FF. Pittsburgh, Pa..... | 1001 |

MISSOURI RIVER SYSTEM.

| | |
|--------------------------|------|
| GG. Kansas City, Mo..... | 1023 |
|--------------------------|------|

MISSISSIPPI RIVER.

| | |
|----------|------|
| HH. | 1067 |
|----------|------|

UPPER MISSISSIPPI SYSTEM.

| | |
|---------------------------|------|
| II. St. Louis, Mo..... | 1227 |
| JJ. Rock Island, Ill..... | 1231 |
| KK. St. Paul, Minn..... | 1245 |

GREAT LAKES SYSTEM.

| | |
|-----------------------------|------|
| LL. Duluth, Minn..... | 1263 |
| MM. Milwaukee, Wis..... | 1295 |
| NN. Chicago, Ill..... | 1347 |
| OO. Grand Rapids, Mich..... | 1375 |
| PP. Detroit, Mich..... | 1417 |
| QQ. Cleveland, Ohio..... | 1459 |
| RR. Buffalo, N. Y..... | 1491 |

PACIFIC COAST.

| | |
|-------------------------------------|------|
| SS. Los Angeles, Cal..... | 1541 |
| TT. San Francisco, Cal., No. 1..... | 1553 |
| UU. San Francisco, Cal., No. 3..... | 1575 |
| VV. Portland, Oreg., No. 1..... | 1591 |
| WW. Portland, Oreg., No. 2..... | 1613 |
| XX. Seattle, Wash..... | 1653 |

INSULAR POSSESSIONS.

| | |
|----------------------------------|------|
| YY. Porto Rico, Hawaii, etc..... | 1683 |
|----------------------------------|------|

| | |
|---|------|
| Alphabetical finding list, United States waterways..... | 1693 |
|---|------|

VOLUME II.

| | |
|------------------------------|------|
| PART II. FORTIFICATIONS..... | 1793 |
|------------------------------|------|

PART III. MISCELLANEOUS.

| | |
|--|------|
| Miscellaneous (District of Columbia; Great Lakes Surveys; National Parks; Corps of Engineers, United States Army; Explorations, etc.)..... | 2035 |
|--|------|

PART IV. SPECIAL SUBJECTS.

| | |
|--|------|
| Special subjects (Bridges, Dams, Harbor lines, Wrecks, Contractors, Engineers, Abstract of laws, Floating plant, Summary of appropriations and commerce..... | 2137 |
|--|------|

| | |
|---|-------------|
| PART V. PANAMA CANAL. | Page. |
| Reports of the Isthmian Canal (Panama Canal) Commissions..... | 2357 |
| PART VI. TOPICAL INDEX. | |
| Topical index to engineering and physical data | 2623 |
| PART VII. GENERAL FINDING LIST. | |
| Consolidated finding list to Volumes I and II | 2849 |
| NOTES.—To pages 1-1791 | 2779 |

ILLUSTRATIONS.

| | |
|--|--------------|
| | Pages. |
| Colored map of the United States showing elevations and outlining districts under the care of the Corps of Engineers, United States Army..... | Frontispiece |
| District maps (see immediately following the title page of each engineering district in Volume I). | |
| The Panama Canal | 2357 |
| Engineering constructions. Seventy-two sets of photographs showing engi- neering constructions performed under the direction of the Corps of Engi- neers, United States Army | 2625 |

GUIDE TO USE OF INDEX.

Order of subjects.—The subjects considered are classified and appear in the following order:

- Rivers and harbors.
- Fortifications.
- Miscellaneous.
- Bridges.
- Dams, dolphins, and weirs.
- Harbor lines.
- Wrecks.
- Engineers.
- Contractors.
- Floating plant.
- Appropriations.
- Panama Canal.

Arrangement of data.—Rivers and harbors, and fortifications, are arranged in *geographical* order, other data in *special* or *alphabetical* order. Each subject is treated independently of the others.

Subdivisions of subjects.—Lists of titles of such subdivisions appear at the beginning of each subject. Page figures attached to data almost always refer to reports of Chief of Engineers; where they refer to other matter, this is made clear.

Explanatory notes appear at the beginning of each subject, the topical index, and the alphabetical finding lists.

Topical index.—This part of the index covers engineering, physical and miscellaneous information, the *subject names* arranged in alphabetical sequence, and is not otherwise indexed.

Alphabetical finding lists.—Several alphabetical finding lists are provided, as follows:

(a) A general or consolidated finding list for both volumes, at the back of Volume II, forming Part VII of the work, containing the names of important waterways, fortifications, bridges, etc., referred to in both volumes.

(b) A finding list at the back of Volume I, containing the names of waterways listed in Volume I, Part I of this work.

(c) A finding list for each of the following rivers—Ohio, Missouri, Mississippi, and Columbia—immediately preceding the abstracts of those rivers, containing references to each point and section mentioned in the abstracts.

Maps.—A map of the United States divided into districts appears at the beginning of Vol. I and district maps at the beginning of each river and harbor district. There is a map of the Panama Canal in Part V.

Illustrations.—Views of typical classes of construction appear in the topical part under the subject "Construction."

References.—References in all parts of the main index are to year and page of *reports* of the Chief of Engineers, etc., *except* in the alphabetical finding lists, where the paging refers to *this book*. Deviations from this rule are usually embraced in footnotes, or are inclosed in parenthesis.

ABBREVIATIONS.¹

The following is a list of the more important abbreviations employed:

| | | | |
|---------|--|-----------|-------------------------------------|
| au. | authority | misc. | miscellaneous |
| * | allotment | min. | minimum |
| an. | annual, annually | mainten. | maintenance, maintaining |
| approx. | approximate | mlw. | mean low water |
| B. | Bay, Board | n. | north |
| BE. | Board of Engineers | obstr. | obstruction |
| BERH. | Board of Engineers for Rivers and Harbors | orig. | original |
| break'r | breakwater | proj. | project |
| br. | bridge | pre. | preliminary |
| C. | commerce, commercial | pt. | point |
| constr. | construction | p. | pier |
| chan. | channel | P. | Panama |
| ¢ | cents | % | per cent |
| cy. | cubic yard | RR. | railroad |
| DO. | District Officer or Engineer | revet. | revetment |
| dw. | deep water | R. | (in blackface type) for Re- port |
| dr. | dredging | R. | river |
| DE. | Division Engineer | recom. | recommended, recommen- dations |
| e. | east | Sec. War | Secretary of War |
| est. | estimate | SS. | steamboats |
| estab. | establishment | s. | south, or supplement |
| ex. | examination | st. | stone |
| expend. | expenditures, expending | sur. | survey |
| Engrs. | Engineers (Chief of Engi- neers in full) | sq. | square |
| fav. | favorable | St. | street |
| h. | high | superstr. | superstructure |
| H. | Harbor | t. | ton, tonnage |
| imp. | improvement | Treas. | Treasury, Treasurer |
| j. | jetty | U.S. | United States, government |
| l. | long, length, lengthening | unfav. | unfavorable |
| l. & d. | lock and dam | vol. | volume |
| m. | miles | w. | west |
| max. | maximum | | |

There are other abbreviations, such as Capt. for Captain, and the like, but all these should require no explanation.

Waterway dimensions are in numerals, in the order of depth and width and length, as 18' x 100' x 12 m.

02, S49, means the annual report for 1902, supplement, page 49. P12, 403, means the report of the Panama or I. C. Commission for 1912, page 403. (See below.)

PAGE AND VOLUME REFERENCE.

The volume references are in black figures and the page references in ordinary roman. 88, 786 means the annual reports for 1888, page 786. 1900 is indicated by 00. The years from 1901 to 1912 are indicated by 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12. Some

¹ Not a few instances may be found where words are not abbreviated according to this list. These may be instances where a group of abbreviations might obscure the meaning. In most cases, however, the abbreviations in the list are employed.

of the earlier references have lower-case i's after them, in which case "i" means the first volume, "ii" the second volume, and so on. **R** always means Report.

PAGING OF THE ANNUAL REPORTS.

Table showing what page ends each part of the annual reports of the Chief of Engineers, U. S. Army, from 1866 to 1912.

| Year. | Part 1. | Part 2. | Part 3. | Part 4. | Part 5. | Part 6. | Part 7. | Part 8. |
|------------|---------|----------|---------|---------|-----------|-----------|---------|---------|
| 1866..... | a 1-58 | a 1-238 | a 1-40 | a 1-336 | ..... | ..... | ..... | ..... |
| 1867..... | 867 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1868..... | 1200 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1869..... | 650 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1870..... | 631 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1871..... | 1030 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1872..... | 1174 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1873..... | 1249 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1874..... | 897 | b 1-633 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1875..... | 982 | b 1-1245 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1876..... | 767 | b 1-700 | b 1-755 | ..... | ..... | ..... | ..... | ..... |
| 1877..... | 836 | 1455 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1878..... | 840 | 1354 | 1883 | ..... | ..... | ..... | ..... | ..... |
| 1879..... | 950 | 1890 | 2399 | ..... | ..... | ..... | ..... | ..... |
| 1880..... | 1047 | 1873 | 2556 | ..... | ..... | ..... | ..... | ..... |
| 1881..... | 1042 | 1898 | 2877 | ..... | ..... | ..... | ..... | ..... |
| 1882..... | 1068 | 1908 | 2856 | ..... | ..... | ..... | ..... | ..... |
| 1883..... | 1045 | 1960 | 2413 | ..... | ..... | ..... | ..... | ..... |
| 1884..... | 886 | 1530 | 2406 | 2903 | ..... | ..... | ..... | ..... |
| 1885..... | 916 | 1660 | 2533 | 3032 | ..... | ..... | ..... | ..... |
| 1886..... | 800 | 1392 | 2170 | ..... | ..... | ..... | ..... | ..... |
| 1887..... | 962 | 1735 | 2525 | 3152 | ..... | ..... | ..... | ..... |
| 1888..... | 753 | 1417 | 2190 | 2941 | ..... | ..... | ..... | ..... |
| 1889..... | 845 | 1533 | 2208 | 2880 | ..... | ..... | ..... | ..... |
| 1890..... | 1035 | 1818 | 2854 | 3718 | ..... | ..... | ..... | ..... |
| 1891..... | 975 | 1499 | 1943 | 2606 | 3395 | 3948 | ..... | ..... |
| 1892..... | 1003 | 1958 | 2885 | 3545 | Atlas. | ..... | ..... | ..... |
| 1893..... | 1140 | 1793 | 2649 | 3544 | 3919 | 4404 | ..... | ..... |
| 1894..... | 828 | 1332 | 2008 | 2896 | 3074 | 3591 | ..... | ..... |
| 1895..... | 1020 | 1724 | 2525 | 3070 | 3615 | 3956 | 4301 | ..... |
| 1896..... | 680 | 1338 | 2060 | 2672 | 3401 | 4196 | ..... | ..... |
| 1897..... | 1190 | 1876 | 2648 | 3503 | 3835 | 4225 | ..... | ..... |
| 1898..... | 1374 | 1686 | 2414 | 3135 | 3458 | 3855 | ..... | ..... |
| 1899..... | 1206 | 2045 | 2724 | 3290 | 3653 | 4002 | ..... | ..... |
| 1900..... | 1072 | 1792 | 2306 | 2906 | 3946 | 4524 | 5008 | 5535 |
| 1901..... | 989 | 1750 | 2596 | 3462 | 3933 | c d 1-428 | ..... | ..... |
| 1902..... | 991 | 1876 | 2565 | 3265 | c d 1-215 | ..... | ..... | ..... |
| 1903..... | 1026 | 1885 | 2370 | 3012 | c 1-318 | ..... | ..... | ..... |
| 1904*..... | 1362 | 2403 | 3580 | 4315 | c 1-298 | ..... | ..... | ..... |
| 1905..... | 1234 | 2239 | 3036 | c 1-300 | ..... | ..... | ..... | ..... |
| 1906..... | 1432 | 2609 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1907..... | 982 | 1866 | 2768 | ..... | ..... | ..... | ..... | ..... |
| 1908..... | 1253 | 2168 | 2833 | ..... | ..... | ..... | ..... | ..... |
| 1909..... | 1271 | 2161 | 2845 | ..... | ..... | ..... | ..... | ..... |
| 1910..... | 1374 | 2338 | 3110 | ..... | ..... | ..... | ..... | ..... |
| 1911..... | 1314 | 2508 | 3365 | ..... | ..... | ..... | ..... | ..... |
| 1912..... | 1404 | 2682 | 3988 | ..... | ..... | ..... | ..... | ..... |

a Bound with the three other parts into one volume.

b Each part begins with page No. 1.

c Mississippi River Commission.

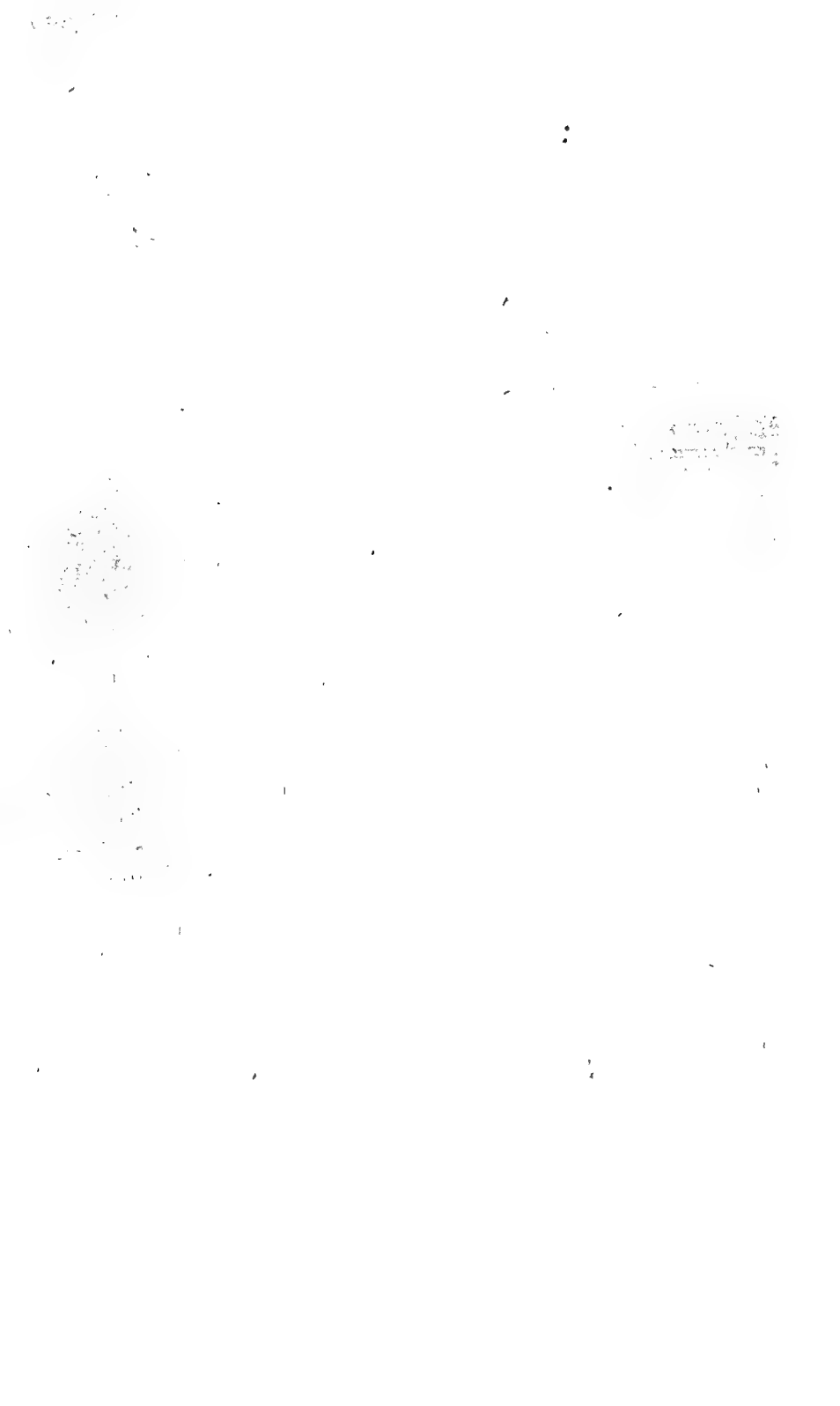
d Includes Missouri River Commission Reports.

* After this date there is a noticeable compression of volumes, due to less work on fortifications and to issue of reports on examination and surveys as congressional documents.

PART II.

FORTIFICATIONS.

NOTE.—The special and necessary form of the fortification reports is such that probably no two persons would index them alike in detail. This index will, however, be clearly intelligible to those who have charge of the works referred to.



GUIDE TO THE USE OF PART II.

1. Alphabetical finding list.
2. Order of arrangement of the data.
3. Explanation of subheads employed.

1. ALPHABETICAL FINDING LIST AT THE BACK OF THIS INDEX.

There is a general finding list at the back of this book, made up of names of the various localities named throughout this index, including, of course, the names of places at which fortification work has been done. Under each name of a locality reference is made to the pages of this index on which data pertaining to the place named will be found. The first page of the finding list presents details explaining further the uses of the finding list.

2. ORDER OF ARRANGEMENT OF FORTIFICATION DATA.

The data concerning fortifications, as found in the reports of the Chief of Engineers, are, in this index, arranged under the following two heads or classes:

Section 1. General data, arranged according to table below.

Section 2. Fortification works, arranged according to geographical situation (see table below).

SECTION 1—GENERAL DATA.

NOTE.—A combination of symbolic letters is given each related group of facts concerning fortifications. This is done for convenience in making reference and in arranging details.

The first letter is always F. This letter is the initial of "fortifications."

The second letter may be any one of the following:

M for Miscellaneous.

N for North Atlantic works.

S for South Atlantic works.

G for Gulf of Mexico works.

L for Great Lakes works.

P for Pacific coast works.

O for Insular or Oversea.

The third or the third and fourth letters refer to the waterways district in which the defenses are situated, and hence to the office in charge. (See frontispiece map.) An exception is made in the case of FM data, the third letter indicating sequence only.

Illustration: FMD means "fortifications," "miscellaneous data" concerning "preservation or repair," which is fourth or D in the list of general data.

Illustration: FNH refers to "fortifications," "North Atlantic Group," waterways district H.

Illustration: FPSS refers to "fortifications," "Pacific coast," waterways district SS.

MISCELLANEOUS.

| | |
|-----|---|
| FMA | Appropriations. |
| FMB | Boards. |
| FMC | Operations, general. |
| FMD | Preservation and repair. |
| FME | Range and position finders, and fire control. |
| FMF | Searchlights and electrical equipment. |
| FMG | Sites, batteries, and emplacements. |
| FMH | Supplies. |
| FMI | Torpedoes and mining. |
| FMJ | Sea walls and embankments. |

SECTION 2—FORTIFICATION WORKS.

North Atlantic works:

| | |
|-----|---------------------------------------|
| FNA | Maine and New Hampshire Group. |
| FNB | Boston Group. |
| FNC | Massachusetts and Rhode Island Group. |
| FND | Connecticut Group. |
| FNF | New York City Group. |
| FNH | Delaware River Group. |

South Atlantic works:

| | |
|-----|-----------------------|
| FSJ | Baltimore Group. |
| FSK | Washington Group. |
| FSL | Hampton Roads Group. |
| FSM | North Carolina Group. |
| FSN | South Carolina Group. |
| FSO | Georgia Group. |

Gulf of Mexico works:

| | |
|-----|---|
| FGP | East and south Florida and Tampa Group. |
| FGQ | Pensacola Group. |
| FGR | Mobile and Mississippi Sound Group. |
| FGS | New Orleans and Sabine Pass Group. |
| FGU | Galveston Group. |

Great Lakes works:

| | |
|------|----------------|
| FLPP | Detroit Group. |
| FLRR | Buffalo Group. |

Pacific coast works:

| | |
|-------|-----------------------|
| FPSS | San Diego Group. |
| FPTT* | San Francisco Group. |
| FPWW | Columbia River Group. |
| FPXX | Puget Sound Group. |

Oversea works:

| | |
|------|-----------------------------------|
| FOPR | Porto Rico Group. |
| FOPI | Philippines Group. |
| FOHI | Hawaiian Group. |
| FOPC | Panama Canal or Isthmian America. |

* In charge of a special office.

3. EXPLANATION OF SUBHEADS.

NOTE.

The names of centers of coast defense are arranged in groups in geographical order as shown in section 2, p. 1796 of this index.

Under each name the following subheads are arranged in the order in which they are placed below, and the data pertaining to each of these subheads are given in historical order, except in the case of engineering features, the latter being arranged alphabetically.

Contracts.—Important contracts, etc., the more important articles, prices, quantities, being mentioned.

Engineers.—Subdivided into: References to reports of the Chief of Engineers; Boards and their duties; Engineers in charge, showing term of service; Assistants.

Engineering features.—Cost of work, electric installations, arrangement of plant, these and other data under this head being arranged in alphabetical order.

Forts and batteries.—Such works are arranged separately in the order of mention. Under each work brief abstracts of operations by years are given.

Miscellaneous.—References to data not coming properly under the other subheads.

Preservation and repair.—References to work relating to preservation and repair.

Range and position finders.—Important items concerning these instruments.

Sea walls and embankments.—The more important data relating to these structures.

Sites.—Acquisition, lease, sale, etc., of sites.

Submarine mines.—Data relating to torpedo casemates, storehouses, cable tanks, searchlights, etc.

FORTIFICATIONS.

SECTION I.—INDEX TO GENERAL DATA.

| | |
|---|---|
| FMA APPROPRIATION. | FMG SITES, BATTERIES, AND EMPLACEMENTS. |
| FMB BOARDS. | FMH SUPPLIES. |
| FMC OPERATION—GENERAL. | FMI TORPEDOES AND MINING. |
| FMD PRESERVATION AND REPAIR. | FMJ SEA WALLS AND EMBANKMENTS. |
| FME RANGE AND POSITION FINDER AND FIRE CONTROL. | |
| FMF SEARCHLIGHTS AND ELECTRICAL EQUIPMENT. | |

FMA.

APPROPRIATIONS.

| Part. | Title. |
|-------|---|
| 1 | Appropriation, by States, etc., and by years. |
| 2 | Summary of totals for States. |

Part 1, FMA. Appropriations by States, Forts, etc., and by years.

ALABAMA:

| | | |
|----------------------------|----------------|---------------------|
| Fort Gaines— | | |
| 1825-60..... | | \$453,947.78 |
| Fort Morgan, Mobile Point— | | |
| 1821-56..... | \$1,317,251.09 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | | <u>1,342,251.09</u> |
| Total..... | | <u>1,796,198.87</u> |

ARKANSAS:

| | | |
|--------------|--|------------|
| Fort Smith— | | |
| 1836-44..... | | 152,707.71 |

CALIFORNIA:

| | | |
|---|--------------|---------------------|
| San Francisco, defenses of (See Batteries, Pneumatic, under Miscellaneous)— | | |
| 1853-65..... | 1,027,000.00 | |
| Mar. 2, 1889..... | 22,000.00 | |
| | | <u>1,049,000.00</u> |
| Fort Alcatraz— | | |
| 1854-65..... | 1,295,000.00 | |
| June 12, 1866..... | 90,000.00 | |
| Mar. 2, 1867..... | 50,000.00 | |
| July 11, 1870..... | 50,000.00 | |
| Mar. 3, 1871..... | 75,000.00 | |
| June 10, 1872..... | 42,500.00 | |
| Feb. 21, 1873..... | 50,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | | <u>1,697,500.00</u> |
| Fort at Fort Point— | | |
| 1854-65..... | 2,012,500.00 | |
| June 12, 1866..... | 125,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| July 11, 1870..... | 100,000.00 | |
| Mar. 3, 1871..... | 50,000.00 | |
| June 10, 1872..... | 85,000.00 | |
| Feb. 21, 1873..... | 65,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | | <u>2,517,500.00</u> |
| Fort at Lime Point— | | |
| June 12, 1866..... | 75,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| July 11, 1870..... | 100,000.00 | |
| Mar. 3, 1871..... | 100,000.00 | |
| June 10, 1872..... | 75,000.00 | |
| Feb. 21, 1873..... | 75,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Jan. 10, 1875..... | 20,000.00 | |
| | | <u>500,000.00</u> |

1802 INDEX TO REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

CALIFORNIA—Continued.

| | |
|---------------------|---------------------|
| Fort at San Diego— | |
| Feb. 21, 1873..... | \$0,000.00 |
| Yerba Buena Island— | |
| Feb. 24, 1891..... | 16,000.00 |
| Total..... | <u>5,830,000.00</u> |

CONNECTICUT:

| | |
|--------------------|-------------------|
| Fort Griswold— | |
| 1841-42..... | 15,000.00 |
| Fort Hale— | |
| 1865..... | 50,000.00 |
| Fort Trumbull— | |
| 1833-50..... | \$250,400.00 |
| Apr. 3, 1874..... | 25,000.00 |
| Feb. 10, 1875..... | 20,000.00 |
| | <u>295,400.00</u> |
| Total..... | <u>360,400.00</u> |

DELAWARE:

| | |
|------------------------------|---------------------|
| Fort Delaware— | |
| 1821-63..... | 2,041,208.98 |
| July 11, 1870..... | 37,000.00 |
| Apr. 3, 1874..... | 25,000.00 |
| | <u>2,103,208.98</u> |
| Fort opposite Fort Delaware— | |
| 1862..... | 200,000.00 |
| Mar. 3, 1871..... | 50,000.00 |
| June 10, 1872..... | 42,500.00 |
| Feb. 21, 1873..... | 35,000.00 |
| Apr. 2, 1874..... | 30,000.00 |
| Feb. 10, 1875..... | 25,000.00 |
| | <u>382,500.00</u> |
| Total..... | <u>2,485,708.98</u> |

DISTRICT OF COLUMBIA:

| | |
|--------------------------|---------------------|
| Washington, defenses of— | |
| 1862-65..... | <u>1,250,000.00</u> |

FLORIDA:

| | |
|--------------------|---------------------|
| Fort Barrancas— | |
| 1838-57..... | 523,500.00 |
| Fort Clinch— | |
| 1846-65..... | 700,000.00 |
| June 12, 1866..... | 50,000.00 |
| Mar. 2, 1867..... | 12,500.00 |
| | <u>762,500.00</u> |
| Fort Jefferson— | |
| 1844-65..... | 2,725,000.00 |
| June 12, 1866..... | 50,000.00 |
| Mar. 2, 1867..... | 25,000.00 |
| Mar. 3, 1871..... | 42,500.00 |
| June 10, 1872..... | 42,500.00 |
| Feb. 21, 1873..... | 50,000.00 |
| | <u>2,935,000.00</u> |
| Fort Marion— | |
| 1833-49..... | 139,766.96 |
| July 5, 1884..... | 5,000.00 |
| Aug. 18, 1890..... | 15,000.00 |
| | <u>159,766.96</u> |
| Fort McRea— | |
| 1833-60..... | 447,000.00 |
| Fort Pickens— | |
| 1823-57..... | 766,223.31 |
| Feb. 10, 1875..... | 25,000.00 |
| | <u>791,223.31</u> |

FLORIDA—Continued.

Fort Taylor, Key West—

| | | |
|--------------------|-----------------------|---------------------|
| 1848-65..... | \$2,160,000.00 | |
| June 12, 1866..... | 100,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| June 10, 1872..... | 42,500.00 | |
| Feb. 21, 1873..... | 50,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| Feb. 10, 1875..... | 15,000.00 | |
| | <u>\$2,412,500.00</u> | |
| Total..... | | <u>8,031,490.27</u> |

GEORGIA:

Fort Jackson—

| | | |
|--------------------|-------------------|--|
| 1823-57..... | 270,000.00 | |
| June 10, 1872..... | 15,000.00 | |
| | <u>285,000.00</u> | |

Fort Pulaski—

| | | |
|--------------------|---------------------|---------------------|
| 1830-57..... | 882,308.56 | |
| Mar. 3, 1871..... | 26,500.00 | |
| June 10, 1872..... | 25,000.00 | |
| Feb. 21, 1873..... | 50,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | <u>1,028,808.56</u> | |
| Total..... | | <u>1,313,808.56</u> |

INDIAN TERRITORY:

Fort Towson—

| | | |
|--------------|-----------|--|
| 1842-44..... | 16,000.00 | |
|--------------|-----------|--|

LOUISIANA:

Bayou Bienvenue, battery at—

| | | |
|--------------|------------|--|
| 1826-50..... | 113,951.80 | |
|--------------|------------|--|

Fort Jackson—

| | | |
|--------------------|---------------------|--|
| 1822-63..... | 895,692.00 | |
| Mar. 3, 1871..... | 50,000.00 | |
| June 10, 1872..... | 64,000.00 | |
| Feb. 21, 1873..... | 65,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | <u>1,129,692.00</u> | |

Fort Livingston—

| | | |
|--------------|------------|--|
| 1833-57..... | 385,000.00 | |
|--------------|------------|--|

Fort Macomb—

| | | |
|--------------|-----------|--|
| 1831-57..... | 52,180.00 | |
|--------------|-----------|--|

Fort Pike, the Rigolets—

| | | |
|--------------|------------|--|
| 1821-54..... | 660,192.00 | |
|--------------|------------|--|

Fort at Proctors Landing, Lake Borgne—

| | | |
|--------------|------------|--|
| 1855-57..... | 150,000.00 | |
|--------------|------------|--|

Fort St. Philip—

| | | |
|--------------------|-------------------|--|
| 1840-63..... | 363,300.00 | |
| Mar. 3, 1871..... | 37,500.00 | |
| June 10, 1872..... | 42,500.00 | |
| Feb. 21, 1873..... | 50,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | <u>548,300.00</u> | |

Tower Dupre—

| | | |
|--------------|-----------|--|
| 1829-57..... | 35,077.41 | |
|--------------|-----------|--|

| | | |
|------------|--|---------------------|
| Total..... | | <u>3,074,393.21</u> |
|------------|--|---------------------|

1804 INDEX TO REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-191

MAINE:

Battery on Portland Head—

| | | |
|--------------------|-------------|-----------|
| June 10, 1872..... | \$50,000.00 | |
| Feb. 10, 1875..... | 20,000.00 | \$70,000. |

Fort Gorges—

| | | |
|--------------------|------------|----------|
| 1857-65..... | 730,000.00 | |
| June 12, 1866..... | 50,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| Mar. 3, 1871..... | 15,000.00 | |
| June 10, 1872..... | 20,000.00 | 840,000. |

Fort Knox—

| | | |
|--------------|--|----------|
| 1841-65..... | | 930,000. |
|--------------|--|----------|

Fort McClary—

| | | |
|-------------------|------------|----------|
| 1840-65..... | 214,250.00 | |
| Mar. 2, 1867..... | 25,000.00 | 239,250. |

Fort Popham—

| | | |
|--------------------|------------|----------|
| 1857-65..... | 375,000.00 | |
| June 12, 1866..... | 50,000.00 | 425,000. |

Fort Preble—

| | | |
|--------------------|------------|----------|
| 1833-65..... | 412,970.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| Mar. 3, 1871..... | 28,500.00 | |
| June 10, 1872..... | 42,500.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| Feb. 10, 1875..... | 10,000.00 | 578,970. |

Fort Scammel—

| | | |
|--------------------|------------|----------|
| 1840-65..... | 428,400.00 | |
| June 12, 1866..... | 35,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| Mar. 3, 1871..... | 50,000.00 | |
| June 10, 1872..... | 42,500.00 | |
| Feb. 21, 1873..... | 50,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 20,000.00 | 680,900. |

Total..... 3,764,120.

MARYLAND:

Fort Carroll—

| | | |
|--------------|--|------------|
| 1846-64..... | | 1,375,000. |
|--------------|--|------------|

Fort Foote—

| | | |
|--------------------|-----------|---------|
| June 10, 1872..... | 21,000.00 | |
| Feb. 21, 1873..... | 25,000.00 | 46,000. |

Fort at Lazaretto Point—

| | | |
|--------------------|--|---------|
| June 10, 1872..... | | 13,000. |
|--------------------|--|---------|

Fort Madison—

| | | |
|--------------|--|---------|
| 1841-57..... | | 55,600. |
|--------------|--|---------|

Fort McHenry—

| | | |
|--------------------|-----------|----------|
| 1829-38..... | 84,005.40 | |
| June 10, 1872..... | 21,000.00 | |
| Feb. 21, 1873..... | 25,000.00 | |
| Feb. 10, 1875..... | 20,000.00 | 150,005. |

Fort Washington—

| | | |
|--------------------|------------|----------|
| 1821-65..... | 238,000.00 | |
| June 12, 1866..... | 20,000.00 | |
| Mar. 2, 1867..... | 12,500.00 | |
| June 10, 1872..... | 21,000.00 | |
| Feb. 21, 1873..... | 25,000.00 | 316,500. |

Total..... 1,955,505.

MASSACHUSETTS:**Battery on Long Island Head, Boston Harbor—**

| | | |
|--------------------|------------|--------------|
| Mar. 28, 1867..... | \$5,000.00 | |
| Mar. 3, 1871..... | 37,500.00 | |
| Apr. 3, 1874..... | 40,000.00 | |
| Feb. 10, 1875..... | 30,000.00 | |
| | | \$112,500.00 |

Fort at Clarks Point, New Bedford Harbor—

| | | |
|--------------------|------------|------------|
| 1857-65..... | 650,000.00 | |
| June 12, 1866..... | 30,000.00 | |
| Mar. 2, 1867..... | 15,000.00 | |
| | | 695,000.00 |

Fort Independence—

| | | |
|--------------------|------------|------------|
| 1832-65..... | 531,094.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| Mar. 3, 1871..... | 27,500.00 | |
| July 11, 1871..... | 53,000.00 | |
| June 10, 1872..... | 42,500.00 | |
| Feb. 21, 1873..... | 35,000.00 | |
| | | 714,094.00 |

Fort Warren—

| | | |
|--------------------|--------------|--------------|
| 1833-65..... | 1,323,000.00 | |
| June 12, 1866..... | 25,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| July 11, 1870..... | 100,000.00 | |
| Mar. 3, 1871..... | 50,000.00 | |
| June 10, 1872..... | 85,000.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | | 1,673,000.00 |

Fort Winthrop—

| | | |
|--------------------|------------|--------------|
| 1841-65..... | 385,000.72 | |
| June 12, 1866..... | 30,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| July 11, 1870..... | 69,000.00 | |
| Mar. 3, 1871..... | 45,500.00 | |
| June 10, 1872..... | 64,000.00 | |
| Feb. 21, 1873..... | 50,000.00 | |
| | | 668,500.72 |
| Total..... | | 3,863,094.72 |

MICHIGAN:**Fort at Green Bay—**

| | | |
|-----------|--|-----------|
| 1834..... | | 10,000.00 |
|-----------|--|-----------|

Fort Wayne—

| | | |
|--------------------|------------|------------|
| 1841-65..... | 275,000.00 | |
| June 12, 1866..... | 50,000.00 | |
| | | 325,000.00 |
| Total..... | | 335,000.00 |

MISSISSIPPI:**Fort at Ship Island—**

| | | |
|--------------------|------------|------------|
| 1857-65..... | 545,000.00 | |
| June 12, 1866..... | 10,000.00 | |
| Total..... | | 555,000.00 |

NEW HAMPSHIRE:**Battery in Portsmouth Harbor—**

| | | |
|--------------------|------------|------------|
| 1862-65..... | 550,000.00 | |
| Feb. 21, 1873..... | 50,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 20,000.00 | |
| | | 650,000.00 |

Fort Constitution—

| | | |
|--------------------|------------|--------------|
| 1826-65..... | 336,771.00 | |
| June 12, 1866..... | 75,000.00 | |
| | | 411,771.00 |
| Total..... | | 1,061,771.00 |

NEW JERSEY:**Battery at Finns Point—**

| | | |
|--------------------|-------------|---------------------|
| July 11, 1870..... | \$33,500.00 | |
| Mar. 3, 1871..... | 20,000.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | | \$148,500.00 |

Fort at Sandy Hook—

| | | |
|--------------------|--------------|---------------------|
| 1857-65..... | 1,050,000.00 | |
| June 12, 1866..... | 50,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| Aug. 1, 1894..... | 7,500.00 | |
| Mar. 3, 1897..... | 75,000.00 | |
| | | 1,207,500.00 |

Total..... **1,356,000.00**

NEW YORK:**Battery Hudson—**

| | | |
|--------------------|------------|-------------------|
| 1850-64..... | 385,000.00 | |
| July 11, 1870..... | 30,000.00 | |
| Mar. 3, 1871..... | 16,500.00 | |
| June 10, 1872..... | 17,000.00 | |
| Feb. 21, 1873..... | 29,000.00 | |
| Apr. 3, 1874..... | 13,000.00 | |
| Feb. 10, 1875..... | 15,000.00 | |
| | | 505,500.00 |

Battery at Willets Point—

| | | |
|--------------------|------------|---------------------|
| 1857-65..... | 950,000.00 | |
| June 12, 1866..... | 50,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| July 11, 1870..... | 90,000.00 | |
| Mar. 3, 1871..... | 45,000.00 | |
| June 10, 1872..... | 76,500.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | | 1,331,500.00 |

Fort Columbus and Castle William—

| | | |
|--------------------|------------|-------------------|
| 1831-64..... | 416,897.00 | |
| July 11, 1870..... | 52,000.00 | |
| | | 468,897.00 |

Fort Hamilton—

| | | |
|--------------------|------------|---------------------|
| 1824-65..... | 988,000.00 | |
| June 12, 1866..... | 30,000.00 | |
| July 11, 1870..... | 46,000.00 | |
| Mar. 3, 1871..... | 25,000.00 | |
| June 10, 1872..... | 40,000.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 26,000.00 | |
| Feb. 10, 1875..... | 10,000.00 | |
| | | 1,205,000.00 |

Fort Lafayette—

| | | |
|--------------|--|------------------|
| 1829-57..... | | 66,113.16 |
|--------------|--|------------------|

Fort Montgomery—

| | | |
|--------------------|------------|-------------------|
| 1841-65..... | 750,000.00 | |
| June 12, 1866..... | 50,000.00 | |
| Mar. 2, 1867..... | 12,500.00 | |
| | | 812,500.00 |

Fort Niagara—

| | | |
|--------------|--|-------------------|
| 1838-65..... | | 124,500.00 |
|--------------|--|-------------------|

Fort Ontario—

| | | |
|--------------------|------------|-------------------|
| 1839-65..... | 145,500.00 | |
| June 12, 1866..... | 50,000.00 | |
| | | 195,500.00 |

Fort Porter—

| | | |
|--------------|--|-------------------|
| 1841-65..... | | 180,000.00 |
|--------------|--|-------------------|

NEW YORK—Continued.

Fort Schuyler—

| | | |
|--------------------|----------------|-----------------------|
| 1826-65..... | \$1,052,000.00 | |
| June 12, 1866..... | 30,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| July 11, 1870..... | 80,000.00 | |
| Mar. 3, 1871..... | 57,500.00 | |
| June 10, 1872..... | 85,000.00 | |
| Feb. 21, 1873..... | 65,000.00 | |
| Apr. 3, 1874..... | 25,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| | | <u>\$1,444,500.00</u> |

Fort Tompkins—

| | | |
|--------------------|------------|---------------------|
| 1857-65..... | 942,300.00 | |
| June 12, 1866..... | 50,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| Mar. 3, 1871..... | 52,000.00 | |
| June 10, 1872..... | 83,000.00 | |
| Feb. 21, 1873..... | 30,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 20,000.00 | |
| | | <u>1,470,300.41</u> |

Fort Wadsworth (formerly Fort Richmond)—

| | | |
|--------------------|------------|-------------------|
| 1846-64..... | 738,646.58 | |
| Feb. 10, 1875..... | 5,000.00 | |
| | | <u>743,646.56</u> |

Fort Wood, Bedloes Island—

| | | |
|--------------------|------------|-------------------|
| 1841-57..... | 218,000.00 | |
| July 11, 1870..... | 16,000.00 | |
| June 10, 1872..... | 17,000.00 | |
| | | <u>251,000.00</u> |

Governors Island—

| | | |
|--------------------|-----------|---------------------|
| Aug. 18, 1890..... | 50,000.00 | |
| Total..... | | <u>8,848,957.13</u> |

NORTH CAROLINA:

Fort Caswell—

| | | |
|-------------------|------------|-------------------|
| 1825-57..... | 544,264.59 | |
| May 25, 1900..... | 150,000.00 | |
| | | <u>694,264.59</u> |

Fort Macon, Beaufort—

| | | |
|--------------|------------|---------------------|
| 1825-61..... | 466,500.00 | |
| Total..... | | <u>1,160,764.59</u> |

PENNSYLVANIA:

Fort Mifflin—

| | | |
|--------------------|-----------|-------------------|
| 1841-65..... | 75,900.00 | |
| June 12, 1866..... | 25,000.00 | |
| July 11, 1870..... | 55,000.00 | |
| Mar. 3, 1871..... | 28,000.00 | |
| June 10, 1872..... | 72,000.00 | |
| Feb. 10, 1875..... | 25,000.00 | |
| Total..... | | <u>278,900.00</u> |

RHODE ISLAND:

Battery on Dutch Island—

| | | |
|--------------------|------------|-------------------|
| 1862-63..... | 350,000.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| Feb. 10, 1875..... | 20,000.00 | |
| | | <u>430,000.00</u> |

¹ Transferred from Battery Hudson, above.

1808 INDEX TO REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912

RHODE ISLAND—Continued.

Fort Adams, Bretons Point—

| | | |
|--------------------|----------------|---------------|
| 1824-65..... | \$1,838,316.67 | |
| June 10, 1872..... | 85,000.00 | |
| Feb. 21, 1873..... | 65,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| Feb. 10, 1875..... | 15,000.00 | |
| | | \$2,023,316.6 |

Fort Wolcott—

| | | |
|--------------|--|-------------|
| 1827-36..... | | 1,000.0 |
| Total..... | | 2,454,316.6 |

SOUTH CAROLINA:

Castle Pinckney—

| | | |
|--------------|--|----------|
| 1841-56..... | | 12,000.0 |
|--------------|--|----------|

Fort Johnson—

| | | |
|--------------|--|----------|
| 1841-54..... | | 38,700.0 |
|--------------|--|----------|

Fort Moultrie—

| | | |
|--------------------|------------|-------------|
| 1828-60..... | 942,144.91 | |
| Mar. 3, 1871..... | 25,000.00 | |
| June 10, 1872..... | 35,000.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| Feb. 10, 1875..... | 15,000.00 | |
| | | 1,077,144.9 |

Fort Sumter—

| | | |
|--------------------|------------|-----------|
| 1840-59..... | 823,000.00 | |
| Mar. 3, 1871..... | 25,000.00 | |
| June 10, 1872..... | 35,000.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 20,000.00 | |
| | | 943,000.0 |

Sullivan's Island, Charleston—

| | | |
|-------------------|--|-------------|
| May 25, 1900..... | | 135,000.0 |
| Total..... | | 2,205,844.9 |

TEXAS:

Defenses of Galveston Harbor—

| | | |
|--------------|--|-----------|
| 1857-60..... | | 100,000.0 |
|--------------|--|-----------|

Fort Brown—

| | | |
|-------------------|------------|-----------|
| 1854-55..... | 150,000.00 | |
| Mar. 3, 1875..... | 25,000.00 | |
| | | 175,000.0 |

Fort Duncan—

| | | |
|------------|--|-----------|
| 1875..... | | 10,000.0 |
| Total..... | | 285,000.0 |

VIRGINIA:

Fort Monroe—

| | | |
|---------------------|--------------|--------------|
| 1821-65..... | 2,224,113.10 | |
| June 12, 1866..... | 30,000.00 | |
| Mar. 2, 1867..... | 25,000.00 | |
| June 10, 1872..... | 42,500.00 | |
| Feb. 21, 1873..... | 40,000.00 | |
| Apr. 3, 1874..... | 30,000.00 | |
| Feb. 10, 1875..... | 20,000.00 | |
| Aug. 4, 1886..... | 100,000.00 | |
| Aug. 10, 1888..... | 75,000.00 | |
| June 30, 1890..... | 20,000.00 | |
| Feb. 24, 1891..... | 27,000.00 | |
| Artesian wells..... | 6,000.00 | |
| Aug. 1, 1894..... | 37,500.00 | |
| | | 2,677,113.10 |

Fort Wool (formerly Calhoun), ripraps—

| | | |
|--------------|--|--------------|
| 1821-64..... | | 2,355,000.0 |
| Total..... | | 5,032,113.10 |

MISCELLANEOUS:

Batteries, gun and mortar—

| | | | |
|---|----------------|--|-----------------|
| Aug. 18, 1890..... | \$1,221,000.00 | | |
| Feb. 24, 1891..... | 750,000.00 | | |
| July 23, 1892..... | 500,000.00 | | |
| Feb. 18, 1893..... | 50,000.00 | | |
| Aug. 1, 1894..... | 500,000.00 | | |
| Mar. 2, 1895..... | 500,000.00 | | |
| June 6, 1896..... | 2,400,000.00 | | |
| Mar. 3, 1897..... | 3,841,333.00 | | |
| Allotments from the appropriation for "national defense," act of Mar. 9, 1898..... | 3,827,842.80 | | |
| May 7, 1898..... | 3,000,000.00 | | |
| July 7, 1898..... | 2,562,000.00 | | |
| Mar. 3, 1899..... | 1,000,000.00 | | |
| May 25, 1900..... | 2,000,000.00 | | |
| Mar. 1, 1901..... | 1,615,000.00 | | |
| June 6, 1902..... | 2,000,000.00 | | |
| Mar. 3, 1903..... | 2,236,425.00 | | |
| Apr. 21, 1904..... | 700,000.00 | | |
| May 27, 1908..... | 300,000.00 | | |
| Mar. 3, 1909..... | 5,064.00 | | |
| | | | \$29,008,664.80 |

Batteries, gun and mortar, insular possessions—

| | Generally applicable. | Hawaiian Islands. | Philippine Islands. | |
|--------------------|--------------------------|----------------------|------------------------|--------------|
| Apr. 21, 1904..... | \$700,000.00 | | | |
| Mar. 3, 1905..... | 700,000.00 | | | |
| June 25, 1906..... | | \$260,000.00 | | |
| Mar. 2, 1907..... | | 200,000.00 | \$500,000.00 | |
| May 27, 1908..... | | 400,000.00 | 954,000.00 | |
| Mar. 3, 1909..... | | 337,200.00 | 1,000,000.00 | |
| June 23, 1910..... | | | 800,000.00 | |
| Mar. 4, 1911..... | | 150,000.00 | 1,169,000.00 | |
| June 6, 1912..... | | 170,000.00 | 800,000.00 | |
| | 1,400,000.00 | 1,517,200.00 | 5,223,000.00 | 8,140,200.00 |

Batteries, pneumatic—

| | | |
|-------------------|----------------|------------|
| July 7, 1898..... | 1 \$150,000.00 | |
| May 25, 1900..... | 180,000.00 | 330,000.00 |

Board, Endicott—

| | | |
|-------------------|--|-----------|
| Mar. 3, 1885..... | | 40,000.00 |
|-------------------|--|-----------|

Columbia River, defenses at mouth of, Oregon and Washington Territory—

| | | |
|--------------|--|------------|
| 1862-64..... | | 400,000.00 |
|--------------|--|------------|

Contingencies of fortifications—

| | | |
|---------------------|------------------------|--------------|
| 1821-65..... | 5,711,677.17 | |
| July 11, 1870..... | 150,000.00 | |
| Mar. 3, 1871..... | 250,000.00 | |
| June 10, 1872..... | 250,000.00 | |
| Feb. 21, 1873..... | 100,000.00 | |
| Apr. 3, 1874..... | 75,000.00 | |
| Feb. 10, 1875..... | 75,000.00 | |
| Mar. 3, 1883..... | 158.00 | |
| July 7, 1884..... | 93.87 | |
| Aug. 4, 1886..... | 2,339.42 | |
| Sept. 30, 1890..... | 71.17 | |
| | 2,682.39 | |
| | ² 74,768.48 | |
| Mar. 3, 1891..... | 13.90 | |
| | 28.00 | |
| July 28, 1892..... | 352.17 | |
| Mar. 3, 1893..... | 77.02 | |
| July 7, 1898..... | 2.22 | |
| June 6, 1900..... | 54.79 | |
| | | 6,692,318.60 |

¹ San Francisco Harbor.² Credited in accounts of Maj. J. C. Fremont.

MISCELLANEOUS—Continued.

| | | | |
|--|-----------------------|-------------------|---------------------|
| Emplacements, modernizing older— | | | |
| Mar. 3, 1905..... | | \$450,000.00 | |
| June 25, 1906..... | | 150,000.00 | |
| Mar. 2, 1907..... | | 100,000.00 | |
| May 27, 1908 (new application of funds appropriated for pneumatic-dynamite batteries)..... | | 165,261.36 | |
| Mar. 3, 1909..... | | 100,000.00 | |
| | | | \$965,261.36 |
| Fortifications— | | | |
| 1813-36..... | | | 4,860,723.10 |
| Fortifications of ports and harbors— | | | |
| 1794-1812..... | | | 4,551,046.30 |
| Fortifications, plans of— | | | |
| Aug. 18, 1890..... | | 5,000.00 | |
| Feb. 24, 1891..... | | 5,000.00 | |
| July 23, 1892..... | | 5,000.00 | |
| Feb. 18, 1893..... | | 5,000.00 | |
| Aug. 1, 1894..... | | 5,000.00 | |
| Mar. 2, 1895..... | | 5,000.00 | |
| June 6, 1896..... | | 5,000.00 | |
| Mar. 3, 1897..... | | 5,000.00 | |
| May 7, 1898..... | | 5,000.00 | |
| Mar. 3, 1899..... | | 5,000.00 | |
| May 25, 1900..... | | 5,000.00 | |
| | | | 55,000.00 |
| Fortifications on the northern frontier— | | | |
| 1862..... | | | 750,000.00 |
| National defense— | | | |
| Mar. 9, 1899..... | | | 13,817,879.62 |
| Plant—Electric light and power— | | | |
| May 25, 1900..... | | | 25,000.00 |
| Plant—Electrical installation— | | | |
| May 27, 1908..... | | 348,888.00 | |
| Mar. 3, 1909..... | | 100,000.00 | |
| Mar. 4, 1911..... | | 50,000.00 | |
| | | | 498,888.00 |
| Plant—Searchlights and electrical connections— | | | |
| Mar. 1, 1901 (New York Harbor)..... | | 150,000.00 | |
| June 6, 1902..... | | 150,000.00 | |
| Mar. 3, 1903..... | | 150,000.00 | |
| Apr. 21, 1904..... | | 150,000.00 | |
| Mar. 3, 1905..... | | 200,000.00 | |
| June 25, 1906..... | | 125,000.00 | |
| Mar. 2, 1907..... | | 210,000.00 | |
| May 27, 1908..... | | 210,000.00 | |
| Mar. 3, 1909..... | | 210,000.00 | |
| June 23, 1910..... | | 50,000.00 | |
| Mar. 4, 1911..... | | 50,000.00 | |
| June 6, 1912 (reappropriated from balances of other funds)..... | | 25,000.00 | |
| | | | 1,680,000.00 |
| Plant—Reserve lights— | | | |
| Mar. 3, 1909..... | | | 10,000.00 |
| Plant—Searchlights, insular possessions— | | | |
| | Generally applicable. | Hawaiian Islands. | Philippine Islands. |
| Mar. 2, 1907..... | \$30,000.00 | | |
| May 27, 1908..... | | \$47,500.00 | \$180,000.00 |
| Mar. 3, 1909..... | | 66,000.00 | |
| June 23, 1910..... | | | 139,000.00 |
| Mar. 4, 1911..... | | 40,100.00 | |
| Total..... | 30,000.00 | 153,600.00 | 319,000.00 |
| | | | 502,600.00 |

¹ Allotted from \$50,000,000 for national defense.

MISCELLANEOUS—Continued.

Plant—Electrical installations, insular possessions—

| | Hawaiian Islands. | Philippine Islands. | |
|--------------------|----------------------|------------------------|--------------|
| May 27, 1908..... | \$20,000.00 | \$115,000.00 | |
| Mar. 3, 1909..... | 14,469.00 | 88,823.00 | |
| June 23, 1910..... | | 45,000.00 | |
| Mar. 4, 1911..... | | 171,962.00 | |
| Total..... | 34,469.00 | 420,785.00 | \$455,254.00 |

Preservation and repair of fortifications—

| | | | |
|---|--|------------|--------------|
| 1841-61..... | | 67,000.00 | |
| June 8, 1868..... | | 200,000.00 | |
| Mar. 3, 1869..... | | 200,000.00 | |
| July 11, 1870..... | | 75,000.00 | |
| June 20, 1876..... | | 100,000.00 | |
| Mar. 3, 1877..... | | 100,000.00 | |
| Mar. 3, 1878..... | | 100,000.00 | |
| Mar. 3, 1879..... | | 100,000.00 | |
| May 4, 1880..... | | 100,000.00 | |
| Mar. 3, 1881..... | | 175,000.00 | |
| May 19, 1882..... | | 175,000.00 | |
| Mar. 3, 1883..... | | 175,000.00 | |
| July 5, 1884..... | | 175,000.00 | |
| Mar. 3, 1885..... | | 100,210.00 | |
| Sept. 22, 1888..... | | 100,000.00 | |
| Mar. 2, 1889..... | | 100,000.00 | |
| Aug. 18, 1890..... | | 80,000.00 | |
| Feb. 24, 1891..... | | 80,000.00 | |
| July 23, 1892..... | | 60,000.00 | |
| Feb. 18, 1893..... | | 45,000.00 | |
| Aug. 1, 1894..... | | 45,000.00 | |
| Mar. 2, 1895..... | | 45,000.00 | |
| June 6, 1896..... | | 50,000.00 | |
| Mar. 2, 1897..... | | 100,000.00 | |
| May 7, 1898..... | | 100,000.00 | |
| Mar. 3, 1899..... | | 100,000.00 | |
| May 25, 1900..... | | 100,000.00 | |
| Mar. 1, 1901..... | | 100,000.00 | |
| Feb. 14, 1902..... | | 3,000.00 | |
| June 6, 1902..... | | 300,000.00 | |
| Mar. 3, 1903..... | | 300,000.00 | |
| Apr. 21, 1904..... | | 300,000.00 | |
| Mar. 3, 1905..... | | 300,000.00 | |
| June 25, 1906..... | | 200,000.00 | |
| Mar. 2, 1907..... | | 200,000.00 | |
| May 27, 1908..... | | 225,000.00 | |
| Mar. 3, 1909..... | | 225,000.00 | |
| June 23, 1910..... | | 300,000.00 | |
| Mar. 4, 1911..... | | 300,000.00 | |
| June 6, 1912 (\$125,000 reappropriated from balances of other funds)... | | 300,000.00 | 4,058,000.00 |

Preservation and repair of fortifications, insular possessions—

| | Hawaiian Islands. | Philippine Islands. | |
|--------------------|----------------------|------------------------|-----------|
| June 23, 1910..... | | \$7,000.00 | |
| Mar. 4, 1911..... | | 7,000.00 | |
| June 6, 1912..... | \$500.00 | 8,000.00 | |
| | 500.00 | 22,000.00 | 22,500.00 |

MISCELLANEOUS—Continued.

Preservation and repair, torpedo structures—

| | | |
|--------------------|-------------|--------------|
| June 25, 1906..... | \$10,000.00 | |
| Mar. 2, 1907..... | 10,000.00 | |
| May 27, 1908..... | 15,000.00 | |
| Mar. 3, 1909..... | 20,000.00 | |
| June 23, 1910..... | 20,000.00 | |
| Mar. 4, 1911..... | 20,000.00 | |
| June 6, 1912..... | 20,000.00 | |
| | <hr/> | \$115,000.00 |

Preservation and repair, torpedo structures, insular possessions—

| | | |
|---|----------|----------|
| June 23, 1910 (Philippine Islands)..... | 1,000.00 | |
| Mar. 4, 1911 (Philippine Islands)..... | 1,000.00 | |
| June 6, 1912 (Philippine Islands)..... | 500.00 | |
| | <hr/> | 2,500.00 |

Range and position finders—

Prior to 1905 appropriations for this work were made under the title
"Installation of range and position finders" (expended entirely by
the Engineer Department), as follows:

| | | |
|--------------------|------------|--------------|
| July 7, 1898..... | 150,000.00 | |
| May 25, 1900..... | 150,000.00 | |
| Mar. 1, 1901..... | 150,000.00 | |
| June 6, 1902..... | 325,000.00 | |
| Mar. 3, 1903..... | 223,500.00 | |
| Apr. 21, 1904..... | 225,000.00 | |
| | <hr/> | 1,223,500.00 |

Later appropriations have been made, under the title
"Fire control at fortifications," applicable to the
work of the Engineer and Ordnance Departments
and the Signal Corps. The amounts appropriated
and the portions thereof assigned to the Engineer
Department are as follows:

| | Appro- priated. | Assigned to Engineer Department. | |
|--------------------|--------------------|--|--------------|
| Mar. 3, 1905..... | \$1,000,000.00 | \$590,000.00 | |
| June 25, 1906..... | 700,000.00 | 217,631.37 | |
| Mar. 2, 1907..... | 900,000.00 | 432,784.81 | |
| May 27, 1908..... | 270,256.00 | 129,456.00 | |
| Mar. 3, 1909..... | 247,055.00 | 211,555.00 | |
| June 23, 1910..... | 200,000.00 | 98,690.39 | |
| Mar. 4, 1911..... | 100,000.00 | | |
| June 6, 1912..... | 100,000.00 | | |
| | <hr/> | <hr/> | |
| | 3,517,311.00 | 1,680,117.57 | 3,517,311.00 |

Fire control at batteries, insular possessions—

| | Appro- priated. | Assigned to Engineer Department. | |
|--------------------|--------------------|--|------------|
| Mar. 2, 1907..... | \$100,000.00 | \$75,000.00 | |
| May 27, 1908..... | 243,000.00 | 75,000.00 | |
| Mar. 3, 1909..... | 250,000.00 | 222,427.00 | |
| June 23, 1910..... | 200,000.00 | 13,150.00 | |
| | <hr/> | <hr/> | |
| | 793,000.00 | 385,577.00 | 793,000.00 |

Seacoast mortar batteries—

| | | |
|--------------------|------------|------------|
| July 11, 1870..... | 75,000.00 | |
| Mar. 3, 1871..... | 100,000.00 | |
| June 2, 1872..... | 100,000.00 | |
| June 14, 1878..... | 301.50 | |
| | <hr/> | 275,301.50 |

MISCELLANEOUS—Continued.

Sea walls and embankments—

| | |
|---|--------------|
| Sept. 22, 1888..... | \$117,000.00 |
| June 6, 1896..... | 17,975.00 |
| Mar. 3, 1897..... | 33,000.00 |
| May 7, 1898..... | 55,000.00 |
| Mar. 3, 1899..... | 2,500.00 |
| May 25, 1900..... | 50,000.00 |
| Mar. 1, 1901..... | 100,000.00 |
| June 6, 1902..... | 100,000.00 |
| Mar. 3, 1903..... | 89,575.00 |
| Apr. 21, 1904..... | 99,000.00 |
| Mar. 3, 1905..... | 19,400.00 |
| June 25, 1906..... | 50,000.00 |
| Mar. 2, 1907..... | 25,000.00 |
| May 27, 1908..... | 50,000.00 |
| Mar. 3, 1909..... | 50,000.00 |
| June 6, 1912 (reappropriated from balances of other funds)..... | 25,000.00 |

\$883,450.00

Sites for seacoast defenses—

| | |
|--------------------|------------|
| June 12, 1866..... | 35,000.00 |
| Mar. 2, 1867..... | 37,500.00 |
| Mar. 3, 1871..... | 150,000.00 |
| Aug. 18, 1890..... | 500,000.00 |
| Feb. 24, 1891..... | 500,000.00 |
| July 23, 1892..... | 500,000.00 |
| Feb. 18, 1893..... | 175,000.00 |
| Aug. 1, 1894..... | 150,000.00 |
| June 6, 1896..... | 500,000.00 |
| Mar. 3, 1897..... | 300,000.00 |
| May 7, 1898..... | 300,000.00 |
| Mar. 3, 1899..... | 300,000.00 |
| May 25, 1900..... | 200,000.00 |
| Mar. 1, 1901..... | 200,000.00 |
| June 6, 1902..... | 200,000.00 |
| Mar. 3, 1903..... | 200,000.00 |
| Apr. 21, 1904..... | 100,000.00 |
| May 27, 1908..... | 121,048.00 |
| Mar. 3, 1909..... | 250,000.00 |

4,718,448.00

Sites, insular possessions—

| | Hawaiian Islands. | Philippine Islands. |
|--------------------|----------------------|------------------------|
| Apr. 21, 1904..... | \$200,000.00 | ..... |
| June 25, 1906..... | 150,000.00 | ..... |
| May 27, 1908..... | ..... | \$5,000.00 |
| Mar. 3, 1909..... | ..... | 12,000.00 |
| | 350,000.00 | 17,000.00 |

367,000.00

Supplies for seacoast defenses—

| | |
|--------------------|-----------|
| May 25, 1900..... | 25,000.00 |
| Mar. 1, 1901..... | 25,000.00 |
| June 6, 1902..... | 25,000.00 |
| Mar. 3, 1903..... | 35,000.00 |
| Apr. 21, 1904..... | 35,000.00 |
| Mar. 3, 1905..... | 40,000.00 |
| June 25, 1906..... | 30,000.00 |
| Mar. 2, 1907..... | 40,000.00 |
| May 27, 1908..... | 44,500.00 |
| Mar. 3, 1909..... | 40,000.00 |
| June 23, 1910..... | 45,000.00 |
| Mar. 4, 1911..... | 45,000.00 |
| June 6, 1912..... | 45,000.00 |

474,500.00

MISCELLANEOUS—Continued.

Supplies for seacoast defenses, insular possessions—

| | Hawaiian Islands. | Philippine Islands. | |
|--------------------|----------------------|------------------------|------------|
| June 23, 1910..... | ..... | \$2,500.00 | |
| Mar. 4, 1911..... | \$1,000.00 | 2,500.00 | |
| June 6, 1912..... | 750.00 | 2,500.00 | |
| | <u>1,750.00</u> | <u>7,500.00</u> | \$9,250.00 |

Equipment of Coast Artillery, armories, Organized Militia—

| | |
|-------------------|------------|
| Mar. 3, 1911..... | 238,170.00 |
|-------------------|------------|

Actual amount assigned to Engineer Department, \$105,426.56.

Submarine mines—

| | Appro- riated. | Covered into surplus fund or repaid to national- defense fund. | Net appro- priation. |
|---|-------------------|--|-------------------------|
| May 19, 1882— | | | |
| Torpedoes, preservation of torpedoes, experiments, and instruction of troops..... | \$100,000.00 | ..... | \$100,000.00 |
| Mar. 3, 1883— | | | |
| One-half for latest improved tor- pedoes..... | 75,000.00 | ..... | 75,000.00 |
| July 5, 1884— | | | |
| Purchase, if recommended, of sub- marine movable torpedoes..... | 50,000.00 | ..... | 50,000.00 |
| Improving and testing motors for movable torpedoes..... | 25,000.00 | ..... | 25,000.00 |
| Submarine mines..... | 5,000.00 | ..... | 5,000.00 |
| Torpedo experiments and instruction of troops..... | 20,000.00 | ..... | 20,000.00 |
| Mar. 3, 1885— | | | |
| Submarine movable torpedoes..... | 50,000.00 | ..... | 50,000.00 |
| Motors for torpedoes..... | 25,000.00 | ..... | 25,000.00 |
| Appliances for submarine mines..... | 19,000.00 | ..... | 19,000.00 |
| Experiments and instructions..... | 20,000.00 | ..... | 20,000.00 |
| Sept. 22, 1888— | | | |
| Materials, structures, experiments, instruction, and movable torpedoes. | 200,000.00 | ..... | 200,000.00 |
| Mar. 2, 1889— | | | |
| Mines and appliances..... | 250,000.00 | ..... | 250,000.00 |
| Structures..... | 250,000.00 | ..... | 250,000.00 |
| Experiments and instruction..... | 30,000.00 | ..... | 30,000.00 |
| Movable torpedoes..... | 50,000.00 | \$24,775.00 | 25,225.00 |
| Shed, San Francisco..... | 22,000.00 | 216.77 | 21,783.23 |
| Aug. 18, 1890— | | | |
| Mines and appliances..... | 100,000.00 | ..... | 100,000.00 |
| Structures..... | 100,000.00 | ..... | 100,000.00 |
| Experiments and instruction..... | 30,000.00 | 100.09 | 29,900.00 |
| Feb. 24, 1891— | | | |
| Mines and appliances..... | 50,000.00 | ..... | 50,000.00 |
| Structures..... | 50,000.00 | ..... | 50,000.00 |
| Structures, Goat Island, Cal..... | 16,000.00 | 4,616.68 | 11,383.32 |
| Mar. 2, 1895— | | | |
| Mines and appliances..... | 20,000.00 | ..... | 20,000.00 |
| Structures..... | 20,000.00 | ..... | 20,000.00 |
| June 6, 1896— | | | |
| Materials and structures..... | 100,000.00 | ..... | 100,000.00 |
| Mar. 3, 1897— | | | |
| Materials and structures..... | 150,000.00 | ..... | 150,000.00 |

MISCELLANEOUS—Continued.

Submarine mines—Continued.

| | Appropriated. | Covered into surplus fund or repaid to national-defense fund. | Net appropriation. |
|--|---------------|---|--------------------|
| Mar. 9, 1898 (national defense); presidential allotments— | | | |
| Mar. 17, 1898—Materials, including searchlights..... | \$250,000.00 | ..... | \$250,000.00 |
| Mar. 31, 1898—Portion of allotment for torpedo service..... | 8,725.00 | ..... | 8,725.00 |
| Apr. 2, 1898—Torpedo operations..... | 1,150,000.00 | \$120,323.70 | 1,029,676.30 |
| Apr. 21, 1898—Planting torpedoes.... | 150,000.00 | 48,290.45 | 101,709.55 |
| Jan. 21, 1899—Torpedo defense (actually expended from consolidated allotment)..... | 456.71 | ..... | 456.71 |
| May 4, 1898— | | | |
| Material..... | 50,000.00 | 1,194.39 | 48,805.61 |
| Planting mines..... | 300,000.00 | 68,097.84 | 231,902.16 |
| May 7, 1898— | | | |
| Materials and structures..... | 150,000.00 | ..... | 150,000.00 |
| July 7, 1898— | | | |
| Maintenance of mine fields..... | 736,000.00 | 736,000.00 | ..... |
| Additional material, operating searchlights and electric plants..... | 650,000.00 | 192,616.49 | 457,383.51 |
| Mar. 3, 1899— | | | |
| Material and structures..... | 50,000.00 | ..... | 50,000.00 |
| May 25, 1900— | | | |
| Material and structures..... | 50,000.00 | ..... | 50,000.00 |
| Mar. 1, 1901— | | | |
| Material and structures..... | 50,000.00 | ..... | 50,000.00 |
| Feb. 14, 1902— | | | |
| Deficiency..... | 2.68 | ..... | 2.68 |
| June 6, 1902— | | | |
| Structures..... | 33,000.00 | ..... | 33,000.00 |
| July 1, 1902— | | | |
| Deficiency..... | 4.38 | ..... | 4.38 |
| Mar. 3, 1903— | | | |
| Structures..... | 50,000.00 | ..... | 50,000.00 |
| Apr. 21, 1904— | | | |
| Structures..... | 87,000.00 | ..... | 87,000.00 |
| Mar. 3, 1905— | | | |
| Structures..... | 400,000.00 | ..... | 400,000.00 |
| June 25, 1906— | | | |
| Structures..... | 175,000.00 | ..... | 175,000.00 |
| Mar. 2, 1907— | | | |
| Structures..... | 175,000.00 | ..... | 175,000.00 |
| May 27, 1908— | | | |
| Structures..... | 175,000.00 | ..... | 175,000.00 |
| Mar. 3, 1909— | | | |
| Structures..... | 100,000.00 | ..... | 100,000.00 |
| Mar. 4, 1911— | | | |
| Structures..... | 50,000.00 | ..... | 50,000.00 |
| | 6,667,188.77 | 1,196,231.32 | 5,470,957.45 |

Submarine mines, insular possessions—

| | Generally applicable. | Philippine Islands. | Hawaiian Islands. |
|---------------------------------------|-----------------------|---------------------|-------------------|
| June 8, 1898 (for Manila Harbor)..... | | \$150,000.00 | ..... |
| Mar. 2, 1907..... | \$200,000.00 | ..... | ..... |
| May 27, 1908..... | ..... | ..... | \$129,000.00 |
| | | | \$479,000.00 |

Total, miscellaneous..... 85,530,823.73

Grand total..... 142,997,918.85

Part 2, FMA. Recapitulation of Appropriations for Fortifications, by States.

| | |
|----------------------------------|-----------------------|
| Alabama..... | \$1,796,198.87 |
| Arkansas..... | 152,707.71 |
| California..... | 5,830,000.00 |
| Connecticut..... | 360,400.00 |
| Delaware..... | 2,485,708.98 |
| District of Columbia..... | 1,250,000.00 |
| Florida..... | 8,031,490.27 |
| Georgia..... | 1,313,808.56 |
| Indian Territory..... | 16,000.00 |
| Louisiana..... | 3,074,393.21 |
| Maine..... | 3,764,120.00 |
| Maryland..... | 1,955,505.40 |
| Massachusetts..... | 3,863,094.72 |
| Michigan..... | 335,000.00 |
| Mississippi..... | 555,000.00 |
| New Hampshire..... | 1,061,771.00 |
| New Jersey..... | 1,356,000.00 |
| New York..... | 8,848,957.13 |
| North Carolina..... | 1,160,764.59 |
| Pennsylvania..... | 278,900.00 |
| Rhode Island..... | 2,454,316.67 |
| South Carolina..... | 2,205,844.91 |
| Texas..... | 285,000.00 |
| Virginia..... | 5,032,113.10 |
| MISCELLANEOUS ¹ | 85,530,823.73 |
| Total..... | 142,997,918.85 |

¹ Lump appropriations, disbursed among various works throughout the U. S., etc.

FMB.

BOARDS.

| Part. | Title. |
|-------|--|
| 1 | The Board of Engineers. |
| 2 | Board of Engineers on the Pacific coast. |
| 3 | Board on torpedo system. |
| 4 | Endicott Board. |
| 5 | Roosevelt ("Taft Board") Board. |

Part 1, FMB. Boards of Engineers on Fortifications.

ENGINEERS.

Chief of Engineers. **R.**, 66, ii, 2; 67, 2; 70, 28; 71, 26; 72, 24; 73, 25; 74, 29; 75, 28; 76, 30; 77, 24; 78, 28; 79, 33; 80, 54; 81, 56; 82, 56, 411; 83, 51; 84, 55; 85, 48; 86, 48; 87, 5; 88, 5; 89, 8; 90, 6; 91, 11; 92, 16; 93, 15; 94, 15; 95, 15; 96, 5, 447; 97, 4, 553; 98, 5, 557; 99, 5, 645; 00, 5, 727; 01, 5, 691; 02, 6, 615; 03, 8, 679; 04, 4, 749; 05, 4, 755; 06, 4, 835; 07, 5, 865; 08, 9, 907; 09, 10, 955; 10, 11; 11, 7; 12, 6.

Officers:¹

Col. G. J. Barnard, 1867-80.
Col. G. W. Cullum, 1867-74.
Col. Z. B. Tower, 1867-83.
Lt. Col. H. G. Wright, 1867-79.
Maj. C. B. Reese, 1867.
Capt. C. W. Raymond, 1870.
Col. J. Newton, 1880-84.
Col. H. L. Abbot, 1880-95.
Col. C. B. Comstock, 1883-94.
Col. J. C. Duane, 1884-87.
Col. D. C. Houston, 1886-93.
Lt. Col. W. McFarland, 1886-88.
Col. T. L. Casey, 1887-89.
Col. W. P. Craighill, 1887-89.
Maj. W. R. King, 1887-89.
Col. G. L. Gillespie, 1889-1900.
Col. H. M. Robert, 1893-1900. **R.**, 96, 447; 97, 553; 98, 557; 99, 645; 00, 727.

Maj. C. W. Raymond, 1895-96.
Maj. J. G. D. Knight, 1896-97.
Capt. H. F. Hodges, 1896-98.
Maj. H. M. Adams, 1897-99.
Col. J. W. Barlow, 1899-1900.
Capt. W. V. Judson, 1899.
Capt. E. Jadwin, 1900-01.
Col. C. R. Suter, 1900-06.
Col. S. M. Mansfield, 1900.
Lt. Col. C. W. Raymond, 1900-04.
Maj. S. Pratt (Coast Artillery), 1900.
Lt. E. H. Schulz, 1901-02.
Col. A. Stickney, 1902-07.
Lt. Col. W. R. Livermore, 1902-05.
Commander W. J. Barnette (U. S. N.), 1902.
Maj. R. Birnie (Ord. Dept.), 1902-07 (Lt. Col.).
Maj. A. Murray (Artillery Corps), 1905 (Lt. Col.).
Capt. R. Wainwright (U. S. N.), 1904-10 (Rear Admiral).
Col. D. W. Lockwood, 1906-09.
Col. J. G. D. Knight, 1906-09.
Maj. J. E. Kuhn, 1906-08.
Col. W. L. Marshall, 1907.
Lt. Col. E. B. Babbitt (Ord. Dept.), 1907-10.
Col. S. W. Roessler, 1908-10.
Capt. H. L. Wigmore, 1908-10.
Col. Wm. T. Rossell, 1909.
Col. W. M. Black, 1909.
Capt. E. M. Adams, 1910.

Part 2, FMB. Board of Engineers on the Pacific Coast.

ENGINEERS.

Chief of Engineers. **R.**, 67, 2; 68, 4; 70, 28; 71, 26; 72, 25; 73, 26; 74, 32; 75, 32; 76, 32; 77, 28; 78, 31; 79, 39; 80, 60; 81, 60; 82, 60; 83, 56; 84, 64; 85, 52.

Officers:¹

Lt. Col. B. S. Alexander, 1867-79.
Capt. C. W. Raymond, 1867-69.

Capt. T. H. Handbury, 1870-73.
Lt. Col. G. H. Mendell, 1872-85.
Lt. Col. C. S. Stewart, 1873-85.
Lt. J. H. Weeden, 1873-77.
Lt. Col. R. S. Williamson, 1876-82.
Capt. A. H. Payson, 1877-83.
Maj. J. M. Wilson, 1878.
Maj. G. L. Gillespie, 1879-80.

¹And for the time being the officers of the defenses under consideration, 73, 25.
Col. G. H. Mendell was a member when matter pertaining to the defensive works on the Pacific coast was acted upon, 90, 6.

²And for the time being the officers of the defenses under consideration.
List of subjects referred by the Chief of Engineers, and the special duties of the individual members, given in each annual report beginning with 1879.

Part 3, FMB. Board on Torpedo System.

Chief of Engineers. R., 99, 5; 00, 5; 01, 5;
02, 6.

Officers:

Capt. J. Millis, 1898-99.

Lt. J. F. McIndoe, 1899.

Lt. G. P. Howell, 1899-1900.

Maj. J. G. D. Knight, 1898-1900. R., 99, 649;
00, 731.

Capt. H. Jervey, 00.

Maj. H. M. Black, 1900-01.

Capt. J. F. McIndoe, 1900-01.

Capt. G. P. Howell, 1900-01.

Part 4, FMB.

Endicott Board.¹

BOARD OF ENGINEERS.

(Endicott Board.) Constituted by act of Mar. 3, 1885, to examine and report at what ports, fortifications, or other defenses mostly required, the

character and kind of defenses best adapted for each, with reference to armament and the utilization of torpedoes, mines, or other defensive appliances. R., 86, 499. (W. C. Endicott, Sec. of War, presi-

¹ This board might be considered the result of repeated invitations of the Chief of Engineers to the alarming lack of adequate fortifications in the United States. The following extracts serve as an index to the Reports of the Chief of Engineers upon the subject:

Annual report for 1880, pp. 4, 5, 6, 8, 9, 10, 11, 12, 14, 15. Report of the Chief of Engineers, United States Army, Washington, D. C., Oct. 16, 1880.

* * * * *
SEACOAST AND LAKE-FRONTIER DEFENSES.

The importance of early and reasonable expenditures for our seacoast defenses can not be more strongly urged than by reiterating what has been stated in former reports by this department, and therefore in the following remarks on the subject the arguments and the statements contained in these reports will, when necessary, be freely used.

The United States, separated from the rest of the world by wide oceans, pursuing toward all nations a policy strikingly characterized by its pacific tendency, its impartiality and justice, contracting no political alliances, confining her intercourse with the rest of the world rigidly to the letter of such temporary arrangements as are dictated by reciprocal commercial interests, might, at first view, be regarded as too remote physically and as politically too insulated to be endangered by the convulsions which from time to time disturb the nations of the earth.

Neither our geographical position, however, nor our forbearance, nor the equity of our policy can always avail us under the relation in which it is our destiny to stand to the rest of the world.

Experience has shown that even the intercourse of traffic, much as it conduces to our prosperity, can be indulged only at the risk of obliging the Nation occasionally to assume a belligerent attitude and of surrendering to the spirit of contention—which seems to govern nations as it does the natural man—a portion of its fruits. The certainty of the return of periods of embarrassment and strife with foreign nations similar in their origin to those which have visited this Nation affords a sufficient reason of itself for securing ourselves in the best manner against the more serious evils of these unavoidable collisions.

No one acquainted with our history can hesitate to ascribe much of the wantonness and duration of the wrongs we have endured to a knowledge on the part of the nations of the scantiness and inefficiency of our military and naval forces. It is certain that in our present condition injuries to our citizens abroad and insults to our flag could not be resented with that vigor and promptitude demanded by the dignity and honor of the Nation, and justified by a knowledge that our fine harbors, important navy yards, rich commercial cities, and depots for military and naval stores were guarded by impregnable fortifications and obstructions.

It concerns the honor of the United States, when involved in controversy with other powers, to be able to appeal to the sword, but that appeal should be accompanied by the consciousness that the weapon appealed to would not be inferior to that held by the adversary. This relation of inferiority may at present exist though the adversary be a comparatively weaker power.

* * * There is nothing so costly to a nation as a lack of preparation for war. In fact, to be prepared for war will often prevent it, and though we may not feel the daily imminence of war with great foreign powers, as England did, yet with incomplete or inadequately armed defenses for our great seaport cities, even the attitude of belligerency, which we not unfrequently have to assume, has not the imposing effect it should have, nor is it accompanied with a justly founded self-confidence on our own part. The neglect of suitable preparation cost France many millions of treasure, a portion of her territory, and a great humiliation. The same must inevitably happen to the United States if it does not push forward its coast defenses and provide them with guns like those possessed not only by the great powers, but even by smaller nations.

* * * * *

In the event of war with a maritime nation, if we had no well-digested system of fortifications ready for use, the cruisers and war vessels of the enemy could run into our harbors and, without landing, could

dent; Brig. Gen. S. V. Benet, Chief of Ordnance; Brig. Gen. J. Newton, Chief of Engineers; Lt. Col. H. L. Abbot, Corps of Engineers; Capt. C. S. Smith, Ordnance Department; Commanders W. T. Sampson and C. F. Goodrich, U. S. Navy, and J. E. Morgan, jr., of Pennsylvania, and E. Corning, of New York.)

Report dated Jan. 16, 1886: Contents—Where defenses are most urgent. Ports arranged in order of urgency. The defenses and their accessories. List of ports, etc. Guns on hand.

Est. for land defenses, exclusive of armament, \$55,483,000.

Est. for armament and mountings, \$37,965,000.

either destroy the property along our shores or else lay our cities under contribution. We have a seacoast line of more than 3,000 miles in extent on the Atlantic and Gulf of Mexico and 1,000 miles on the Pacific, not including Alaska, along both of which lie scattered all the great cities, all the depots of commerce, all the establishments of naval construction, outfit and repair, and towns, villages, and establishments of private enterprise without number. From these lines of seacoasts, navigable bays, estuaries, and rivers, the shores of which are similarly occupied, penetrate deep into the heart of the country. The accurate detailed charts of our harbors and channels published by the United States Coast Survey are accessible to all nations and are doubtless in their possession. There are foreign military and naval depots and arsenals in close proximity to our shores, and the arrival of armed vessels will follow in a few days or even hours the declaration of war.

* * * * *

In what way may a powerful enemy wage war against us? He may do so—

1. By attacking our commerce and navigation upon the ocean. As, however, no military preparations on the shore can avert this danger, and the means of meeting it must be purely naval, these means do not now fall under consideration; or,

2. By assailing one or more of the important points of the coast with a large military and naval force, with a view to immediate damage, or more or less protracted occupation; or,

3. By suddenly appearing with a large squadron of vessels before our principal commercial cities, laying them under contribution, and burning or carrying off the shipping, and by making powerful attacks upon our navy yards in order to destroy those establishments; or,

4. By attacks on smaller towns and establishments of the coast with small squadrons or single vessels, or with privateers, capturing or destroying the shipping therein, and levying contributions, and by like means intercepting the interior commerce within the bays, sounds, and estuaries of the coast, these lesser enterprises being often conducted under the countenance and support of considerable fleets.

The danger may take any of these forms, or all of them. And against any or all of these a naval force of equal or greater strength, if it could with any certainty be found at hand, might be an adequate resort, though it would not be the most economical. But, in the first place, we are yet, and shall be for years, inferior in our naval preparation to nations with which we are likely to be in conflict; and, next, if we were even far superior, it would be impossible to have at each of the points to be guarded a naval force sufficient to secure it, because a hostile squadron of powerful, fast-running armored steamers would fall with equal ease on either of the important points, and could with no more certainty be expected at one than at another; so that, to resist successfully, we must be ready at each and all with a force not less than that of the enemy; if less, an unavailing resistance would but augment the calamitous consequences.

* * * * *

It is truly an axiom in military science, and one fully illustrated by military history, that the worst mode of waging war, although strictly defensive, is to allow its field of action to be within the borders, and that the best is that which most frequently assumes an offensive attitude. In our case war can only be excluded from our territory by fortifications, and we can only assume the offensive through our Navy. The construction of the former secures the means of creating, equipping, and repairing the latter, and leaves it unencumbered with duties which it imperfectly performs, to the full exercise of its important and appropriate functions.

The opinion that the Navy is the true defense of the country has been so acceptable and popular that it demands a careful examination.

For the purpose of first considering this proposition in its simplest terms, we will begin by supposing the Nation to possess but a single seaport, and that this is to be defended by a fleet alone.

By remaining constantly within this port our fleet would be certain of meeting the enemy should he assail it. But if inferior to the enemy there would be no reason to look for a successful defense; and as there could be no escape for the defeated vessels, the presence of the fleet instead of averting the issue would only render it the more calamitous.

Should our fleet be equal to the enemy's, the defense might be complete, and probably it would be so. Still, hazard—some of the many mishaps liable to attend contests of this nature—might decide against us, and in that event the consequences would be even more disastrous than on the preceding supposition. In this case the chances of victory to the two parties would be equal, but the consequences very unequal. It might be the enemy's fate to lose his whole fleet, but he could lose nothing more, while we, in a similar attempt, would lose not only the whole fleet, but also the object that the fleet was designed to protect.

If superior to the enemy, the defense of the port would in all respects be complete. But instead of making an attack the enemy would in such case employ himself in cutting up our commerce on the ocean,

Est. for floating batteries, including armament,
\$18,875,000.

Est. for submarine mines and their adjuncts,
\$4,334,000.

Est. for torpedo boats, \$9,720,000.

Grand total estimate, \$126,377,800.

Appropriations recommended for first year,
\$21,500,000.

Annual appropriations thereafter, \$9,000,000.

and nothing could be done to protect this commerce without leaving the port in a condition to be successfully assailed.

In either of the above cases the fleet might await the enemy in front of the harbor instead of lying within. But no advantage is apparent from such an arrangement, and there would be superadded the risk of being injured by tempests, and thereby disqualified for the duty of defense, or of being driven off the coast by gales of wind, thus for a time removing all opposition.

In the same cases, also, especially when equal or superior to the enemy, our fleet, depending on having correct and timely notice as to the position and state of preparation of the enemy's forces, might think proper to meet him at the outlet of his own port, or intercept him on the way, instead of awaiting him within or off our own harbor. Here it must be noticed that the enemy, like ourselves, is supposed to possess a single harbor only, but having protected it by other means, that his navy is disposable for offensive operations. If it were attempted thus to shut him up within his own port, he, in any case but that of decided inferiority, would not hesitate to come out and risk a battle; because, if defeated, he could retire under shelter of his defenses to refit, and if successful he could proceed with a small portion of his force—even a single vessel would suffice—to the capture of our port, now defenseless, while with the remainder he would follow up his advantage over our defeated vessels, not failing to pursue them into their harbor should they return thither.

Actual superiority on our part would keep the enemy from volunteering a battle, but it would be indispensable that the superiority be steadily maintained and that the superior fleet be constantly present. If driven off by tempests or absent from any other cause, the blockaded fleet would escape, when it would be necessary for our fleet to fly back to the defense of its own port. Experience abundantly proves, moreover, that it is in vain to attempt to shut a hostile squadron in port for any length of time. It seems, then, that whether we defend by remaining at home or by shutting the enemy's fleet within his own harbor, actual superiority in vessels is indispensable to the security of our port.

With this superiority the defense will be complete, provided our fleet remain within its harbor. But then all the commerce of the country upon the ocean must be left to its fate, and no attempt can be made to react offensively upon the foe, unless we can control the chances of finding the enemy's fleet within his port, and the still more uncertain chance of keeping him there, the escape of a single vessel being sufficient to cause the loss of our harbor.

Let us next see what will be the state of the question on the supposition of numerous important ports on either side instead of a single one, relying on our part still exclusively on a navy.

In order to examine this question we will suppose our adversary to be fortified in all his harbors and possessed of available naval means equal to our own. This is certainly a fair supposition, because what is assumed as regards his harbors is true of all maritime nations except the United States, and as regards naval means it is elevating our own strength considerably above its present measure and above that it is likely to attain for years.

Being thus relatively situated, the first difference that strikes us is that the enemy, believing all his ports to be safe, without the presence of his vessels, sets at once about making our seas and shores the theater of operations, while we are left without choice in the matter; for if he think proper to come, and we are not present, he attains his object without resistance.

The next difference is, that while the enemy is certain to fall upon the single point, or the many points he may have selected, there will exist no previous indications of his particular choice, and consequently no reason for preparing our defense on one point rather than another; so that the chances of not being present and ready on his arrival are directly in proportion to the number of our ports; that is to say, the greater the number of ports, the greater the chances that he will meet no opposition whatever.

Another difference is, that the enemy can choose the mode of warfare as well as the plan of operations, leaving as little option to us in the one case as in the other. It will be necessary for us to act in the first instance on the supposition that an assault will be made with his entire fleet; because, should we act otherwise, his coming in that array would involve both fleet and coast in inevitable defeat and ruin. Being in this state of concentration, then, should the enemy have any apprehensions as to the result of a general engagement; should he be unwilling to put anything at hazard, or should he, for any other reason, prefer acting by detachments, he can, on approaching the coast, disperse his force into small squadrons and single ships, and make simultaneous attacks on numerous points. These enterprises would be speedily consummated, because as the single point occupied by our fleet would be avoided, all the detachments would be unopposed, and after a few hours devoted to burning cities, or shipping, or public establishments and taking in spoil, the several expeditions would leave the coast for some convenient rendezvous, whence they might return, either in fleet or in detachments, to visit other portions with the scourge.

Is it insisted that our fleet might, notwithstanding, be so arranged as to meet these enterprises?

As it can not be denied that the enemy may select his point of attack out of the whole extent of coast, where is the prescience that can indicate the spot? And if it can not be foretold, how is that ubiquity to be imparted that shall always place our fleet in the path of the advancing foe. Suppose we attempt to cover

Part 5, FMB. National Coast-Defense Board (Roosevelt Board, or "Taft Board").

Appointed by President Roosevelt, Executive order, Jan. 31, 1905. * * * "a joint board of officers of the Army and Navy 'to recommend the armament, fixed and floating, mobile torpedoes,

submarine mines, and all other defensive appliances that may be necessary to complete the harbor defense with the most economical and advantageous expenditure of money." * * * The board was

the coast by cruising in front of it, shall we sweep its whole length, a distance scarcely less than that which the enemy must traverse in passing from his coast to ours? Must the Gulf of Mexico be swept, as well as the Atlantic or, shall we give up the Gulf to the enemy? Shall we cover the southern cities, or give them up also?

The uncertainty of the point on which an enemy may direct his attack, the suddenness with which he may reach it, and the powerful masses which he can concentrate at a distance out of our reach and knowledge, or suddenly, and at the very moment of attack, require that every important point be duly prepared to repel his attempt, or retard it, until reinforcements can arrive and adequate means of resistance be organized. By land we are acquainted with the motions of an enemy, with the movements and direction of its columns; we know the roads by which he must pass; but the ocean is a vast plain without obstacle there his movements are made out of our sight, and we know nothing of his approach until he is already; within the range of the eye. We must, unquestionably, do one of two things—either relinquish a great extent of coast, confining our cruisers to a small portion only, or include so much that the chances of intercepting an enemy would soon be out of the question.

But what are the enemy's means? They consist of his whole seagoing force which he concentrates for the sake of inflicting the blow.

"From the nature of maritime operations, such a fleet could bring its whole strength to bear upon any particular position, and by threatening or assailing various portions of the coast, either anticipate the tardy movements of troops upon land and effect the object before their concentration, or render it necessary to keep in service a force far superior to that of the enemy, but so divided as to be inferior to it on any one point." [Secretary of War Cass.]

On the impracticability of covering even a small extent of coast by cruising in front of it, or in other words, the impossibility of anticipating an enemy's operations; of discovering the object of movements of which we get no glimpse and hear no tidings; and of seeing the impress of his footsteps on the surface of the ocean, it would be well to consult experience.

* * * * *

Our fortifications and torpedoes, then, must close all of our important harbors against an enemy, and secure them to our military and commercial marine; second, must deprive an enemy of all strong positions where, protected by naval superiority, he might fix permanent quarters in our territory, maintain himself during the war, and keep the whole frontier in perpetual alarm; third, must cover the great cities from attack; fourth, must prevent, as far as practicable, the great avenues of interior navigation from being blockaded at their entrances into the ocean; fifth, must cover the coastwise and interior navigation; and sixth, must protect the great naval establishments. In these places are to be found objects that are in every sense of the highest value. On the one hand we see accumulations of military and naval material, and structure for naval accommodation that could not be replaced during a war, which are of indispensable necessity and of great cost; and on the other hand, the untold wealth of great cities. As these objects must be great in the eyes of the enemy—great for him to gain and for us to lose—corresponding efforts on his part must be looked for and guarded against.

There should now be stated, in a few words, our system of seacoast defense, a system steadily pursued from the first by this department, but modified from time to time as new improvements in attack and defense of coasts have been introduced.

Fortifications must command from the shores exterior to our harbors all the waters from which the enemy can reach our cities and navy yards with his shot and shell; the harbor mouths and all the narrow passes within them, must also be occupied, and if nature has not afforded all the positions deemed requisite, others must, if practicable, be formed artificially. Fortifications should succeed each other along the channels of approach and in our harbors, so that the enemy may nowhere find shelter from our fire while lying within our harbors, should he succeed in passing the outer lines of works. The harbor mouths and channels must be obstructed by lines of electrical torpedoes for holding the enemy's vessels under fire of the fortifications, previously constructed and stored in the latter, and laid, on the advent of war, in systems, the plans of which have been carefully elaborated in time of peace, by studies of the local charts and tidal currents, each harbor having its own system recorded in this department. The wires, for conducting the current from the electric apparatus on shore, must at the same time be laid securely in subterranean galleries carried out to deep water, and the electric machines themselves—the hearts of the torpedo system—must be placed in chambers within the fortifications, hidden from the enemy, and secured beyond all peradventure from his direct and curved fire. These galleries and chambers must be covered with heavy masonry arches and great masses of earth, and the former, to be efficient, must be indurated, and the latter compacted by time. The torpedo lines must be served by officers selected from the Engineers and the Artillery, assisted by detachments from a torpedo corps of intelligent and skilled Engineer soldiers, and both officers and men must be thoroughly instructed in the theory and practice of electricity and torpedo obstructions, for they must know how to render the torpedoes instantly harmless for our own vessels, or active against an enemy's.

further instructed "to extend its examinations so as to include estimates and recommendations relative to defenses of the insular possessions" and to "recommend the order in which the proposed defense shall be completed, so that all the elements of harbor defense may be properly and effectively coordinated."

Report dated Feb. 1, 1906. Printed as Senate Document 248, 59th Congress, first session.

CONCLUSIONS OF THE BOARD:

The board, after carefully weighing the relative commercial and strategic importance of the ports and harbors of the United States and the insular possessions, modifies and revises the list of ports submitted by the Endicott Board as requiring defense. The revised list below is arranged in geographical order.

Heavy mortars must be placed in large numbers to command all those positions where an enemy is likely to anchor within their range, either for the purpose of tampering with, or destroying our torpedo lines, or shelling our cities and public depots of military and naval supplies. The efficiency of mortar batteries against shipping is acknowledged by all military engineers; it is fully appreciated by the navies of all nations and they are comparatively inexpensive.

Our guns and mortars must be capable of piercing the sides of his ironclads and of breaking in his decks, and they must be mounted in numbers sufficient to make it impossible for any of his fast-running war steamers to get past our works.

* * * * *

—H. G. WRIGHT, *Chief of Engineers, Brig. and Bvt. Major General.*

Annual report for 1884, 4, 5, 6, 7, 8, 9. Report of the Chief of Engineers, United States Army. Washington, D. C., Oct. 15, 1884.

* * * * *

SEACOAST AND LAKE-FRONTIER DEFENSES.

It would doubtless be superfluous at this late date to explain the principles upon which the system of our seacoast fortifications should be based but for the persistent misrepresentations made by individuals whose positions unfortunately enable them to mislead public opinion.

The sole object of seacoast forts and batteries, as constructed by the Corps of Engineers, has been to prevent hostile fleets from approaching near enough to our important seaports to destroy shipping, public establishments, such as navy yards, etc., and lay our cities under contribution. The contribution which could be levied from New York alone would probably pay four or five fold the cost of all the fortifications of the important harbors of the country.

* * * * *

The present system, by the use of torpedoes—that is, submarine mines anchored in the channels—enables the defense to stop the ingress of hostile fleets until the mines shall have been removed, or, at least, the means of exploding them destroyed.

These mines consist of a shell of iron inclosing a charge of dynamite, guncotton, or explosive gelatin, and are so arranged as to make it impossible for a vessel to enter without touching one or more.

The explosion is regulated by electric currents communicated from the shore through cables, so as to take place from simple contact of the vessel with the torpedo, or by the act of the electrician, as he may choose; so that a friendly vessel shall pass over unharmed, while that of an enemy immediately following would be destroyed.

But unless these lines of torpedoes are defended by guns of such power as to pierce the armor of ironclads, they may be countermined and removed with impunity, or the cables and other electrical communications may be dragged for and the whole system rendered innocuous.

The rooms which contain the electric apparatus and whence the cables start, as well as the tunnels through which these pass into the water and communicate with the mines, require to be shot and shell proof, for a solitary missile penetrating either the operating room or the cable tunnel might destroy electric connection with the mines and render the entire system useless.

* * * * *

The persons who tell us to wait for war, and then to improvise a sand heap as a fort without making any provision of emplacements for the guns or for their service, either assume the people to be profoundly ignorant, or are so themselves.

* * * * *

Some of the guns on land should at least equal the most powerful afloat on the fleet. The armor on land should be much heavier than that carried by ships. The heavier guns of the batteries should be so protected as not to be reached except by a shot coming through the port. It would be very bad judgment, in order to save a little armor, not to make the more important batteries invulnerable to the fire of the fleet.

* * * * *

Those persons are greatly in error who imagine that by diplomatic delays war may be averted until proper preparations for defense can be made. Were we as well prepared as many other nations, this might be true; but while a diplomatic delay of a few months might be necessary for a naval power to commission

HOME PORTS.

Kennebec River.
Portland.
Portsmouth.
Boston.
New Bedford.
Narragansett Bay.
Eastern entrance to Long Island Sound.
Eastern entrance to New York.
Southern entrance to New York.
Delaware Bay.
Baltimore.
Entrance to Chesapeake Bay.
Hampton Roads.
Potomac River.
Cape Fear River.
Charleston.
Savannah.
Key West.
Tampa.
Pensacola.

Mobile Bay.
Mississippi River.
Galveston.
San Diego.
San Francisco.
Columbia River.
Puget Sound.
Lake ports.
Kiska Island.

INSULAR PORTS.

Guantanamo.
San Juan.
Guam.
Subic Bay.
Manila Bay.
Pearl Harbor and Honolulu.

ISTHMIAN CANAL PORTS.

Colon.
Panama.

its ships, it would require a great many years for us to get together modern guns, without reference to constructing forts and batteries for their reception.

Past events by no means justify the assertions made that our cotton and grain have become so necessary to the nations that they could not engage in war with us for a short period without the interruption of their supplies of these articles. It seems to be forgotten that a descent upon our coast, to hold our unprotected cities under the guns of a hostile fleet, would consume but a few months, and in the meantime cotton and grain in sufficient quantity might be obtained elsewhere. Let it be well understood that the modern system is to make war sudden, sharp, and decisive, and to make the beaten party pay expenses.

If a future struggle for the supremacy in shipping should result in war, let us at least enter into it with our harbors and cities well protected, so that our merchantmen, and even naval vessels, may have places of refuge without fear of capture at our wharves.

Should, however, the evil day come and find us without modern guns, without sufficiency of torpedoes, without fortifications except the sand heap which forms the staple quotation, without emplacements for the guns if we had them, or magazines, or machinery for loading or maneuver, or any facilities whatever for shelter of guns and cannoners against shells and machine guns, it is to be feared we would not cordially welcome the prophet who, having opposed timely preparations promised that in the supreme moment, when the hostile ironclads, whatever their strength and power, should approach the harbor of New York, they would be turned back somehow, without explaining how, by "Yankee energy, Yankee skill, Yankee inventive genius." It is to be feared that the first flash of the monster guns would dissipate this oratorical vapor emitted when the danger was far off, and leave the deluded hearers to realize the fate of the blind who follow the blind.

—JOHN NEWTON, *Chief of Engineers, Brig. and Bvt. Maj. Gen.*

Annual report for 1888, 5. Report of the Chief of Engineers, United States Army. Washington, D. C., Oct. 1, 1888.

SEACOAST AND LAKE-FRONTIER DEFENSES.

Neglect of any structure, however massive or well built, results in more or less rapid deterioration, and we find to-day everything connected with our permanent defenses, which are dependent upon annual appropriations for their maintenance and repair, going to rack and ruin; slopes overgrown with grass and weeds and gullied by the rain; walks and roads ragged and untrimmed and full of holes and breaks; ditches and drains filled up or fallen in, and pools of stagnant water on the parades and in the casemates; the sewers in bad order, with the consequent evils; mortar and cement falling from the joints of masonry for want of repointing; timber gun and ammunition platforms rotten or decayed, and permanent concrete or masonry platforms settling or out of plumb, thus preventing the proper service of the guns; casemates and quarters leaky, unhealthy, and uninhabitable; magazines damp and useless; revetment walls on water fronts falling down, and waves making serious and rapid encroachments on valuable ground, thus impairing eligible sites for future works, and generally about the ungarrisoned forts an appearance of total abandonment and decay, and from the commanders of garrisoned forts continued and urgent appeals to keep the works in proper repair for the comfort and convenience of the garrison and the efficient use of the armaments.

—THOS. LINCOLN CASEY, *Brig. Gen., Chief of Engineers.*

GUNS.

The gun defense of a port of first importance should consist of guns of not less than 12-inch caliber, 12-inch mortars, and suitable rapid-fire guns for the defense of the mine fields.

Ten-inch guns are sufficient to cover channels liable only to cruiser attack.

Six-inch guns should be used for the protection of places subject to naval raids and the special case of mine fields at distant ranges.

Three-inch guns should be used for the protection of mine fields at ordinary ranges.

No fixed rule for determining the number of guns required to give an adequate protection, and in arriving at a conclusion as to what should constitute the defense, the following considerations have been accepted, which tend to diminish the number recommended by the Endicott Board without decreasing in any way the protection to the harbors.

1. The development of a system of range finding, fire control and direction, much more efficient than could be anticipated at the time of the Endicott Board, which gives the land gun a very great advantage in accuracy of fire over the gun afloat, especially at the longer ranges.

2. The increased power developed in guns of a given caliber.

3. The adoption of the disappearing carriage for the higher-caliber guns, thereby attaining an increased rate of fire.

4. Ships engaged in an attack of a fortified position must have ample room in which to turn, and as war vessels are being constructed larger and of deeper draft, the defenses required for narrow and shallow channels, whether natural or dredged, may be diminished, since the heavier ships are excluded.

5. If the armament will compel the enemy to land in order to effect its capture, it has fulfilled its function, and any increase in armament thereafter is an unwarrantable expense in material and personnel.

SUBMARINE MINES AND TORPEDOES.

Are essential features. Suitably equipped boats and barges necessary. Boats already employed insufficient. Claims of Navy to command of seagoing defenses recognized, and also the general inadvisability of assigning naval units to special stations. Because of conditions in Long Island Sound, Puget Sound, and Golden Gate defenses, submarine mines can not be relied upon. Navy should assign submarine boats or other suitable vessels to such points.

Board recommended experiments with automatic torpedoes.

ELECTRICAL APPLIANCES.

Central plant obligatory, with reserve, scattered, or individual smaller units.

SYSTEM OF RANGE FINDING, FIRE CONTROL AND DIRECTION.

Central fire control essential. Expense a very small percentage of the cost of the whole fortifications controlled. Suitable boats and appliances necessary for submarine cable system.

SEARCHLIGHTS.

Experience has emphasized their importance.

SECURITY AND INFORMATION.

Defenses should communicate with each other with suitable signaling apparatus, including wireless telegraph, military, or commercial lines. Special report submitted laying stress on U. S. control of communications with Isthmian America.

GOVERNMENT ENCOURAGEMENT OF PRIVATE ESTABLISHMENTS IN THE SUPPLYING OF WAR MATERIAL FOR COAST DEFENSE.

Experience has not shown the necessity for the Government's embarking in the manufacture of any class of material which has thus far been furnished exclusively by private establishments.

There is certain ordnance material for which there is an increased need in time of war, and it is imperative that adequate provision should be made to supply the consequent demand. This can be accomplished only by establishing in advance plants in excess of peace requirements in which, of necessity, must be partially unemployed in time of peace. It is unreasonable to expect the private manufacturers to maintain such plants.

HARBOR FLOATING DEFENSE.

An adequate naval battle fleet required. Floating defense scheme advocated by the old Endicott Board deemed unwieldy and of little value.

ARMAMENT RECOMMENDED.

The board presents a table covering armament details ranging from 16-inch guns downward, embracing mortars, submarine defenses, power plants searchlights, etc.

Total of detailed estimates—home ports \$50,879,339; insular ports, \$19,873,895 (including ammunition, \$2,900,000); Isthmian Canal ports \$4,827,682.

ORDER IN WHICH DEFENSES SHOULD BE COMPLETED.

(a) Reserve ammunition supply; (b) fire-control and power installations for existing works; (c) torpedo defense to be completed. Urgent that additional guns and emplacements recommended for important channels should be commenced at an early date in view of the number of years required to complete such work.

Among the places recommended to be defended are the following, in the order desirable:

- Entrance to Chesapeake Bay.
- Eastern entrance to Long Island Sound.
- Puget Sound.
- Subic Bay.
- Guantanamo.
- Entrance to Manila Bay.

Adequate personnel should be provided.

Order in which the actual work should be taken up should be left to discretion of the Chief of Engineers, with cooperation, etc., of Chief Signal Officer, Chief of Ordnance, and Chief of Artillery.

MEMBERS OF THE BOARD.

Wm. H. Taft, Secretary of War, president of the board; Adna R. Chaffee, lieutenant general, U. S. Army; J. C. Bates, major general, U. S. Army, Chief of Staff; Charles M. Thomas, rear admiral, U. S. Navy; J. P. Story, major general, U. S. Army; A. W. Greely, brigadier general, Chief Signal Officer; William Crozier, brigadier general, Chief of Ordnance; A. Mackenzie, brigadier general, Chief of Engineers; Samuel M. Mills, brigadier general, Chief of Artillery; C. S. Sperry, captain, U. S. Navy; George W. Goethals, major, General Staff, secretary of the board.

CONTENTS OF REPORT.

Message of President Roosevelt to Congress, Mar. 5, 1906; letter from Secretary of War Wm. H. Taft, transmitting report of the board; report of the board.

Report of Committee No. 1 composed of: Maj. Gen. John P. Story, U. S. Army; Brig. Gen. William Crozier, Chief of Ordnance; Brig. Gen. Alexander Mackenzie, Chief of Engineers; Brig. Gen. Samuel M. Mills, Chief of Artillery; Capt. Charles S. Sperry, U. S. Navy; Maj. George W. Goethals, General Staff, recorder. Reporting on the following subjects: (1) The study of exposed ports of our sea-coast, including insular possessions, and information as to increase of existing defense required and additional ports and harbors to be defended. (2) The number and caliber of high-power and, rapid-fire guns necessary to be emplaced to give a reasonably good defense at all points recommended for defense,

with the cost of said guns, mounts, and emplacements. (3) Service and reserve ammunition supply and storage magazines. (4) The capacity of gun and gun-carriage works in the United States.

Report of Committee No. 2 composed of: Maj. Gen. John P. Story, U. S. Army; Brig. Gen. Adolphus W. Greely, Chief Signal Officer; Brig. Gen. William Crozier, Chief of Ordnance; Brig. Gen. Alexander Mackenzie, Chief of Engineers; Brig. Gen. Samuel M. Mills, Chief of Artillery; Capt. Charles S. Sperry, U. S. Navy; Maj. George W. Goethals, General Staff, recorder. Reporting on the following subjects: (1) Torpedo defense, fixed and automobile. (2) Power plants and use of electricity for posts, armament, and accessories. (3) Installations for fire control. (4) Searchlights. (5) Security and information.

Report of Committee No. 3 composed of: Rear Admiral Charles M. Thomas, U. S. Navy; Maj. Gen. John P. Story, U. S. Army; Brig. Gen. Adolphus W. Greely, Chief Signal Officer; Brig. Gen. Alexander Mackenzie, Chief of Engineers; Brig. Gen. Samuel M. Mills, Chief of Artillery; Capt. Charles S. Sperry, U. S. Navy; Maj. George W. Goethals, General Staff, recorder. Reporting on: Floating defenses, consisting of retired battleships, monitors, etc., for defense of harbors, particularly of wide entrances, and the auxiliary use of scout boats, torpedo boats, and submarine boats; the number and cost of such boats and other floating defenses.

FMC. OPERATIONS ON DEFENSES IN GENERAL, 1866-1912.

(See also FMA, p 1801, of this Index.)

1870. Results of a series of experiments with modern projectiles upon iron shields and earth and sand parapets. **70**, 4. Co. G. Barnard, Lt. Col. H. G. Wright, and Capt. P. S. Michie ordered to determine by actual inspection the extent to which iron has been introduced into seacoast defenses by the maritime powers of Europe. **70**, 10.

1872. BE. organized in June, 1865. The projects for the application of torpedoes to H. defense was considered, the commanding officer of the engineer battalion being a member for that purpose. **72**, 25.

1873. \$300,000 app. for torpedoes for H. defense and preservation of the same, and for obtaining the latest information concerning the electrical apparatus, experiments, conditions of service, and the systems of torpedo defense in other countries. Maj. T. L. Casey and H. L. Abbot ordered to Europe to obtain this information. **73**, 25.

1874. Some results of torpedo experiments. **74**, 30.

1875. Torpedo experiments continued, number of trained men necessary to plant mines. **75**, 29.

1876. Experiments with the iron target, torpedo crate, torpedo cases, etc. **76**, 30. Comparison of defensive armament with that of an enemy's offensive armament. Cost of some of the British ships of war. **76**, 5; **79**, 6.

1877. Torpedo trials: Submerged ring, torpedo target, torpedo material, and reduction of data, with recom. **77**, 25. Recom. of the board. **77**, 27; **78**, 31.

1878. Project for the year 1879-80 presented. **78**, 34. Torpedo trials, submerged ring, torpedo target, torpedo cases, circuit closers, the telephone, with recom. **78**, 30. Current observations in reference to torpedo defense, by Lt. A. H. Payson. **78**, 1304.

1879. Some results of the analysis of subaqueous explosions and of electrical fuses, with recom. **79**, 35.

1880. Seacoasts, proper method of defense. Comparison of the methods adopted by other countries for seacoast defenses. **80**, 4; **81**, 4. Results of investigations of the sympathetic explosions of dynamite and other experiments. **80**, 57. Plans for coast defenses, questions on R. and H. imp., torpedo defense, with results of the investigations and recom. of the board. **80**, 54; **81**, 56.

1881. Report by Lt. Col. Q. A. Gillmore on the condition of our seacoast defenses and the importance of strengthening them, involving the following subjects: An unprotected seacoast; character of the attack; requirements of a good defense; functions of the Regular Army and militia; defense by a H. fleet alone; defense by fortifications and their accessories; a perfect defense; torpedo boats and their achievements; with a brief description of Buffington's and King's counterpoise gun carriages, with drawings. **81**, 399.

1882. Report by Lt. W. H. Bixby of a journey made, 1881-82, in Belgium, Holland, Germany, and England, to obtain information in relation to turrets, armor plate, and the service of heavy guns of seacoast defenses. **82**, 435. Coast defenses, torpedo defenses, and other subjects considered. **82**, 56. Report, dated Nov. 30, 1881, on the condition of the fortifications, and what number of them, if any, could be dispensed with. **82**, 411.

1883. Seacoast and lake frontier defenses considered. Estimated cost of fortifications of eight principal ports, \$60,000,000. Itemized estimate of app. required for 1885-86. **83**, 4. Coast defense, torpedo defense, etc., considered. **83**, 15.

1884. Coast defenses, consideration of. Elements of defense for the entrance to a H. given, and est. cost of heavy guns and emplacements needed for localities mentioned. \$75,000 allotted for torpedo defense, experiments continued with explosives, with results and est. required. Summary of operations of the board: Aug. 30, 1884, the board submitted estimates for heavy guns and emplacements for the places given. **84**, 55.

1885. Preparation of report by Capt. Bixby upon his investigations in Europe. **84**, 421. Operations restricted to those necessary for the preservation and repair of existing works. The subject of the defensive system of the country, as far as regards the ports at which fortifications or other defenses were most urgently required, referred by Congress to a board of which the Sec. of War was president. Est. cost for the modification and repair of existing works for 1886-87, \$1,274,000. **85**, 4. Capt. Bixby's report upon investigations in Europe completed. **85**, 421. Fortifications, R. and H., coast defenses, and torpedo defense considered; experiments made with the Sims movable torpedo and new explosives. **85**, 48.

1886. Coast defense, torpedo defense, with results of experiments. **86**, 48. Comparisons of fortifications of the present day, both for offense

and defense, with those of 1880. The largest gun in service, 1860, was the 10-inch Rodman smooth bore, the energy of whose projectile was 2,000 f.-t., while the guns of the "present" day deliver 45,000 f.-t. of energy, and are steadily increasing in power. Discussions of a naval attack and coast defenses, localities given in order of urgency for defensive armament. The defenses and their accessories discussed, comparison of the U. S. 12-inch B. L. rifle, cast iron, and the Krupp's 12-inch B. L. rifle, steel; other calibers discussed; torpedo system considered among the most important means of conducting an active defense of the coast. List of ports, with description of fortifications and other defenses with reference to armament, mines, torpedoes, etc. Practical measures for obtaining the appliances for defenses. Recapitulation of est. 86, 499-525.

1887. Est. for constr. of gun and mortar batteries, torpedo casemates and galleries, and for purchase of torpedo material for the defense of the chief seaports. 87, 4.

1888. Acts of 1876-80 app. each year for the protection, preservation, and repair of fortifications and other works of defense, \$100,000; acts of 1881-84, an., \$175,000; and act of 1885, \$100,000. This latter was the last app. and was practically exhausted by the end of the year for which it was app. Est. of app. required for 1889-90, \$4,952,000. 88, 4.

1889. Extract from report of Board of Engineers with reference to the existing contracts for making armament. Main features of the proj. of the board on fortifications, 1885, and permanent Board of Engineers, with est.; \$200,000 app. for torpedoes for H. defense and \$250,000 for casemates and cable galleries for operating submarine mines. Repair and preservation of Fort Marion, St. Augustine, Fla., advised; \$117,000 app. for sea walls and embankments. Est. given of app. required. 89, 4.

1890. Est. for defensive works; \$117,000 app. for sea walls and earth embankments at Fort Niagara, Davids Isld., and Governors Isld., N. Y. 90, 4.

1891. Localities named at which app. are to be expended and where defensive works are in progress. 91, 4.

1892. Est. and proj. given. 92, 4.

1893. Proposed new works. Table giving locality and armament for which funds have been allotted. 93, 4.

1894. Allotments made. 94, 4, 11.

1895. Proj. for defense prepared for localities named. Places named where allotments have been made for emplacements and additional platforms; 25 casemates completed at places named, and 3 more being built; \$20,000 app. for submarine mine material and necessary appliances. 95, 4. Places named where allotments have been made for beginning new works. 95, 12. Places named where work of preservation and repair of fortifications

has been carried on during the year. 95, 13. \$150,000 app., 1894, for sites for defenses at Narragansett B., Baltimore H., and Charleston H. 95, 14.

1896. List of places named where detailed proj. for artillery defenses have been prepared. Use made of the existing old-type fortifications. 96, 7. \$500,000 app. for sites; negotiations in progress. Work in progress on sea walls and embankments. Emplacements named where allotments have been made. Statement showing the conditions of the various emplacements Sept. 15, 1896. Total armament proposed in the proj. for defenses. 96, 10. \$100,000 app. for submarine mine defense; 28 casemates completed, 1 more being built. 96, 11.

1897. Localities named where title to sites has been obtained. Table giving emplacements provided for. Work in progress at 22 ports. Objections given to the contract system as applied to fortifications. Statement showing the condition of the various emplacements at the close of the fiscal year. 97, 10. \$150,000 app. for submarine mine material; 4 casemates, 2 special torpedo storehouses and storerooms being built. 97, 11.

1898. Localities named where proj. for permanent and temporary coast defenses have been prepared. Statements of app. for gun and mortar batteries and of the type of gun, with total guns and total emplacements provided. Tables giving total number of emplacements provided for, and either completed or under constr. at the beginning of the year. Nearly all the guns mounted transferred to the artillery. 98, 8. Discussions of the duties of a fortress commander as applied to the defenses of New York H., by Brig. Gen. G. L. Gillespie. 98, 579.

Dynamite batteries: These batteries constr. under the Ordnance Department in past years at locations named; \$150,000 app. in 1898 for work in San Francisco H.; work in progress. Localities given where batteries will be erected. 98, 11.

Submarine mines: List of some of the torpedo material purchased.

Preservation and repair of fortifications: Necessary minor repairs made.

Sea walls and embankments: \$55,000 app. for repairs at places named.

Sites: Localities given where title has been obtained to sites.

National defense: Allotments and their objects for 1898 given. 98, 14.

1899. Thirty localities named where proj. for defense have been adopted, also places where considerable study has been given coast defenses of insular possessions. Work has been carried on at 25 localities, at nearly all of which sufficient heavy guns and mortars now installed permit of an effective defense against naval attack. Temporary batteries maintained till the close of the war with Spain. 99, 9.

Gun and mortar batteries: The contract work authorized by Congress completed except one contract. Discussion of contract work.

Dynamite batteries: Work completed at San Francisco; provision yet remains for work at Sandy Hook, and other places given where contracts have been made under act of Sept. 22, 1888.

Range and position finders: The question of the type of finder best adapted not yet definitely settled. 99, 12.

Preservation and repair of fortifications: Repairs confined mainly to engineer material in the new seacoast batteries. The question of waterproofing magazines to be further considered.

Supplies for seacoast defenses necessary for operating electric light and power plants, no funds available. 99, 14.

Sea walls and embankments: \$2,500 app. Work carried on at Fort Schuyler. 99, 14.

Sites: \$300,000 app., negotiations in progress at places given. 99, 14.

Submarine mines: \$1,386,000 app. for torpedo material and the planting and maintaining of the mine fields; \$50,000 app. for torpedoes for H. defense, and applied to purchase of additional torpedo material and constr. of additional storage facilities for material on hand, and torpedo experiments. The practical experience gained with the adopted torpedo system during the war with Spain invaluable. 99, 15.

National defense: App. and purposes given. 99, 15.

¹ 1900. Localities named where proj. for defense have been adopted. 00, 6. \$1,800,000, the est. cost for defense of San Juan, Porto Rico. Rapid increase in the resisting power of armor plate in ship constr., necessitating corresponding changes in the details of coast defenses. The seacoast defenses are now about 50% completed. 00, 7.

Gun and mortar batteries: App., 1890 to 1900, \$22,142,212.62, not including \$306,805.04 for national defense. Tables giving type of gun and carriage, with total number of each provided, also emplacements provided. Table giving total number of emplacements of every kind provided for by all app., also their condition. 00, 7.

Dynamite batteries: \$180,000 app. for pneumatic dynamite batteries; work begun at Sandy Hook, and plans in progress for other places given. 00, 10.

Range and position finders: \$150,000 app. for 2 additional range-finder stations; 30 previously constructed; total number projected, 177. 00, 10.

Preservation and repair of fortifications: Water proofing, and care of engineer material the principle work. 00, 11.

Supplies for seacoast defenses: \$25,000 app. for supplies for light and power plants. 00, 11.

Sea walls and embankments: \$200,000 app. for places named; work in progress. 00, 11.

Sites: \$200,000 app.; sites bought and proceedings instituted for others. 00, 12.

Submarine mines: \$50,000 app.; work in progress equipping all Hs. with a full complement of torpedoes. 00, 12.

1900-01. Continuance of study of existing torpedo system in the light of reports submitted by officers of the Corps of Engineers in charge of submarine-mine defenses during Spanish-American War. 01, 5, 695.

1900-01. Proj. for 31 localities adopted. Likewise given. Detailed proj. for defense of entrance to Chesapeake B. at Cape Henry, Va., approved Sec. of War. Several additional localities under consideration. Study of defenses of Porto Rico and Hawaiian Islands. Est. for San Juan, P. R. \$1,800,000 prepared, pre. proj. for Pearl H. at Honolulu, H. T., available. 01, 6. Defenses of U. S. about 50% done. During past year considerable progress made toward installation of adequate rapid-fire armament. Existing app. proj. for seacoast defense contemplate mounting about 464 heavy guns of 8, 10, 12, and 16 inch caliber; about 1,041 R. F. guns from 6-pounder to 6-inch caliber, and of about 704 mortars; total cost estimated \$50,000,000. Up to present time \$23,757,009.00 app. \$992,000 spent for reconstr. and repair of damaged fortifications at Galveston in hurricane of Sept. 8, 1900. Table showing guns and carriages provided for by Ordnance Department and emplacements provided for by Engineer Department. During year following armament added: Fifteen 12-inch, seven 10-inch, eleven 8-inch, 35 R. F. guns, and 23 mortars. Existing contract Venab Constr. Co., Atlanta, Ga., for constr. of gun and mortar batteries at Key West, Fla., abandoned. Work readvertised and let to L. L. Leach & Son.

¹ Up to June 30, 1900, provision had been made for emplacing 309 heavy guns, 368 rapid-fire guns, and 372 12-inch mortars.

The status of emplacements for which funds had been provided by Congress up to June 30, 1900, was as follows:

| | 12-inch. | 10-inch. | 8-inch. | Rapid fire. | 12-inch mortars |
|-------------------------|----------|----------|-----------------|------------------|-----------------|
| Guns mounted..... | 57 | 105 | ² 75 | 53 | 2 |
| Ready for armament..... | 23 | 8 | 16 | ³ 189 | |
| Under construction..... | 13 | 9 | 3 | 81 | |
| Not yet begun..... | | | | 45 | |
| Total..... | 93 | 122 | 94 | 368 | 3 |

² Ten of these, mounted temporarily, have since been dismounted.

³ Including seventy 6-pounders not requiring permanent emplacements.

Chicago, Ill. Est. of \$4,000,000 sub. for contr. work on gun and mortar batteries in accordance with proj. Table of guns provided and emplacement work done. 01, 5-10.

1901-02. Board on torpedo system dissolved. Records sent to Artillery School of Submarine Defense, Willets Point, N. Y. 02, 6. Defense of Great Lakes and St. Lawrence R. under consideration. Proj. for defense of Porto Rico, Hawaii, Guam, Manila, and Subig B. approv. by Sec. of War. Defense board similar to Endicott Board to devise a modern-defense scheme necessary due to rapid development of defense and attack methods since Endicott Board. Existing proj. for seacoast defenses comprise 356 heavy guns of 8, 10, and 12 inch caliber, 1,294 R. F. guns from 2.24 to 6 inch caliber, and 544 mortars. Total engineering cost, \$50,000,000. Act May 25, 1900, does not permit constr. of mortar batteries. Summer, 1901, satisfactory tests made of mortar batteries. 02, 8. Table of guns provided and emplacement done. 02, 9. Ordnance Department designing 5 R. F. guns to fit emplacements for Brown segmental guns. 02, 10. Added during year: Eight 12-inch guns, three 8-inch guns, 20 R. F. guns, and 34 mortars. 02, 11. Contract for Key West work let L. L. Leach & Son (failed), annulled. Work to be done by hired labor and charged against contractor's bondsmen. 02, 11. Est. \$4,000,000 made for continuing constr. gun and mortar batteries. 02, 11.

1902-03. In the absence of legislation, a mixed board of Engineer and Artillery officers by au. Sec. of War has partly planned and reported upon emergency defense of most important insular Hs. Suggested to add a naval officer and that board meet in Washington, D. C. 03, 8. Defenses more than 50% done. Existing proj. for defense comprise 358 guns of 8, 10, and 12 inch caliber, 1,294 R. F. guns from 2.24 to 6 inch caliber, and 532 mortars. 03, 9. Added during year: Twelve 12-inch, three 10-inch, four 8-inch, 70 R. F., and 31 mortars. 03, 12. Est. of \$4,250,000 for contr. work. 03, 12.

1904. Existing proj. calls for three hundred and sixty-four 8, 10, and 12 inch guns, 1,296 R. F. 2.24 to 6 inch, and 524 mortars. Provision made for emplacing 334 heavy guns (including 26 temporary emplacements), 587 R. F. (including 1 temporary emplacement), and three hundred and seventy-six 12-inch mortars. Added during the year: One 12-inch, four 10-inch, 7 R. F., and 22 mortars. Est., \$4,000,000. 04, 6, 7, 8.

1904-05. A board, known as the National Coast Defense Board, with Sec. of War as its president, to study modern defenses, constituted by Executive order. 05, 7. Guns added during year: Seventeen mortars, eight 12-inch guns, one 8-inch gun, and 46 R. F. guns. Est., \$4,000,000. 05, 8.

1905-06. Board submitted final report Feb. 1, 1906. 06, 5. (See Part 5, FMB, p. 1821, of this index.)

Est., \$16,052,431 will be required. 06, 6. Guns added during year: Eight mortars, four 12-inch guns, and 94 R. F. guns. 06, 6. Est., \$4,247,400. 06, 7.

1906-07. Guns added during year: One mortar, three 10-inch guns, and 130 R. F. guns. 07, 7. Est., \$4,247,400. 07, 7.

1907-08. Added during year: Four 10-inch guns and 51 R. F. guns. 07, 11. Table, status of permanent work completed, or in progress. 07, 10.

1908-09. Added during year: Three 8-inch guns and 28 R. F. guns. 09, 12.

1909-10. Added during year: Three 10-inch guns and 46 R. F. guns. 10, 14.

1910-11. Added: Four 10-inch guns and 23 R. F. guns. 11, 9.

1911-12. Total app., \$29,008,664.80. Est., \$100,000 submitted. 12, 8.

FMD. PRESERVATION AND REPAIR.

(See also FMA, p. 1801 of this Index.)

| Part. | Title. |
|-------|---|
| 1 | Preservation and repair. |
| 2 | Preservation and repair, insular. |
| 3 | Preservation and repair, torpedo structures. |
| 4 | Preservation and repair, torpedo structures, insular. |

Part 1, FMD. Preservation and Repair.

1900-01. Operations limited mainly to the preservation of engr. material in the new batteries, to the application of remedial measures for imp. the conditions of the magazines of the earlier works as regards dampness, and to the care and preservation of the torpedo material stored at each H. Est., \$300,000 for next year, as \$100,000 of past year inadequate. **01, 11.**

1901-05. \$300,000 additional urgently needed. **02, 12; 03, 12; 04, 9; 05, 10.**

1905-06. To keep fortifications in effective condition an average expenditure of not less than \$25,000 a month is essential. **06, 8; 07, 9; 08, 13; 09, 14; 10, 16; 11, 12; 12, 11.**

Part 2, FMD. Preservation and Repair of Fortifications, Insular Possessions.

1908-09. Est. prepared for preservation and repair of completed batteries, by minor repairs, painting, etc. \$900 for Guantanamo B., Cuba;

\$1,500 for Hawaiian Islds.; and \$14,000 for Philippine Islds. **09, 19; 10, 20; 11, 21; 12, 19.**

Part 3, FMD. Preservation and Repair of Torpedo Structures.

1904-05. New torpedo-defense structures are built of timber and corrugated iron, and are liable to more rapid deterioration and decay than the more costly structures of concrete and masonry.

An est. of \$50,000 submitted for preservation and repair. **05, 12; 06, 9; 07, 11; 08, 16; 09, 17; 10, 18; 11, 15.**

Part 4, FMD. Preservation and Repair, Torpedo-Defense Structures, Insular Possessions.

1908-09. In order to provide for maintenance in proper condition of the numerous structures already erected in connection with torpedo defense,

est. \$1,000 submitted for Philippine Islds., and \$500 for Hawaiian Islds. **09, 19; 10, 20; 11, 21; 12, 20.**

FME. RANGE AND POSITION FINDERS, AND FIRE CONTROL.

(See FMA, p. 1801 of this index.)

| Part. | Title. |
|-------|-------------------------------------|
| 1 | Range and position finders, etc. |
| 2 | Fire control at batteries, insular. |

Part 1, FME. Range and Position Finders.

1900-01. Objection made by experts to the use of high towers on low sites. Work on towers stopped till views of artillery could be obtained. Est. of \$150,000 submitted. **01, 11.**

1901-02. Progress made in systematizing matter of fire control. Division of authority among Engr., Ordnance, Signal, and Artillery Departments. Steelwork delayed by steel market. Nine fire comm., 45 battery comm. sta. done; 12 fire comm., 3 battery comm. sta. under contract. Experiments under way to make smaller towers. **02, 11, 12.**

1902-03. Eleven fire comm., 55 battery comm. sta. completed; 22 f. c. and 55 b. c. under constr. **03, 12.**

1904. Horizontal-base system of position finding recently adopted by Artillery; boards of 2

traveling Artillery officers, associated with local Artillery commanders, and district Engr. officers at each fortified H. on the Atlantic and Gulf coasts prepared necessary schemes of base-end stations. **04, 8.**

1904-05. Tentative fire-control schemes for existing batteries adopted by Chief of Artillery, and detailed plans covering engineering part of work prepared. **05, 9.**

1905-06. \$590,000 allotted from act Mar. 3, 1905, applied at New York, Boston, and Portland. Plans and est. for work to be done with app. of \$700,000, act June 25, 1910, in preparation. **06, 7.**

1906-07. Engr. work in progress under allotments. **07, 8; 08, 12; 09, 13; 10, 15; 11, 10; 12, 8, 9.**

Part 2, FME. Fire Control at Batteries, Insular Possessions.

1905-06. In order that the high-power batteries now building and those to be built during the next fiscal year may be equipped with adequate fire-control systems, an est. amounting to \$752,360 is submitted to cover cost of Engr. work.

\$96,480 for Guantanamo B., \$165,120 for Honolulu and Pearl H., \$329,480 for Manila, and \$161,280 for Subic B. **06, 11; 07, 12; 08, 17; 09, 18; 10, 20; 11, 22; 12, 20.**

FMF. SEARCHLIGHTS AND ELECTRICAL EQUIPMENT.

(See FMA, p. 1801 of this index.)

| Part. | Title. |
|-------|--|
| 1 | Searchlights and electrical connections. |
| 2 | Reserve lights. |
| 3 | Searchlights, insular. |
| 4 | Electrical installations. |
| 5 | Electrical installations, insular. |

Part 1, FMF. Searchlights and Electrical Connections.

1900-01. Work on installation of searchlights at defenses of New York H. well advanced. Becoming important to inaugurate systematic installation of searchlight apparatus for night defenses. Economy in installation and the keeping of electric plants in good order in time of peace are promoted by habitually using fortification plants for post illumination also. Ests. \$500,000 for installation of searchlights and \$500,000 for installation of post mains and conduits urgently reqdm. **01, 13.**

1901-06. Est. \$500,000 submitted. **02, 14; 03, 14; 04, 9; 05, 10; 06, 8.** National Coast Defense Board est. cost of sufficient searchlights for coast of U. S. as \$2,987,700. **06, 8.**

1906-07. Est. \$1,000,000 submitted. **07, 9.**

1907-08. Eight projectors of a new type developed abroad and 2 of domestic manufacture purchased and issued to troops for test. Est. \$907,000 submitted. **08, 13.**

1908-09. Est. \$897,000 submitted; reduced by Sec. of War to \$50,000. **09, 14.**

1909-10. Est. \$516,000 submitted; reduced to \$50,000. **10, 16.**

1910-11. Est. \$102,000 submitted. **11, 11.**

1911-12. Est. \$250,000 submitted. **12, 9.**

Part 2, FMF.**Reserve Lights.**

1908. An est. \$19,500 submitted to supply reserve electric lanterns in sufficient quantity to all

batteries. **09, 17; 10, 17; 11, 13; 12, 11.**

Part 3, FMF. Searchlights, Insular Possessions.

1906. For the purchase and installation of searchlights at the defenses of the insular possessions, est. of \$500,000 is submitted, \$84,000 to be applied to Guantanamo B., Cuba; \$57,000 to San

Juan, P. R.; \$95,000 to Pearl H. and Honolulu, Hawaii; \$57,000 to Guam; \$95,000 to Subic B., P. I.; and \$114,000 to Manila, P. I. **07, 12; 08, 17; 09, 18; 10, 21; 11, 20; 12, 18.**

Part 4, FMF.**Electrical Installations.**

1906-07. The National Coast Defense Board est. that \$5,216,031 would be required to furnish necessary electrical equipment for defenses in

addition to current required for searchlights. **07, 8; 08, 13; 09, 13; 10, 15; 11, 10; 12, 9.**

Part 5, FMF. Electrical Installations, Insular Possessions.

1906-07. National Coast Defense Board est. \$788,713 would be required to furnish necessary electrical equipment for defenses of insular possessions, in addition to current required for searchlights. Ests. \$103,727 for Guantanamo B., \$34,469 for Honolulu and Pearl H., \$259,080 for Manila, and \$105,716 for Subic B. submitted. **07, 12.**

1907-08. Funds provided; work in progress. For continuation est. \$230,638 submitted, \$14,469 for Hawaiian Islds. and \$216,169 for Philippines. **08, 17.**

1908-09. Est. \$127,346 for Philippines submitted. **09, 18.**

1909-10. Est. \$171,962 for Philippines submitted. **10, 19.**

1910-11. Est. \$25,000 for Hawaiian Islds., \$21,614 for Philippines. **11, 20.**

1911-12. Est. \$34,469 for Hawaiian Islds. **12, 18.**

FMG. SITES, BATTERIES, AND EMBLACEMENTS.

(See FMA p. 1801 of this Index.)

| Part. | Title. |
|-------|-------------------------------|
| 1 | Sites, etc. |
| 2 | Sites, insular. |
| 3 | Dynamite batteries. |
| 4 | Modernizing old emplacements. |

Part 1, FMG.**Sites.**

1900-01. Negotiations continued for acquisition of sites at Boston H. (2 sites), Narragansett B. (3 sites), New York H. (extension of Fort Newton), Port Royal, S. C., San Francisco H., San Diego H., St. Johns R., Fla., Fort St. Phillips, La., and Cape Henry, Va. Acquisition of 1 site at Narragansett B., 2 tracts at Fort Newton, 1 site at San Francisco, and remainder of site required at Port Royal, S. C. completed during year. Est. \$2,000,000 submitted. **01, 12.**

1901-02. Negotiations for site at Portland, Me. Est. \$2,000,000 submitted. **02, 13.**

1902-03. Site at entrance to Long Isld. Sound and 1 tract at Fort Hunt, Va. Est. \$2,000,000 submitted. **03, 13.**

1903-04. Negotiations for sites at defenses of Kennebec R., Me.; Charleston, S. C.; Mobile Ala.; the Columbia R., and Puget Sound. Est. \$650,000 submitted. **04, 9.**

1904-05. Est. \$500,000 submitted. **05, 10.**

1905-06. Est. \$3,310,500 submitted. **06, 8.**

1906-07. Est. \$3,478,500 submitted. **07, 8.**

1907-08. Constr. of wall at Boston by city in progress. Tract at Fort Armistead, Md., purchased. Est. \$250,000 submitted. **08, 13.**

1908-09. R. on defense of San Pedro, Cal. submitted. Est. \$400,000 inadequate. **09, 14.**

1909-10. Acquisition of land for San Pedro completed. **10, 15.**

1910-11. Est. \$150,000 for acquisition of land at Cape Henry. **11, 11; 12, 10.**

Part 2, FMG. Defenses of Insular Possessions.

1902-03. Imp. of providing for defenses of insular possessions. Est. \$2,000,000 for constr. gun and mortar batteries. Est. \$526,100 for land for sites. **03, 14.**

1903-04. Preparation of pre. projs., accurate surs. of sites completed. Funds applied in the Philippines. Negotiations under way for acquisition of land. **04, 10.**

1904-05. Installation of batteries for the defense of important naval station at Guantanamo B., Cuba. Important that remaining sites be obtained as soon as possible. **05, 12.**

1905-06. Act 1906 provided for batteries in the Hawaiian Islds. **06, 10.**

1906-07. Est. for next year, \$8,618,000. **07, 11.**

1905-06. Est. \$526,100 submitted for acquisition of sites in the Hawaiian Islds. **06, 11.**

1907-08. Suggest condemnation proceedings **08, 17.**

1907-08. Est. \$2,818,400. **08, 16.**

1908-09. Condemnation proceedings instituted; court decree rendered. **09, 18; 10, 21; 11, 21; 12, 19.**

1908-09. Batteries have been constr. at Guantanamo B., Cuba, and constr. work now in progress at Honolulu and Pearl H., Hawaii, and Manila and Subic B., P. I. **09, 17.**

1909-10. Est. \$262,200 (reduced to \$150,000 for Hawaiian Islds., and \$1,169,000 for Philippine for completion of projs. **10, 19; 11, 19; 12, 18.**

1910-11. For constr. of works of defense against landing parties in the Philippine Islds. app. as follows: Act Mar. 4, 1911, \$180,000. **11, 22, 12, 20.**

Part 3, FMG.

Dynamite Batteries.

1900-01. Work on battery at Sandy Hook completed; that at Fishers Isld. begun. On June 5, 1901, Board of Ordnance and Fortifications reported this type of battery obsolete. Sec. of War ordered discontinuance of work at Fishers Isld. and Port Royal. **01, 10.**

1901-02. Sec. of War directed sale of obsolete dynamite guns. No further reports to be submitted. **02, 11.**

Part 4, FMG. Modernizing the Older Emplacements.

1903-06. Proposed to bring older emplacements, first constr. under Endicott plan, up to date. Est. \$942,500 for 1,297 different emplacements. **04, 8; 05, 9; 06, 7.**

1906-12. Au. asked to apply \$165,261.36 to the initiation of mechanical powder service. **07, 8.** Au. granted; arrangements for manufacture and installation of machines in progress. **08, 12; 09, 13; 10, 14; 11, 8; 12, 8.**

FMH.**SUPPLIES.**

(See FMA. p. 1801 of this Index.)

| Part. | Title. |
|-------|--|
| 1 | Supplies for coast defense. |
| 2 | Supplies for coast defense, insular. |
| 3 | Equipment of Coast Artillery, armories, Organized Militia. |

Part 1, FMH. Supplies for Seacoast Defenses.

1900-01. Requisitions are made directly upon Chief of Engineers for tools and electrical and engine supplies for use of troops for maintaining light and power plants in gun and mortar batteries. Est. \$25,000 submitted for next year. 01, 11.

1901-03. Est. \$35,000 submitted. 02, 12; 03, 12.

1903-08. Est. \$40,000. 04, 10; 05, 11; 06, 9; 07, 10.

1907-08. Wattmeters being procured. As plants become worn, demands for supplies increase \$45,000 est. necessary for procurement of electrical supplies. In addition, issue of reserve electrical lights of a form approved after exhaustive test by the Artillery requested by Chief of Coast Artillery believed desirable by Chief of Engineers; est. \$19,500 additional to the \$45,000 above. 08, 15.

1908-12. Est. \$45,000 submitted for 1910 09, 16; 10, 17; 11, 12; 12, 11.

Part 2, FMH. Supplies for Seacoast Defenses, Insular Possessions.

1908-12. Est. \$5,000 submitted for necessary supplies and material for plants in Philippine

Islands, \$1,000 for Hawaiian Islands. 09, 19; 10, 20 11, 22; 12, 20.

Part 2, FMH. Equipment of Coast Artillery, Armories, Organized Militia.

The Army app. act approved Mar. 3, 1911, provided the sum of \$338,170 for the equipment of armory buildings provided by States for instructional purposes for Coast Artillery companies of the Organized Militia. With these funds equipments are being installed for the instruction of Coast Artillery militia at the following places:

Boston, Mass., South Armory.

Bridgeport, Conn.

New York City:

Ninth District Armory.

Thirteenth District Armory.

Savannah, Ga.

San Francisco, Cal.

For the work required of the Engineer Department in this connection the sum of \$105,426.50 has been assigned to this department for expenditure by the Sec. of War. At the close of the fiscal year the engineer work at the Boston Armory had been completed so far as possible pending the arrival of the armament and other equipment, and the work remaining to be done at this armory and the necessary work at the other armories had been placed under contract.

By the Army app. act of Aug. 24, 1912, the availability of this app. was extended to include obligations incurred during the fiscal year ending June 30, 1913.

12, 29.

FMI.**TORPEDOES, MINES, ETC.**

(See FMA. p. 1801 of this Index.)

| Part. | Title. |
|-------|---------------------------|
| 1 | Submarine mines. |
| 2 | Submarine mines, insular. |

Part 1, FMI.**Submarine Mines.**

1900-01. With few exceptions all Hs. equipped with torpedo storehouses, cable tanks, mining casemates. Experiments have been conducted. Est. \$100,000 made for continuing work. Work of transferring torpedo equipment to Artillery in progress under act Feb. 2, 1901. **01, 12.**

1901-02. Mining casemates and additional storage facilities required at several localities. Est. \$100,000 submitted. Act June 6, 1902, assigned to Artillery Corps purchase of torpedo material proper, such as cables, cases, floating plant, etc., and left the constr. of buildings, casemates, cable galleries, and cable tanks with the Corps of Engineers. **02, 13.**

1902-03. Est. \$225,000 for additional material. **03, 13.**

1903-04. Based on a list of new casemates, cable tanks, storehouses, and loading rooms prepared by Artillery board. Au. est. \$600,000 submitted. All apparatus has now been transferred to Artillery. **04, 10.**

1904-05. Est. \$540,700 submitted. **05, 12.**

1905-06. Est. \$1,352,819 submitted. **06, 10.**

1906-07. Est. \$464,964 submitted. **07, 11.**

1907-08. Est. \$289,964 submitted. **08, 16.**

1908-09. Est. \$189,964 (omitted). **09, 17.** Reduced to \$50,000. **10, 19; 11, 15.**

1911-12. Est. \$35,000 submitted. **12, 14.**

Part 2, FMI. Submarine Mines, Insular Possessions.

1905-07. Est. \$382,500 submitted for constr. torpedo structures. \$24,000 for Guantanamo B., Cuba; \$221,000 for Manila, P. I.; and \$137,500 for Subic B., P. I. **06, 11; 07, 12.**

1907-08. Detailed plans being prepared. **08, 17; 09, 18; 10, 20; 11, 22; 12, 20.**

FMJ. SEA WALLS AND EMBANKMENTS.

(See FMA. p. 1801 of this Index.)

1900-01. General constr. of sea walls and embankments. Work at Fort Schuyler, N. Y., Fort Monroe, Va., Fort Smallwood, Md., and Gardiners Point, N. Y., completed during year. Storm tide damaged reservation and provisions made for sea wall and filling in at Fort Caswell, N. C. At close of year concrete wall completed, contract for fill behind wall let. App. of Mar. 1, 1901, applied to work at entrance to Long Island Sound, N. Y. H., Narragansett B., Baltimore, Md., Hampton Roads, Va., and New Orleans, La. Est. \$150,000 submitted. **01, 11, 12.**

1901-02. Filling in at Fort Caswell, N. C., completed. App. of June 6, 1902, applied to constr. of sea walls at entrance to Long Island Sound, N. Y. H., Hampton Roads, Va., Tampa, Fla., Mobile, Ala., and San Diego, Cal. Est. \$160,000. **02, 13.**

1902-03. Est. \$200,000. **03 13.**

1903-04. Work at Delaware R., Baltimore Md., Cape Fear, N. C., Charleston, S. C., Tampa, Fla., Pensacola, Fla., Mobile, Ala., and New Orleans, La. Est. \$300,000 submitted. **04, 10.**

1904-05. Est. \$215,900 submitted. **05, 11.**

1905-06. Est. \$236,315 submitted. **06, 9.**

1906-07. Est. \$180,000 submitted. **07, 10.**

1907-08. Est. \$145,914 submitted. **08, 15.**

1908-09. Est. \$164,775 submitted. **09, 16.**

1909-10. Est. \$142,525 submitted. **10, 17.**

1910-11. Est. \$25,000 submitted. **11, 13.**

1911-12. Est. \$30,000 submitted. **12, 11.**

FORTIFICATIONS.

SECTION II.—INDEX TO DATA COVERING SPECIAL WORKS.

(See list of works on p. 1796 of this Index.)

FNA. MAINE COAST FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|------------|
| 1 | Contracts..... | 1897-1902. |
| 2 | Engineering features..... | ..... |
| | Engineers: | |
| 3 | Chief of Engineers..... | 1866-1902 |
| 4 | BE..... | 1882 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1897-1901 |
| 7 | Civilian electricians..... | 1902 |
| 8 | Forts, etc.—Operations, allotments, etc..... | 1808-1902 |
| 9 | Portland H.—Fort Scammel..... | 1808-1901 |
| 10 | New Fort Preble..... | 1808-1885 |
| 11 | Fort Gorges (Hog Island Ledge)..... | 1857-1902 |
| 12 | Site 2—Barbette battery (Portland Head)..... | 1870-1879 |
| 13 | Barbette battery (Little Hog Island)..... | 1870 |
| 14 | Cow Island batteries..... | 1879-1885 |
| 15 | Great Hog Island batteries..... | 1879-1884 |
| 16 | Site 2—Five emplacements, 10-inch rifles..... | 1893-1902 |
| 17 | Site 2—Emplacements, 12-inch B. L. rifles..... | 1901-1902 |
| 18 | Site 1—Mortar battery, Fort Preble..... | 1897-1902 |
| 19 | Site 3—Emplacements, 12-inch guns (Great Diamond Island)..... | 1897-1902 |
| 20 | Site 2—Emplacements, 6-inch R. F. guns (Portland Head)..... | 1878-1899 |
| 21 | Site 2—Emplacements, 10-inch B. L. rifles..... | 1901-1902 |
| 22 | Site 3—Emplacements, 8-inch guns, disappearing carriages (Great Diamond Island)..... | 1898-1902 |
| 23 | Site 3—Temporary platforms, 8-inch converted rifles (Great Diamond Island)..... | 1898 |
| 24 | Site 3—Emplacements, 15-pounder R. F. guns..... | 1899-1902 |
| 25 | Site 3—Emplacements, 6-inch B. L. rifles, pedestal mounts..... | 1901-1902 |
| 26 | Site 3—Emplacements, 6-inch R. F. guns..... | 1899-1902 |
| 27 | Site 3—Mortar battery..... | 1899-1902 |
| 28 | Site 4—Power house..... | 1902 |
| 29 | Site 4—Emplacements, 15-pounder R. F. guns..... | 1901-1902 |
| 30 | Site 5—Emplacements, 15-pounder R. F. guns..... | 1899-1902 |
| 31 | Site 5—Emplacements, 12-inch B. L. rifles, disappearing carriages..... | 1899-1902 |
| 32 | Site 5—Emplacements, 10-inch B. L. rifles, disappearing carriages..... | 1899-1902 |
| 33 | Site 5—Six-inch R. F. guns, pedestal mounts..... | 1902 |
| 34 | Site 5—Power plant..... | 1902 |
| 35 | Penobscot River, narrows—Fort Knox, Bucksport..... | 1843-1901 |
| 36 | Kennebec River, mouth—Fort Popham..... | 1857-1901 |
| 37 | Bar Harbor, temporary defense..... | 1898-1901 |
| 38 | Magazines..... | 1902 |
| 39 | Mounting guns and carriages..... | 1901 |
| 40 | Preservation and repair..... | 1898-1902 |
| 41 | Range and position finders..... | 1899-1902 |
| 42 | Sites..... | 1894-1902 |
| 43 | Submarine mines..... | 1887-1902 |
| 44 | Supplies..... | 1900-1902 |

(See parts 45-62 on p. 1851.)

Part 1, FNA.**Contracts.**

1897. Two 12-inch emplacements complete, \$55,065.20. 97, 593.

1898. Portland cement, \$2.05 and \$2.22 per barrel. Sand, 94¢ and \$1.20 per c. y. Natural cement, 98¢ per barrel. 98, 588.

1899. Electric-lighting plant for 16 mortars, \$5,300. Sand, 94¢ per c. y. Portland cement, \$2.09 per barrel. Rosendale cement, 90¢ per barrel. 99, 681, 688.

1900. Portland "Vulcanite" cement, \$2.35 per barrel; "Atlas," \$2.20 and \$2.50 per barrel. Rosen-

dale "Brooklyn Bridge" cement, \$1.10 and \$1.13¢ per barrel. 00, 757.

1901. Switchboards, \$1,677; accumulators, \$3,700. 01, 703.

1902. Magazine, \$3,895. 02, 627. Boiler, \$6,350; boiler set, \$162.50; boiler and feed-pump, \$73; generating set, \$2,387; misc. apparatus, \$1,387; wire, \$7,682.50. 02, 627. Broken stone, \$1.45 per ton. 02, 634. Portland cement, \$1.55 barrel. and \$1.49 barrel; coal, \$4.50, \$4.70, \$5.40 ton; water, 40¢ per 1,000 gallons; sand, 65¢ ton. 02, 638.

Part 2, FNA.

Engineering Features.

Air spaces, methods of securing ventilation and dryness with. **01**, 912.

Ammunition rooms, lining. **02**, 623.

Ceilings, of hollow tile. **03**, 2372 (pls.).

Cement. Portland cement advisable, because of climate. **01**, 911.

Concrete, cost of. **94**, 7; **97**, 587. Mixing and placing, description and cost. **00**, 757, 761, 762.

Superiority of wet concrete over dry concrete. **01**, 911. Composition, for various walls and masses. **01**, 911.

Condensation, remedies. **01**, 912.

Dampproofing, methods. **04**, 3709.

Drains. Floors. **01**, 912.

Forts, casemates. "One of the finest types." **02**, 621.

Leakage, stopping, methods. **01**, 623, 629; **02**, 623; **04**, 3710.

Linings (see Leakage), of various materials. **03**, 2372, 2373 (pls.).

Materials, cost of. **94**, 7; **97**, 583, 587; **99**, 698; **00**, 757. Methods of handling. **00**, 753.

Power house, electric. **04**, 3710.

Sewers, relaying. **02**, 625.

Stairways, improvements. **01**, 913.

Stone-crushing plant, description and cost. **00**, 757, 759, 765.

Telephones, booths for; details. **03**, 2371. Concrete steel. **03**, 2372 (pls.).

Walls, hollow tile. **03**, 2372 (pls.).

Waterproofing, methods of. **00**, 736, 738, 739, 763; **01**, 911; **02**, 2451.

Part 3, FNA.

Engineers.

Chief of Engineers. **R.**, 66, 4; **67**, 4; **68**, 7; **69**, 7; **70**, 12; **71**, 7; **72**, 4; **73**, 5; **74**, 6; **75**, 6; **76**, 7; **77**, 5; **78**, 7; **79**, 9; **80**, 19; **81**, 17; **82**, 12;

83, 8; **84**, 13; **85**, 7; **86**, 7; **91**, 6; **92**, 8; **93**, 5; **94**, 6; **95**, 6, 503; **96**, 11, 469; **97**, 11, 531; **98**, 14, 583; **99**, 16, 685; **00**, 13, 733; **01**, 13; **02**, 14.

Part 4, FNA.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number,

if any, could be dispensed with. **R.**, 82, 414.

Part 5, FNA.

Engineers in Charge.

Maj. T. L. Casey, 1866-68.

Lt. Col. G. Thom, 1866-69.

Lt. Col. B. S. Alexander, 1867.

Maj. G. Weitzel, 1867.

Lt. Col. J. C. Duane, 1869-79.

Col. C. E. Blunt, 1879-86.

Maj. J. A. Smith, 1886.

Lt. Col. P. C. Hains, 1893-95.

Lt. Col. D. P. Heap, 1895-96.

Lt. Col. A. N. Damrell, 1896-97.

Maj. R. L. Hoxie, 1897-99.

Maj. S. W. Roessler, 1899-02.

Part 6, FNA.

Assistants.

Lt. G. P. Howell, 1897-99.

Capt. C. Keller, 1899-1900.

Lt. T. H. Jackson, 1899-01.

Lt. C. W. Kutz, 1900-01.

Part 7, FNA.

Civilian Electricians.

1902. \$1,200 allotted for pay of an expert electrician. **02**, 638.

Part 8, FNA.—

FORTS AND BATTERIES.

Part 9, FNA. Portland Harbor, Me.—Fort Scammel.

1808. Original work—semicircular battery, with brick scarp and blockhouse in rear; a detached lunette northeast of it built. 80, 15.

1845. The work connected and inclosed with brick scarp and earthen parapet. 80, 15.

1862. Work on new plans begun. 80, 15.

1866. Six casemates, second tier of east bastion, completed; the other 7 platforms ready for armament. 66, 5.

1867. Five embrasures built in scarps of second tier of west bastion; 4 casemates for guns and 1 for flank howitzers completed in east bastion; 2 magazines in gorge nearly finished. 67, 5.

1868. Work on gorge wall, magazines, and excavation for foundations. 68, 9.

1869. Magazine traverse C built and drains completed; site for magazine traverse B excavated. 69, 9.

1870. Modification plans made. Care and preservation. 70, 13.

1871. \$50,000 app. Old building demolished to make way for new work; 6 magazines built and covered with earth; work on great magazine in old work. 71, 8.

1872. \$42,500 app. Stone piers in parade of west bastion built; parados built; communication through traverses of front 4 and the rock excavation for great magazine completed; minor work. 72, 5.

1873. \$50,000 app. Great magazine and concrete arches over parade of east bastion built; work on bombproof of west bastion, embankments of great magazine, and traverses of main work; site prepared for main magazine of new work. 73, 6.

1874. \$30,000 app. Concrete bombproof covering, breast-height walls, and concrete communications of east and west bastions completed; slopes of traverses and parados sodded; and all but one position made ready for platforms. 74, 7.

1875. \$20,000 app. Parapet and bombproof embankments, gun platform and service magazines and stairway communication completed at e. and w. bastions; passages about the great magazine entrance completed; and minor work. 75, 7.

1876. Sally port extension and second passage to extension in main work built in concrete; 2 gun platforms and all traverse and parados embankments of old part of main work completed, and parade graded. 76, 8.

1877-79. Care and preservation. 77, 6; 78, 8; 79, 10.

1885. Plans required revision. 85, 9.

1886. Six magazines put in serviceable order; care and preservation. 86, 9.

1901. Removing old ordnance. 01, 699; 02, 623.

Part 10, FNA. Portland Harbor, Me.—New Fort Preble.

1808. Original work built. 80, 20.

1863. New work begun. 86, 9.

1866. Piling of the scarps finished and bed of foundation of front 2 completed; minor work. 66, 5.

1867. Grillage and capping for foundation of scarps completed; 8 embrasures completed; r. excavation of scarps of old work, and masonry of fronts B and C commenced. 67, 5.

1868. The scarps of old work and earthen parapet nearly finished; stairway from upper to lower parade completed; foundation for magazine traverse, south battery, completed; erecting piers; tearing down quarters; minor work. 68, 8.

1869. Magazine traverse, south battery, completed; excavation for new magazine in old inclosed work finished; parade partly filled in; minor work. 69, 8.

1870. Modification plans made; superior slopes of old work completed and sodded; terreplein partly graded; 250 c. y. concrete placed around magazine in old work; parade partly filled in. 70, 13.

1871. \$28,500 app. Traverse magazine and earthwork in gap between north battery and old redoubt finished; traverse magazine in south battery extension finished; minor work. 71, 8.

1872. \$42,500 app. Great magazine and easterly traverse magazine built in old redoubt and embankments built and sodded; breast-height wall of old redoubt built; second new traverse magazine in south battery finished; minor work. 72, 5.

1873. \$40,000 app. Modification of old redoubt finished; last 6 traverse magazines of south battery built, two-thirds work completed; and north battery extension commenced. 73, 6.

1874. \$20,000 app. Two permanent platforms in redoubt, 1 in north battery, and 1 temporary wooden platform in south battery made ready for guns; traverses and parapets of south battery completed; and concrete magazine, parados, bombproof, breast-height walls, part of embankment, and roadway of north battery completed. 74, 7.

1875. \$10,000 app. Six gun platforms and breast-height walls and parapet of 5 bays in south battery completed; pintle bolts set for 4 additional gun platforms; 1 gun platform laid and all embankments completed in north battery. 75, 7.

1876. Four breast-height walls, 3 gun platforms built in south battery; parapet sodded; and north battery roadway completed. 76, 8.

1877-79. Care and preservation. 77, 6; 78, 7; 79, 10.

1885. Plans require revision. 85, 8.

Part 11, FNA. Portland Harbor, Me.—Fort Gorges, Me. (Hog Island Ledge).

1857. Work begun. 80, 20.

1866. Modifying and constructing the gorge; preparing cut stone for stairway towers; minor work. The gun casemates about completed and ready for armament. 66, 4.

1867. Roof surfaces of the gorge completed and same filled with earth to level of terreplein; quarters partly finished; drainage work; reinforcing with granite arches the scarp walls of the gorge magazines; minor work. 67, 4.

1868. Rubble foundations for 2 stairway towers completed; cut-stone masonry of towers 1, 3, and 4 partly completed; scarps of the magazines reinforced; 3 barbette center-pintle gun platforms built, and 2 magazine traverses on the gorge and 4 bombproof traverses built. 68, 8.

1869. Two magazine traverses on the gorge and bombproofs on fronts 1, 4, and 5 of barbette tier completed, and board roof built over them to protect them against the weather. 69, 8.

1871. \$15,000 app. Work resumed. The great magazine on front 1, central traverse magazine,

new entrance to the easterly traverse magazine, and breast-height walls of front 1 nearly completed; earthwork on front 6 about finished. 71, 8.

1872. \$20,000 app. Earthwork of gorge completed and that of front 1 nearly completed; paradocs and covering of bombproofs begun. 72, 5.

1873. Paradocs on fronts 2, 3, 4, and 5 completed; some minor work. 73, 6.

1874. Quarters plastered, balcony ironwork completed, and stone and ironwork for barbette-gun platforms in progress. 74, 7.

1875. Seven gun-platform stones raised to the terreplein. 75, 6.

1876. Parade graded; balcony on parade wall built; parade gates iron plated and hung; completion of the flooring and finishing of all the quarters in the gorge. 76, 8.

1877-79. Care and preservation. 77, 6; 78, 7; 79, 9.

1901. All armament either condemned or donated; \$600 allotted. 01, 698.

1902. Watchman on duty. 02, 622.

Part 12, FNA. Portland Harbor, Me.—Site No. 2—Barbette Battery (Portland Head).

1870-71. Proj. prepared by BE.; est., \$212,676. 70, 13; 71, 9.

1872. \$50,000 app. Title to land yet to be perfected. 72, 6.

1873. Preparing for constr., 73, 6.

1874. Work begun, 1873; parapet embankment part filled in, and 4 concrete traverse magazines built. 74, 7.

1875. \$20,000 app. Stone for 5 gun platforms prepared. 75, 7.

1876. Work on embankment of parapet and traverses of front 1; 3 breast-height walls, 6 gun platforms, and 2 traverse magazines built; minor work. 76, 8.

1877-79. Care and preservation. 77, 6; 78, 8; 79, 10.

Part 13, FNA. Portland Harbor, Me.—Barbette Battery (Little Hog Island, New Work).

1870. Plans for an irregular hexagonal barbette battery; est., \$234,550. 70, 14.

Part 14, FNA. Portland Harbor, Me.—Cow Island Batteries.

1879. Plans for heaviest armor prepared by BE. 79, 10.

1885. Plans require revision. 85, 9.

Part 15, FNA. Portland Harbor, Me.—Great Hog Island Batteries.

1879. Plans prepared by BE. for heaviest armor. 79, 11.

1884. Plans require revision. 84, 16.

Part 16, FNA. Portland Harbor, Me.—Site No. 2—Five Emplacements for 10-inch Rifles (Portland Head).

1893. \$110,000 allotted. Work begun in April. 93, 5.

1894. 4,088 c. y. concrete placed in 2 emplacements. 94, 7.

1895. \$5,000 allotted. Two emplacements completed, costing \$90,261.05; 12,450 c. y. concrete placed; foundation excavated for third emplacement. 95, 6, 503.

1896. Concrete work for third emplacement nearly completed. 96, 469.

1897. \$83,000 allotted. Work on battery C finished; 2 carriages and 4 guns on hand. 97, 584.

1898. \$21,000 allotted. Batteries B and C nearly completed; all guns mounted. 98, 588.

1899. \$200 allotted. Erection of ironwork. 99, 692.

1900. \$500 allotted. Six observation stations erected; raising floors in magazines and passageways; ventilators placed in magazines and shell rooms; minor work. 00, 736.

1901. \$700 allotted. Speaking tubes bet. platforms and magazines and telephone connection bet. commander's station and telephone booths erected. 01, 701.

1902. Work completed; plans prepared for installing chain hoists. 02, 624.

Part 17, FNA. Portland Harbor, Me.—Site No. 2—Emplacements for Two 12-inch B. L. Rifles.

1901. \$130,000 allotted. Work begun; excavation practically completed. 01, 701. \$34,500 allotted for electric light and power plant; power house and excavation 80% completed. 01, 702.

1902. Excavation, fill, and concrete work completed; post sewer relaid; 2 hydrants placed. 02, 625. \$12,500 allotted. Electric power house; installation conduit work completed. 02, 627.

Part 18, FNA. Portland Harbor, Me.—Site No. 1—Mortar Battery (Fort Preble).

1897. \$125,000 allotted for battery for sixteen 12-inch mortars. Work begun Nov. 30, 1896; excavation well advanced. 97, 581.

1898. \$67,000 allotted. Excavation completed; platforms finished; base rings set and concrete; work of 1 magazine nearly completed; 6,662 c. y. placed. 98, 585.

1899. \$14,050 allotted. All platforms completed, base rings set, carriages assembled, and 8 mortars mounted. 99, 687.

1900. \$19,000 allotted. All mortars mounted, work nearly completed. 00, 735.

1901. \$5,000 allotted. Grading, sodding, floor constr., etc., completed. Shell rooms and magazines lined; floors graded and raised; battery transferred to Artillery. 01, 699.

1902. Lining work completed. 02, 623.

Part 19, FNA. Portland Harbor, Me.—Site No. 3—Two Emplacements for 12-inch Guns (Great Diamond Island).

1897. \$70,000 allotted. Battery to be built under contract. \$3,200 allotted for contingencies. Work begun in April, 1897. 97, 588.

1898. Excavation nearly finished; 2,908 c. y. concrete placed; progress unsatisfactory; contract annulled July 7, 1898. 98, 589.

1899. \$36,800 allotted. Work continued with hired labor; carriages and guns mounted; concreting, setting ironwork, and making drains. 99, 693.

1900. \$9,000 transferred from other works. Battery completed, except macadamizing the roadway and erection of hand railing. 00, 739.

1901. Work completed. 01, 705.

1902. \$2,500 allotted. Platform hoist ordered and preparation of emplacements commenced. 02, 629.

Part 20, FNA. Portland Harbor, Me.—Site No. 2—Emplacement for 6-inch R. F. Gun (Portland Head).

1898. \$8,000 allotted. Work begun in May; platform built, ready for gun. 98, 588. 1899. Gun mounted and work completed. Cost, \$6,545.33. 99, 692.

Part 21, FNA. Portland Harbor, Me.—Site No. 2—Emplacements for Two 6-inch B. L. Rifles.

1901. \$30,000 allotted. Preparation of plans in progress. 01, 703. 1902. \$4,000 allotted. Negotiations for purchase of land in progress. 02, 626.

Part 22, FNA. Portland Harbor, Me.—Site No. 3—Eight Emplacements for 8-inch Guns on Disappearing Carriages (Great Diamond Island).

1898. \$150,000 allotted. Work begun in March. 98, 590.

1899. \$220,000 allotted. Battery A—Three carriages mounted; guns on hand; concreting nearly finished; some asphalt work. Battery B—Both carriages mounted; concreting and asphaltting. Battery D—Emplacement 1 nearly completed. 99, 694.

1900. \$17,000 allotted. Battery A—2,722 c. y. concrete placed; ironwork placed; roadway graded. Battery B—Concrete work; ironwork and roadway completed; battery practically completed. Bat-

tery D—Concrete work for 2 emplacements completed; ironwork, platforms, and masonry walls in progress; minor work not finished. 00, 738.

1901. \$12,000 allotted. First battery—Guns mounted; work completed. Second battery—Practically completed; 1 gun mounted; concrete, masonry, and fill work done. 01, 704.

1902. No. 2 of emplacement 6, loam placed; roadway and slopes graded; gun mounted. Nos. 1 and 3, emplacement 6, fill completed; roadways and slopes graded; trolleys erected etc. 02, 628, 629.

Part 23, FNA. Portland Harbor, Me.—Site No. 3—Temporary Platforms for Two 8-inch Converted Rifles (Great Diamond Island).

1898. \$3,000 allotted. Platforms completed, with magazine, and guns mounted. 98, 590.

Part 24, FNA. Portland Harbor, Me.—Site No. 3—Two Emplacements for 15-pounder R. F. Guns.

1899. \$10,000 allotted. 99, 693.

1900. Work begun; excavation nearly finished; location shifted 25' to the front. 00, 740.

1901. First battery—Gun platforms, floors of magazines and rooms laid. Second battery—\$9,103.10 allotted. Excavation completed; plant

erected; \$478.10 of above for triangulation of Portland H. 01, 707.

1902. First battery—Battery completed; guns mounted. Second battery—Completed; guns mounted. 02, 631.

Part 25, FNA. Portland Harbor, Me.—Site No. 3—Emplacements for Two 6-inch B. L. Rifles on Pedestal Mounts.

1901. \$25,000 allotted. Plans completed and app.; no field work begun. 01, 708.

1902. \$3,900 allotted. Work commenced; ex-

cavation made; plant erected; floors, platforms, etc., laid. 02, 632.

Part 26, FNA. Portland Harbor, Me.—Site No. 3—Two Emplacements for 6-inch R. F. Guns.

1899. \$56,000 allotted. 99, 693.
1900. Work begun; excavation for site completed, and foundation walls of rubble masonry of 1 emplacement laid. 00, 740.
1901. Concrete portion emplacement completed; masonry of others brought to ceiling level;
1 carriage on hand; 3,386 c. y. concrete work done. 01, 706.
1902. Concrete, sand, and loam placed; windows hung; hoists erected; both guns mounted. 02, 630.

Part 27, FNA. Portland Harbor, Me.—Site No. 3—Mortar Battery.

1899. \$125,000 allotted for battery for eight 12-inch mortars; site cleared, and main drain nearly completed. 99, 693.
1900. Drainage completed; 1,301 c. y. concrete placed in traverses and magazine walls; 6,909 c. y. earth excavated; 7,671 c. y. ledge excavated; and 1,128 c. y. filling; 6 carriages received. 00, 740.
1901. \$21,000 allotted. Eastern and middle traverses completed; 8 mortar carriages assembled; floors laid; excavation and concrete work done. 01, 706.
1902. Concrete and fill work done; 4 mortars mounted. 02, 630.

Part 28, FNA. Portland Harbor, Me.—Site No. 4—Power House.

1902. \$3,100 allotted. Work commenced; 1,077 c. y. earth and ledge removed; preparation of sites completed; laying concrete foundations begun. 02, 633.

Part 29, FNA. Portland Harbor, Me.—Site No. 4—Three Emplacements for 15-pounder R. F. Guns.

1901. Plans for battery completed. 01, 708.
1902. \$18,000 allotted. Wharf built; plant erected; excavation completed; drains laid, etc. 02, 633.

Part 30, FNA. Portland Harbor, Me.—Site No. 5—Three Emplacements for 15-pounder R. F. Guns.

1899. \$13,000 allotted. 99, 699.
1900. Work begun 1899; r. excavation completed; all floors constr., drainpipes laid, and concreting commenced. 00, 763.
1901. \$2,000 allotted. Battery completed. 01, 710, 711.
1902. Guns mounted. 02, 635.

Part 31, FNA. Portland Harbor, Me.—Site No. 5—Three Emplacements for 12-inch B. L. Rifles on Disappearing Carriages.

1899. \$162,000 allotted. Site cleared for emplacements 3 and 4; 5,745 c. y. earth and 12,597 c. y. r. excavated. 99, 699, 700.
1900. \$17,000 allotted. Excavation for emplacements 3 and 4; drains and roadway completed; 1,982 c. y. concrete placed and drainpipe laid; waterproofing with Neuchatel-rock asphalt; excavation and drainage for emplacement 2 nearly completed. 00, 762, 763.
1901. \$10,000 allotted for emplacements 3 and 4. Emplacement 4 completed; carriages assembled and gun mounted. Emplacement 3 nearly completed. \$10,500 allotted for emplacement 2; r. excavation, drains, r. fill, and concrete work done. 01, 709.
1902. (Emplacements mentioned as Nos. 1, 2, and 3 in 1902.) Concrete and sand fill placed in No. 2, trolley rails and ammunition hoists erected. At emplacement 1 masonry and fill work done, and asphalt waterproofing laid. Emplacement 1 nearly completed, except receiving carriage and mounting guns. 02, 634

Part 32, FNA. Portland Harbor, Me.—Site No. 5—Two Emplacements for 10-inch B. L. Rifles on Disappearing Carriages.

1899. \$92,000 allotted. Excavation for emplacements and drains completed; 18,294 c. y. removed; artesian well under constr. 99, 699.

1900. \$26,000 allotted. 2,435 c. y. concrete placed and all floors completed. 00, 768.

1901. Carriages assembled and guns on trun-

nions; concrete, asphalt, and sand work done 01, 710.

1902. \$1,000 allotted. 1,692 c. y. fill placed, 100 c. y. concrete laid; guns painted and cleaned. 02, 635.

Part 33, FNA. Portland Harbor, Me.—Site No. 5—"Four" 6-inch R. F. Guns on Pedestal Mounts.

1902. \$55,000 allotted. Work begun, derricks erected, tracks extended, excavations, etc. Half

of battery completed to floor level. 02, 635.

Part 34, FNA. Portland Harbor, Me.—Site No. 5—Power House and Electric Plant.

1902. \$1,000 allotted. Conduit and manholes constr. 02, 636.

Part 35, FNA. Penobscot River, Narrows of—Fort Knox, Bucksport, Me.

1843. Work begun. 80, 19.

1866. Three-gun battery of the southeast place-of-arms nearly completed; covered communication with battery B finished; northeast demi-bastion, howitzer casemate, and defensive gallery built; and 3 positions for center pintle 15-inch guns in batteries A and B made ready for armament. 66, 4.

1867. North covered way, northeast demi-bastion, and defensive gallery, together with the closure wall and single caponniere of the north ditch, completed; minor work. 67, 4.

1868. Masonry and subdrainage of the storage casemates under the parade of main work completed; mounting guns on batteries A and B; finishing parapet and terrepleins of 15-inch guns; minor work. 68, 7.

1869. Exterior slope of the north covered way rebuilt to 8' below the interior crest; and northern

and western exterior slopes of the northeast place-of-arms repaired. 69, 8.

1871-84. Care and preservation. 71, 7; 72, 4; 73, 5; 74, 7; 75, 6; 76, 7; 77, 5; 78, 7; 79, 9; 80, 19; 81, 17; 82, 12; 83, 8; 84, 13.

1885. Six magazine floors renewed, outside buildings repaired; minor work. 85, 7.

1886. Parade graded, care and preservation. 86, 8.

1898. \$150 allotted. Proj. for change in position of old platforms and addition of modern guns; minor repairs of old works. 98, 583.

1899. \$600 allotted. Minor repairs of armament of old works. 99, 686.

1900. Storeroom repaired; minor repair of quarters. 00, 733.

1901. Repairs and removing débris; buildings sold. Plans and est. for 2 emplacements for 6-inch R. F. guns called for. 01, 697.

Part 36, FNA. Kennebec River, Mouth of—Fort Popham, Me.

1857. Casemated work; work begun. 80, 19.

1866. Scarps of the gun fronts and bastions brought to within 2 courses of the cordon line; all gun embrasures of the second tier of fire completed; second-story magazines nearly finished, and 5 second-tier casemates covered with bombproof arches. 66, 4.

1867. Scarps of the gun fronts and bastions brought to level of the cordon line; second-tier casemates along this front completed; minor work. 67, 4.

1868. Concreting arches of gun casemates 24 to 37, inclusive; laying concrete floors of 3 magazines on terreplein of water fronts; minor work. 68, 8.

1869. Board roof built over unfinished casemates; care and preservation. 69, 8.

1870-72. Care and preservation. 70, 13; 71, 8; 72, 5.

1873. Proj. for completion of fort, and constr. of a contiguous exterior battery for 4 guns approv. in 1872. 73, 5.

1874-86. Care and preservation. 74, 7; 75, 6; 76, 7; 77, 5; 78, 7; 79, 9; 80, 20; 81, 17; 82, 13; 83, 8; 84, 14; 85, 8; 86, 8.

1898. Work modified to meet modern requirements as to cover. No work under proj. \$9,030 allotted; temporary wooden platforms for 15-inch guns built, and guns mounted; emplacement for one 8-inch B. L. rifle on strengthened 15-inch S. B. gun finished and carriage mounted; minor work. 98, 584.

1899. \$2,300 allotted. Work on temporary platforms for four 15-inch guns; emplacement for 8-inch rifle finished. 99, 686.

1900. \$1,500 allotted. Four 15-inch S. B. guns dismounted and stored; platforms taken up, and ground leveled. 00, 733.

1901. Repairs, slopes, and retaining walls of emplacement for one 18-inch B. L. rifle practically rebuilt. Plans and est. for 2 emplacements 6-inch R. F. guns on pedestal mounts called for. 01, 698.

Part 37, FNA. Bar Harbor, Me., Temporary Defense.

1898. \$6,000 allotted. Proj. for two 8-inch converted rifles and two 10-inch S. B. guns mounted on temporary wooden platforms; consent of owners of sites secured; materials, guns, and carriages received in May. 98, 591.

1899. \$1,000 transferred from other allotments. Both 8-inch rifles mounted; 1 magazine finished;

mounting two 10-inch S. B. guns and building magazines. Ordered to suspend work. 99, 685.

1901. Two 10-inch guns condemned and sold; two 8-inch converted rifles moved to nearest reservation; ordnance stores to be sent to Watertown 01, 697; 02, 621.

Part 38, FNA. Magazines.

1902. \$5,000 allotted for Peace Storage Magazine; building erected. 02, 626.

Part 39, FNA. Mounting Guns and Carriages.

1901. Table showing cost of handling, caring for, and mounting guns and carriages, site 5, Portland. 01, 711, 712.

Part 40, FNA. Preservation and Repair of Fortifications.

1898. \$50 allotted for Fort Gorges; repairing scarp wall. 98, 584. Minor work at Fort Preble. 98, 585. \$550 allotted for mounting two 15-inch S. B. guns at Fort Scammel. 98, 587.

1899. Minor repairs at Fort Preble. 99, 687. \$600 allotted for minor repairs of old works. 99, 702. \$750 allotted for minor repairs at mining casemate. 99, 703.

1900. \$800 allotted for repairing quarters at Fort Gorges. 99, 734. \$1,400 allotted for site 1;

floors in magazines and shell rooms repaired. 00, 735. \$12,000 allotted for repairing floors, waterproofing experiment, and minor work at site 2. 00, 736. \$700 allotted for torpedo material at site 4. 00, 768.

1901. \$1,600 allotted for repair of slopes and loaming and seeding, Portland, site 1. 01, 700, 701. \$1,000 allotted for site 2, Portland. 01, 703.

1902. \$1,600 allotted for repair, site 1, Portland. 02, 623.

Part 41, FNA. Range and Position Finders.

1899. \$9,000 allotted. Drawings made. 99, 702.

1900. Six observation stations erected. 00 736.

1901. \$4,600 allotted for battery commander's station, Portland, site 1; work completed. 01, 700; 02, 624. \$4,000 allotted. Portland, sites 1 and 3, station an. and plans approv.; site 1 completed; excavation for 5 stations at site 3 completed. 01, 712. \$100 allotted for 2 temporary stations, site 4, for Lewis type A instrument, and

1 at site 1 for base-end instrument; former completed and latter to be constr. 01, 712, 713.

1902. \$2,500 allotted fire commander's station, site 2; Portland; excavation completed and walls constr. 02, 626. Constr. commenced at 2 sites, battery commander's stations; buildings completed; grading done; \$1,000 withdrawn. 02, 636. \$2,700 allotted fire commander's station; building commenced and constr. during year. 02, 637. Necessary work for temporary station completed. 02, 637.

Part 42, FNA.**Sites.**

Cushings Island, Me. Site, about 33.4 acres, acquired by condemnation proceedings, \$112,423.60. 94, 13.

Battery for sixteen 12-inch mortars. Site purchased for \$13,202.50. 97, 12.

1902. Kennebec R., Me. \$10,050 allotted. Site purchased. 02, 622.

Part 43, FNA.**Submarine Mines.**

1887. Three casemates proposed, with est. of cost. 87, 11.

1891. Proj. for additional casemate. 91, 6.

1892. One casemate nearly completed. 92, 8.

1893. One casemate completed; cost, \$8,979.75; work on 2 more begun. 93, 5.

1894. Work on 2 casemates. 94, 7.

1895. Two casemates completed in October, 1894; cost, \$17,968.92. 95, 6.

1898. Cable storage tank at Fort Preble completed; cost, \$2,206.53. \$4,500 allotted, 1897, for torpedo storehouse at Fort Gorges; nearly completed. 98, 584, 585. \$23,300 allotted for torpedo defense—mines placed in the three channels leading into Portland H., and also in the Kennebec and Penobscot Rs.; 6 casemates equipped. 98, 592.

1899. \$350 allotted. Small storehouse built; minor work. 99, 686, 702. \$9,000 allotted—mines removed from H. and Rs., cleaned and stored (explosives utilized in connection with r. excavation

for fortifications). 99, 708. \$1,200 allotted for searchlight supplies; no funds necessary. 99, 709.

1900. Torpedo material overhauled and cleaned. 00, 768.

1901. \$3,000 allotted. Penobscot R., brick storehouse for masonry material built. 01, 697. Stored material overhauled and cleaned. 01, 698. \$9.78 allotted for sixteen 12-inch B. L. mortars, site 1, Portland. 01, 700. \$5,000 allotted, Portland, site 2, plans completed for mining casemates. 01, 703. \$5,500 allotted, site 3, Portland, mining casemate No. 1; excavation completed. \$4,500 allotted, site 3, Portland, mining casemate No. 2. 01, 708. \$150 allotted for overhauling and cleaning. \$2.01 for minor expenses. 01, 713.

1902. Portland, site 2, work on casemates begun and practically completed. 02, 623. Portland, site 3, casemates practically completed. 02, 632. Material overhauled and cleaned. 02, 637.

Part 44, FNA. Supplies for Coast Defenses.

1900. \$600 allotted for filling requisitions by post commanders for material to be supplied by

the Engineer Department. 00, 768. Supplies furnished commanders. 01, 713; 02, 637.

FNA. PORTSMOUTH (N. H.) FORTIFICATIONS.

(See parts 1-44 on p. 1841.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 45 | Contracts..... | 1897-1902 |
| 46 | Engineering features..... | |
| 47 | Engineers—Chief of Engineers..... | 1866-1902 |
| 48 | BE..... | 1882 |
| 49 | In charge..... | 1866-1902 |
| 50 | Assistants..... | 1897-1901 |
| 51 | Forts, etc.—Operations, allotments, etc..... | 1863-1902 |
| 52 | Fort McClary (Kittery Point, Me.)..... | 1863-1901 |
| 53 | Fort Constitution..... | 1866-1901 |
| 54 | Barbette battery (Gerrish Island, Me.)..... | 1872-1884 |
| 55 | Barbette battery (Jerrys Point)..... | 1872-1886 |
| 56 | Two 8-inch gun emplacements..... | 1897-1902 |
| 57 | Two 8-inch B. L. R. guns, on strengthened barbette carriages for 15-inch S. B. guns..... | 1898-1900 |
| 58 | Three emplacements, 10-inch guns, disappearing carriages..... | 1899-1902 |
| 59 | Emplacements, two 12-inch guns, disappearing carriages..... | 1901-1902 |
| 60 | Preservation and repairs..... | |
| 61 | Sites..... | |
| 62 | Submarine mines..... | 1897-1902 |

Part 45, FNA.

Contracts.

1897. Two 8-inch gun emplacements, \$55,-
372.52. 97, 599.

1900. Portland "Atlas" cement, \$2.24 barrel.
00, 769.

1901. "Atlas" Portland cement. 01, 715.

1902. Tile, \$157.50 and \$210 per M; steel doors,
2 x 6", \$27; 3', \$30; 4', \$40; 6', \$54; Saylor's Port-
land cement, \$1.40 barrel in sacks; broken stone,
\$1.85 c. y.; sand, 67¢ c. y. 02, 641.

Part 46, FNA.

Engineering Features.

Cement—tests. 02, 2455. Mixing. 02, 2454.
Concrete—mixing and placing. 00, 770; 02,
2453 (pl.). Superiority of dust over sand. 02,
2457. Strength of various mixtures. 02, 2454.
Construction plant, details. 02, 2452 (pl.).
Doors—ammunition hoist. 05, 3006 (pls.).
Drainage. 02, 2454.
Employees—distribution of. 00, 772.
Leakage—preventing. 05, 3003, 3004, 3006 (pls.).
Linings. 03, 2380 (pls.).

Magazines—stanchions. 05, 3006 (pls.).
Pavements—waterproofing 05, 3006.
Plant—cost of. 00, 772.
Rocks. 05, 3006 (pls.).
Roofs—concrete blocks in. 05, 3006 (pl.).
Ventilation—various methods employed. 05,
3005, 3006 (pls.).
Waterproofing—methods employed. 03, 2374,
2380; 04, 3711; 05, 3003, 3006.

Part 47, FNA.

Engineers.

Chief of Engineers. R., 66, 5; 67, 5; 68, 9;
69, 9; 70, 14; 71, 9; 72, 6; 73, 6; 74, 8; 75, 7;
76, 8; 77, 6; 78, 8; 79, 11; 80, 21; 81, 19; 82, 14;
83, 10; 84, 16; 85, 10; 86, 10; 94, 13; 95, 6; 96;
12; 97, 12, 597; 98, 15, 591; 99, 17, 708; 00, 14, 768;
01, 15; 02, 15.

Part 48, FNA.

Board of Engineers.

Constituted, 1882, to consider and report upon
the condition of fortifications, and what number,

if any, could be dispensed with. R., 82, 416.

Part 49, FNA.

Engineers in Charge.

Lt. Col. J. N. Macomb, 1866.
 Lt. Col. Z. B. Tower, 1867.
 Lt. Col. J. G. Foster, 1867-71.
 Lt. Col. J. C. Duane, 1871-79.
 Col. C. E. Blunt, 1879-86.
 Maj. J. A. Smith, 1886.

Lt. Col. A. N. Damrell, 1897.
 Maj. R. L. Hoxie, 1897-99.
 Maj. S. W. Roessler, 1899-1900.
 Maj. W. L. Fisk, 1900.
 Capt. H. Taylor, 1900-02.

Part 50, FNA.

Assistants.

Lt. G. P. Howell, 1897-99.
 Lt. C. Keller, 1899.
 Lt. T. H. Jackson, 1899-1900.
 Capt. C. Keller, 1900.

W. F. Robinson, 1901.
 C. F. Woodbury, 1901.
 Lt. R. R. Raymond, 1901.

Part 51, FNA—

FORTS AND BATTERIES.

Part 52, FNA. Fort McClary (Kittery Point, Me.).

1863. Original work begun early in century; inclosed barbette work begun in 1863. 80, 21.

1866. 147 l f. coping laid on south, southeast, and east walls; work on west scarp; terreplein excavated. 66, 5.

1867. Work on scarp wall; ditch excavation. 67, 5.

1868. Excavation for ditches completed; work on scarp on west front and northwest caponniere; minor work. 68, 9.

1869-73. Care and preservation. 69, 9; 70, 14; 71, 9; 72, 6; 73, 6.

1874. Three temporary wooden platforms for heavy guns nearly completed. 74, 8.

1875. Roadway repaired. 75, 7.

1876-86. Care and preservation. 76, 8; 77, 6; 78, 8; 79, 11; 80, 21; 81, 19; 82, 15; 83, 10; 84, 16; 85, 10; 86, 10.

1898. \$2,400 allotted for preservation and repairs. Three 15-inch guns mounted on temporary wooden platforms. 98, 587.

1899. Proj. contemplates the use of the existing armament and the mounting of the 15-inch gun pending constr. of modern batteries. 99, 708.

1900. Repairing engine house to store mining material. 00, 773.

1901. Care and preservation. 01, 716.

Part 53, FNA.

Fort Constitution.

1866. Work on north scarp; eastern part of old fort demolished and debris removed; foundation of new work in progress. South front, 1 pier and 6 embrasures built and flagging laid for 9 casemates. 66, 5.

1867. Work on scarp wall; constr. embrasures, and laying flagging. 67, 5.

1868-71. Care and preservation. 68, 9; 69, 9; 70, 14; 71, 9.

1872. Earthen barbette battery for 14 guns in rear of the partially casemated work; est., \$83,500. 72, 6.

1874. Temporary position for 2 heavy guns prepared, and platform partly laid. 74, 8.

1875-86. Care and preservation. 75, 7; 76, 9; 77, 6; 78, 8; 79, 11; 80, 22; 81, 19; 82, 15; 83, 10; 84, 16; 85, 10; 86, 11.

1900. Old building removed; imp. ventilation of magazines. 00, 773.

1901. \$345 allotted for care and preservation. 01, 717.

Part 54, FNA. Barbette Battery at Gerrish Island, Me.

1872. Proj., 12-gun battery; est., \$45,240. 72, 6.

1873. \$25,000 app. Parapet embankment; building concrete magazines. 73, 7.

1874. \$15,000 app. Work on parapet, road-way in rear of terrepleins and 2 traverse magazines. 74, 8.

1875. \$10,000 app. Foundations for all traverse magazines prepared. 75, 8.

1876. Five breast-height walls finished; gun platforms built. 76, 9.

1877-78. Care and preservation. 77, 6; 78, 8.

1879. Plans for completion approv.; partly executed. 79, 11.

1884. Plans require revision. 84, 16.

Part 55, FNA. Barbette Battery at Jerrys Point.

1872. Proj., 12-gun battery; est., \$46,824. 72, 6.

1873. \$25,000 app. Work begun, parapet embankment and building concrete magazines. 73, 7.

1874. \$15,000 app. Raising parapet embankment; excavation for foundations of all traverse magazines completed. 74, 8.

1875. \$10,000 app. Traverse magazines built; 3 breast-height walls completed; work on parapet embankment. 75, 8.

1876. Two traverse magazines built, founda-

tion of another laid, and over 2,000 c. y. of embankment made. 76, 9.

1877-78. Care and preservation. 77, 7; 78, 8.

1879. Plans for completion approv.; partly executed. 79, 11.

1884. Plans require revision. 84, 17.

1885. Placing woodwork in traverse magazines to make them serviceable. 85, 10.

1886. Platforms ready for 15-inch guns; earth-work incomplete. 86, 11.

Part 56, FNA. Two 8-inch Gun Emplacements.

1897. \$53,150 allotted. Emplacements to be built by contract (\$55,372.52). Excavations in progress. 97, 597.

1898. \$800 allotted for repair of buildings. Guns mounted; work nearly completed. 98, 591.

1899. \$16,000 allotted. Battery completed under contract; cost, \$61,936.21. \$500 allotted for repairs of road and buildings. 99, 703.

1902. Floors relaid, concrete surfaces coated and painted. 02, 639, 640.

Part 57, FNA. Two 8-inch B. L. R. Guns Mounted on Strengthened Barbette Carriages for 15-inch S. B. Guns.

1898. \$6,000 allotted. Work begun; carriages received and mounted, awaiting guns. 98, 592.

1899. Guns mounted. 99, 708.

1900. Guns dismounted and shipped elsewhere. 00, 15.

Part 58, FNA. Three Emplacements for 10-inch Guns on Disappearing Carriages.

1899. \$146,000 allotted. Work begun; excavation in progress. 99, 704.

1900. Excavations completed; concrete floors and parapet of 1 emplacement completed to height of loading platform, and floors of second emplacement completed; 3 carriages received. 00, 769.

1901. \$12,000 allotted. Concrete work completed; erection of ironwork, beams, etc., done; gun carriages mounted; battery practically completed; two 10-inch rifles received. 01, 715.

1902. Work completed; battery transferred to Artillery. 02, 639.

Part 59, FNA. Emplacements for Two 12-inch Guns.

1901. \$2,000 allotted. Artesian well dug; plans and est. for battery submitted. 01, 715, 716.
 1902. \$107,000 allotted. Plant installed; battery excavation completed; wall foundations in; frame for concrete forms practically completed. 02, 639.

Part 60, FNA. Preservation and Repair of Fortifications.

The following allotments were made: Fort McClary, \$238.58; Fort Constitution, \$6.25; Portsmouth, \$320.70. Shipping material to depot for minor repairs. 02, 640.

Part 61, FNA. Sites.

Fort McClary Reservation, Me. By act of Jan. 23, 1893, part of the reservation exchanged for other land; sites transferred by deed. 94, 13; 95, ..

Part 62, FNA. Submarine Mines.

1897. \$1,000 allotted. 97, 598.
 1898. \$23,300 allotted in connection with defense of Maine coast; placing mines in H. 98, 592.
 1899. \$5,633.60 allotted. Mining casemate completed. 99, 703. Mines removed from H. 99, 709.
 1900. \$2,800 allotted for cable tank, which was completed; traveling crane installed; overhauling searchlight plant. 00, 773.
 1901. \$300 allotted. Gutters placed and cistern built under torpedo storehouse for cable tank. 01, 716. \$5,700 allotted for torpedo storehouse; building practically completed. 01, 716.
 1902. Crane installed and building for torpedo warehouse entirely completed. 02, 640. Cable tank entirely completed; pump installed; turned over to Artillery. 02, 640.

FNB BOSTON (MASS.) FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1901 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1902 |
| 4 | BE..... | 1882 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1891-1900 |
| 7 | Forts and batteries—Operations, etc..... | 1833-1902 |
| 8 | Fort Warren (Georges Isld.)..... | 1833-1887 |
| 9 | Fort Independence (Castle Isld.)..... | 1833-1899 |
| 10 | Provincetown H.—Permanent forts..... | 1866-1870 |
| 11 | Long Isld. Head Battery..... | 1869-1887 |
| 12 | Fort Sewell (Marblehead)..... | 1884 |
| 13 | Fort Andrew (Plymouth H.)..... | 1884 |
| 14 | Fort Standish (Plymouth H.)..... | 1884 |
| 15 | Fort Winthrop and batteries (Governors Isld.)..... | 1844-1886 |
| 16 | Emplacements for 8-inch guns, disappearing carriages..... | 1891-1892 |
| 17 | Site 4.—Mortar battery for sixteen 12-inch mortars..... | 1891-1902 |
| 18 | Site 5.—Mortar battery for sixteen 12-inch mortars..... | 1897-1902 |
| 19 | Site 5.—Emplacements, two 6-inch R. F. guns..... | 1901-1902 |
| 20 | Site 1.—Emplacements, five 10-inch guns, disappearing carriages..... | 1892-1902 |
| 21 | Site 2.—Emplacements, five 10-inch guns, disappearing carriages..... | 1893-1902 |
| 22 | Site 1.—Two emplacements, 4-inch R. F. guns..... | 1898-1899 |
| 23 | Site 2.—Two emplacements, 4.72-inch R. F. guns..... | 1898-1899 |
| 24 | Site 3.—Three emplacements, 12-inch rifles, disappearing carriages..... | 1898-1902 |
| 25 | Site 6.—Two emplacements, 12-inch rifles, nondisappearing carriages..... | 1898-1901 |
| 26 | Site 1.—Two emplacements, 12-inch guns, disappearing carriages..... | 1899-1902 |
| 27 | Site 1.—Three emplacements, 15-pounder R. F. battery..... | 1899-1900 |
| 28 | Site 7.—Emplacements, two 6-inch rifles..... | 1901-1902 |
| 29 | Site 7.—Emplacements, four 10-inch B. L. rifles..... | 1901-1902 |
| 30 | Site 7.—Three emplacements, 6-inch R. F. guns, disappearing carriages..... | 1899-1902 |
| 31 | Site 6.—Two 5-inch R. F. guns, pillar mounts..... | 1899-1901 |
| 32 | Site 2.—Two emplacements, 15-pounder R. F. guns..... | 1900-1901 |
| 33 | Site 5.—Two emplacements, 5-inch R. F. guns, pedestal mounts..... | 1900-1901 |
| 34 | Site 7.—Emplacements, three 15-pounder R. F. guns..... | 1900-1902 |
| 35 | Site 7.—Emplacements, four 15-pounder R. F. guns..... | 1901-1902 |
| 36 | Miscellaneous—Underground conduit system..... | 1900-1901 |
| 37 | Central electric lighting plants..... | 1900-1901 |
| 38 | Construction of lighter..... | 1901-1902 |
| 39 | Construction of storehouses..... | 1901-1902 |
| 40 | Roadway at Winthrop..... | 1902 |
| 41 | Mounting guns and carriages..... | 1900-1901 |
| 42 | Preservation and repair..... | 1899-1902 |
| 43 | Range and position finders..... | 1900-1901 |
| 44 | Sites..... | 1892-1902 |
| 45 | Submarine mines..... | 1891-1902 |
| 46 | Supplies for coast defenses..... | 1900-1902 |

Part 1, FNB.**Contracts.**

1901. Broken stone, \$1.57, \$1.75 c. y. 02, 649.
Steam lighter, \$19,450; four 6-inch ammunition lifts, \$1,638; constr. earth embankment, 60¢ c. y.; tile, \$157.50 per M; 2210 per M; two 10-inch ammunition hoists, \$2,376; excavation and ditching,

55¢ and 85¢ c. y., respectively; steel doors, various size and prices; furnishing employees' meals, 16¢¢; Saylor's Portland cement, \$1.40 barrel in sacks; sand, 67¢ c. y., 70¢ c. y.; excavating, sodding, etc., various prices listed. 02, 650, 651.

Part 2, FNB.**Engineering Features.**

(See also Part 46, FNA, p. 1851.)

Concrete, ingredients of. 00, 775. Compactness. 01, 913, 916.

Concrete surfaces, exposed, protection of, during winter months. 99, 722.

Condensation, overcoming. 01, 916.

Conduit system, underground, description of.

00, 776.

Cranes, ammunition. 01, 913.

Emplacements, cost of. 01, 914, 916.

Emplacements, liftless. 01, 916.

Excavations, control of quicksand. 01, 913.

Plant, central electric lighting, description of. 00, 777, 779.

Traverses, advantages of. 01, 916.

Ventilation, securing. 01, 916.

Waterproofing, description of. 00, 775, 783.

Part 3, FNB.

Engineers.

Chief of Engineers. R., 66, 5; 67, 6; 68, 9; 16; 83, 11; 84, 17; 85, 11; 86, 12; 91, 6; 92, 4; 69, 9; 70, 14; 71, 9; 72, 6; 73, 7; 74, 8; 75, 8; 93, 5; 94, 7; 95, 6; 96, 12, 469; 97, 12, 600; 98, 76, 9; 77, 7; 78, 8; 79, 12; 80, 23; 81, 20; 82, 16, 592; 99, 18, 709; 00, 15, 773; 01, 15; 02, 16.

Part 4, FNB.

Board of Engineers.

1882. Constituted to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. R., 82, 416. Est. 87, 11; 89, 6; 90, 5; 91, 5.

Part 5, FNB.

Engineers in Charge.

Maj. C. E. Blunt, 1866.
Col. H. W. Benham, 1866-82.
Maj. F. E. Prime, 1870.
Col. C. E. Blunt, 1883.
Maj. C. W. Raymond, 1883-86.

Lt. Col. G. L. Gillespie, 1886-88.
Col. S. M. Mansfield, 1891-99.
Col. C. R. Suter, 1899-1901.
Capt. Harry Taylor, 1901-02.

Part 6, FNB.

Assistants.

Capt. S. S. Leach, 1891-93.
Lt. M. L. Walker, 1897.
Lt. J. S. Sewell, 1897-99.

Lt. R. R. Raymond, 1899-1902.
Lt. C. S. Bromwell, 1899-1900.

Part 7, FNB.—

FORTS AND BATTERIES.

Part 8, FNB.

Fort Warren (Georges Island).

1833. Work begun. 80, 23.
1866. Fort nearly completed according to original plans. Work modifying casemated platforms to suit modern guns of heavy armament; interior finish of casemates for hospital purposes; preparing stone for main gateway; and drainage. 66, 6.
1867. Fittings of casemates completed; traverse circles with longer radii relaid on parapet of front 1; quarters and hospital finished; and minor work. 67, 6.
1868. One bombproof traverse on coverface of northeast front 2 built, another one nearly finished; work on scarp wall and arch of main gateway; repairs to drain, slopes, etc.; removal of old engineer buildings within the fort, and their reconstr. 68, 9.
1869. Masonry and earthwork of bombproof traverse, front 2, completed; repairs to quarters, embankments, and casemates, etc.; modified plans prepared; est. cost, \$402,400. 69, 9.

1870. Repairing leaks in coping of scarp wall, officers' quarters, and renewing asphalt floors, and minor work. 70, 14.

1871. \$50,000 app. Modification work begun; preparing demilune south of main work for larger ordnance; concrete masonry of 2 traverse magazines built; parade walls torn down and drains rebuilt; foundations of all piers for the new, large arches completed; and minor work. 71, 9.

1872. \$85,000 app. Removal of parade wall in bastion A completed; piers of all arches built; stone faces of the arch at the gorge and of arch over stairway completed; work on remaining arches in the bastion, and wing and sustaining wall on right of the gorge; masonry and earth cover of the parados completed; and minor work. 72, 7.

1873. \$40,000 app. All new work in bastion A complete; bastion E masonry of 2 traverse magazines of its barbette completed, and minor work;

demilune masonry of 1 platform completed; work on new sand parapet, and embankment of traverses and parados; minor work. 73, 7.

1874. Bastion A: Completion of five 15-inch gun platforms and their breast-height walls, masonry of 2 traverse magazines with connecting parados arch, and necessary doorways, staircases, etc.; work on earth cover and sand parapet nearly completed. Bastion B: Completion of two 15-inch gun platforms, a third nearly finished, foundation of new arch piers in parade completed. Bastion E: Parados arch built; work on 5 new gun platforms in demilune. Breast-height wall for entire battery built; minor work. 74, 8.

1875. \$25,000 app. Battery for five 15-inch guns finished to admit of armament being placed; 3,000 tons of sand placed in parados and cover of magazines; minor work. 75, 8.

1876. Completion of ravelin battery, and as far as possible of batteries of bastion A of the enceinte; work on modifications of bastion B. 76, 9.

1877. Repairing earthen slopes, concrete and plastering of magazine arches in bastion B, drains, and asphalt cover. 77, 7.

1881. Repairs of slopes, casemates, drains, and ironwork. 81, 20.

1882-84. Repairs of slopes, drains, and buildings. 82, 16; 83, 11; 84, 17.

1885. Repairing sea wall, drains, and casemates; torpedoes painted, 10-inch and 15-inch platforms put in serviceable order; and minor repairs. 85, 11.

1886. Repairs of cisterns; hanging doors; extra traverse irons placed on 10-inch gun front pintle barbette platforms to adapt them to the new ordnance carriage for 8-inch converted rifles; steamer *Tourist* repaired. 86, 12.

1887. Est. by BE. for gun and mortar batteries. 87, 11.

Part 9, FNB. Fort Independence (Castle Island).

1833. Work begun. 80, 24.

1866. Resetting gun platforms; flagging; cutting out and replacing new pintle for 21 barbette guns in main work; repairing breast-height wall and earthen parapet of northwest exterior battery, and building bombproof magazine chamber of this battery. 66, 6.

1868. Masonry, concrete, and earth covering of magazine of the northwest exterior battery completed; completion of masonry of southeast exterior battery bombproof traverse; masonry of adjacent magazine begun; parapet cut down; embankment at outer extremity of battery enlarged and raised; and minor work. 68, 10.

1869. Work on southeast exterior battery magazine, bombproof adjacent completed: slopes repaired; and minor work. Modified plans. 69, 10.

1870. Est. cost of modifications, \$106,000. Earth covering and sodding of east battery magazine completed; repairing breaks in scarp wall and parade wall copings. 70, 15.

1871. \$27,500 app. Modification work begun: necessary buildings for employees built; masonry of 2 new traverse magazines built; minor work. 71, 10.

1872. \$42,500 app. Breast-height walls of east, southeast, and north bastions completed; work on 6 platforms and breast-height walls of northwest bastion; excavation for sand parapet of fronts 1 and 2; minor work. 72, 7.

1873. \$35,000 app. Completion of masonry of 2 center pintle and 4 front pintle 15-inch gun platforms, with their breast-height walls; small magazines on front 1; masonry, earth slopes, and hoist-

ing sand for east bastion; work on earth slopes and excavation for sand parapet of east bastion and curtain of front 1. 73, 8.

1874. New barbette battery finished ready for armament; completion of new sand parapet, traverse magazines, parade on fronts 1 and 2, 2 traverse magazines on front 3, excavation for sand parapet, and minor work in east exterior battery. 74, 9.

1875. Modifications of the battery of the enceinte nearly completed; one 15-inch gun platform in east exterior battery finished; work on 2 others, with their breast-height walls, and new parapet in front of battery. 75, 9.

1876. Completion of proposed modifications of barbette battery of the enceinte, of 5 platforms, ready for armament, in east exterior battery, and minor work. 76, 10.

1877. Care and preservation. 77, 7.

1881-84. Repairs of slopes, drains, and buildings, etc. 81, 22; 82, 17; 83, 13; 84, 19.

1885. Gun platforms put in serviceable condition, and repairs of buildings, wharves, etc. 85, 12.

1886. Doors hung; ironwork on 15-inch platforms painted; extra traverse irons placed on 10-inch gun platforms to adapt them to the 8-inch converted rifles. 86, 13.

1898. Castle Isld. turned over to the city of Boston for park purposes, act of May 1, 1890. Public excluded from fort and batteries. 98, 601.

1899. All explosives removed from the isld. and all torpedo material stored. The isld. again opened to the public. 99, 711.

Part 10, FNB. Provincetown Harbor—Permanent Forts.

1866. Defenses of this part of the coast to be considered by board of officers. Balance in Treasury; \$150,000. **66, 6.**

1867-70. Work awaiting the preparation plans. **67, 6; 68, 10; 69, 10; 70, 15.**

Part 11, FNB. Long Island Head Battery.

1869-70. Possession of this site, for defense of Broad Sound and the main ship channel, acquired by act of Mar. 28, 1867. Proj. for barbette earthen battery for heavy guns; est. cost, \$175,000. **69, 9; 70, 15.**

1871. \$37,500 app. Work begun. Necessary buildings for employees built. **71, 10.**

1872. Work on wharf, excavation for the eastern mortar battery and parados in rear, concrete masonry of these positions, and drainage. **72, 7.**

1873. Completion of drain of eastern part of the battery, 2 large magazine cells and their connected parados arches, foundation of east salient gun platform and its breast-height wall, and excavation for the magazine and parados north of it; minor work. **73, 7.**

1874. \$40,000 app. Completion of center-pintle 15-inch gun platform at east salient of the battery, and masonry of adjacent magazine and parados. **74, 9.**

1875. \$30,000 app. Work on embankment traverse magazines and parados; completion of 15-inch gun platforms with their breast-height walls; minor work. **75, 8.**

1876. Completion of four 15-inch front-pin gun platforms with their breast-height walls, rear for armament. Work on parados. **76, 9.**

1877. Repairing drains, and grading terrepleins of 2 upper batteries to allow guns to traverse. **77, 7.**

1881. Repairs made to buildings, gun carriages, etc. **81, 21.**

1882. Repairs to earth slopes and traverse magazines, buildings, etc. **82, 16.**

1885. Gun platforms put in serviceable order; minor repairs to buildings, fences, drains, and slopes. **85, 11.**

1886. Doors hung; repair of slopes, and painting ironwork of gun platforms. **86, 12.**

1887. Est. by BE. for gun and mortar batteries. **87, 11.**

Part 12, FNB. Fort Sewell (Marblehead.)

1884. Fort built 1863-65. History and description. **84, 17.**

Part 13, FNB. Fort Andrew (Plymouth Harbor).

1884. Fort built 1863-65. History and description. Site purchased, 1870. **84, 19.**

Part 14, FNB. Fort Standish (Plymouth Harbor).

1884. Fort built 1862-65. Description. Site purchased, 1870. **84, 19.**

Part 15, FNB. Fort Winthrop and Batteries (Governor Island).

1844. Existing work, consisting of a central casemated keep, and exterior earthen batteries begun in 1844. **80, 23.**

1866. Three bombproof south battery magazines completed, and slopes of east part of battery sodded, earthwork repaired, and bombproof traverse

next west of the stone redoubt sodded; work on stone walls, entrance to second traverse magazine west of stone redoubt, south battery; repair quarters, and minor work. **66, 6.**

1867. Earth covering and sodding of the west magazine, south battery, completed; parapet

south, east, and northwest batteries repaired and sodded; bluff below south battery graded and seeded; northeast and northwest bastions of the earthwork to surround the tower begun; tunnel covered way to south battery excavated; and concrete foundation of its walls laid. 67, 6.

1868. Work on long covered way between the tower ditch and south battery; raising embankment of the bastions around the tower; repairing embankments of bombproof traverses; minor work. 68, 10.

1869. Covered way completed and bomb-proof traverse, opposite, built; earthen counterscarp slopes around tower finished; embankment repaired; minor work. Plans modified. 69, 10.

1870. Est. cost of modification, \$130,000. Earth counterscarp slopes completed; west half of exterior earthwork of tower completed; communication between ditch of the tower and south battery completed; minor work. 70, 15.

1871. \$45,500 app. Modification work begun; concrete masonry, east battery, constr.; drainage and minor work; 3 traverse magazines, south battery, imp. and enlarged; parade reasphalted; and minor work. 71, 10.

1872. \$64,000 app. Work on traverse magazine, platforms, breast-height wall, and sand parapet, east battery; breast-height wall for 4 gun positions, south battery, built; western magazines and shell room, and pit for mortar beds, completed. 72, 7.

1873. \$50,000 app. Completion of new platforms designed for ordnance carriages in east bat-

tery, and front-pintle platforms of south battery; work on breast-height wall platform, traverse magazine, and new parapet of south battery; mortar battery completed; and minor work. 73, 7.

1874. Platform for forty-four 15-inch guns completed; sand parapet of east battery finished, and work on excavation for sand parapet of south battery; 2 new traverse magazines finished, work on a third. 74, 9.

1875. Completion of masonry of breast-height walls, platforms of two 15-inch guns, necessary ironwork of 4 others; work on breast-height walls for 4 gun positions. Battery, except new sand parapet, completed. 75, 9.

1876. Completion of east and south batteries (comprising forty-three 15-inch platforms), excepting about one-half of new sand parapet of south battery. 76, 10.

1877. Repair of slopes and drains. 77, 7.

1881. Repairs of earth slopes, drains, and buildings; and painting ironwork. 81, 21.

1882-84. History and condition. Repairs of slopes, etc. 82, 17; 83, 12; 84, 18.

1885. Gun platforms put in serviceable condition; repair of slopes, parade of the tower, and buildings. 85, 12.

1886. Doors hung; painting ironwork of gun platforms; extra traverse irons placed on 10-inch gun platforms to adapt them to the new carriage for 8-inch converted rifles; drain of the tower cleaned and extended. 86, 13.

Part 16, FNB. Emplacement for 8-inch Guns, Disappearing Carriages.

1891. One emplacement under constr. 91, 7.

1892. Old masonry demolished. 92, 5.

Part 17, FNB. Site 4.—Mortar Battery for Sixteen 12-inch Mortars.

1891. Work begun June, 1891. 91, 7.

1892. \$121,039.27 allotted, 1891. Excavation completed; 9,000 c. y. embankment built; 6,700 c. y. concrete placed. 92, 5.

1893. \$10,000 allotted. Masonry and earth embankment nearly completed. 93, 6.

1894. Embankments and sodding completed. 94, 7.

1895. Eight mortars mounted; work on 4 platforms. 95, 7.

1896. \$2,786.50 allotted. All platforms finished, mortars mounted, and battery nearly finished. Turned over to Artillery. 96, 12, 470.

1897. Battery completed. 97, 602.

1898. \$275 allotted for repairs of electric plant. 98, 595.

1899. \$6,400 allotted for repairing slopes, electric plant, and for constr. of power house, etc. 00, 781.

1900. \$375 allotted for hanging doors. 00, 781.

1901. \$6,750 allotted. Work on ventilation and drainage system in progress. 01, 723.

1902. Drainage system finished; new floors laid; wall of pit repaired. 02, 644.

Part 18, FNB. Site 5.—Mortar Battery for Sixteen 12-inch Mortars.

1897. Negotiations in progress for purchase of site. 97, 12, 603.

1898. Jurisdiction over site ceded to National Government by the Commonwealth of Massachusetts, Apr. 6, 1897; plans for emplacements for eight 12-inch mortars prepared and work on excavation begun June 15, 1898. 98, 595.

1899. \$108,000 allotted. Wharf and excavation completed; concrete of magazines and passages placed; mortar platforms made ready to receive base rings; earth embankments and road nearly completed; 8 mortars and carriages received. 99, 714.

1900. \$23,450.10 withdrawn from allotment. Road completed; embankments graded and sodded; armament mounted by hired labor; paving of pits in progress. 00, 781, 782.

1901. First half, electric-light conduit installed; second half, \$113,000 allotted; plans submitted for emplacements for eight 12-inch mortars; plant and quarters erected; drains laid; one-half foundation placed. 01, 724.

1902. \$36,720.41 allotted for second half; concrete work nearly completed. 02, 644.

Part 19, FNB. Site 5.—Emplacements for Two 6-inch R. F. Guns.

1901. \$27,000 allotted. Plans prepared. 01, 725.

1902. Excavation work for battery; drainage system laid. 02, 644.

Part 20, FNB. Site 1.—Emplacements for Five 10-inch Guns on Disappearing Carriages.

1892. \$156,194.05 allotted, 1890-91. Work on concrete masonry. 92, 4.

1893. Work on 3 emplacements; 4,000 c. y concrete placed. 93, 5.

1894. Constr. materials collected for 2 emplacements; some masonry built. 94, 7.

1895. Three emplacements ready for guns. 95, 6.

1896. \$53,138.16 allotted. Guns not yet received; some concrete work. 96, 470.

1897. Two 10-inch carriages assembled; work on another one. 97, 601.

1898. New proj. One carriage assembled and three 10-inch guns mounted; some concrete work.

\$74,000 allotted. Work begun on 2 other emplacements. 98, 593.

1899. \$46,800 allotted. Three emplacements practically completed except minor work; work on 2 other emplacements nearly completed; the 2 guns and carriages received but not mounted. 99, 709, 720.

1900. Guns and carriages mounted, completing the emplacements in all respects. 00, 774.

1901. Plant removed. 01, 718.

1902. \$540 allotted. Roadway built; 2 old-type platform lifts removed; new-type chain hoist purchased and installed. 02, 642.

Part 21, FNB. Site 2.—Emplacements for Five 10-inch Guns on Disappearing Carriages.

1893. \$58,000 allotted. Work begun December, 1892; 2,500 c. y. earth excavated and placed in embankment of 1 emplacement. 93, 6.

1894. Masonry of 1 emplacement well advanced; materials collected and stored. 94, 7.

1895. One emplacement ready for gun. 95, 6.

1896. \$21,674.75 allotted. Emplacement will be completed. 96, 470.

1897. \$197,200 allotted. New proj.; completion of emplacements 1, 2, and 3; excavation of emplacement 4 nearly ready for concreting; work on excavation 5; 4 platforms ready for carriages and guns. 97, 601.

1898. Work on excavation, parapet walls

ammunition service, electric-light plant; 5 guns and carriages mounted; battery nearly completed; \$4,000 allotted for commanders' stations, and foundations in place. 98, 594; 99, 713.

1899. Battery, except minor work, completed. 99, 712.

1900. Battery completed. 00, 778.

1901. \$10,500 allotted. Lighthouse removed; grading roadway begun; work transferred to Artillery in 1899. 01, 721.

1902. \$1,425 allotted. Road nearly completed; old platform lifts removed; chain hoist partly installed. 02, 642.

Part 22, FNB. Site 1.—Two Emplacements for 4-inch R. F. Guns.

1898. \$9,090 allotted. Work begun, excavations nearly completed; platforms ready for guns. **98**, 593.

1899. Guns mounted, electric light installed, stairs built; minor work. Emplacements completed by July 1, 1899. **99**, 720.

Part 23, FNB. Site 2.—Two Emplacements for 4.72-inch R. F. Guns.

1898. \$14,740 allotted. Work begun, guns mounted, excavations finished, and concrete work in progress. **98**, 594.

1899. Guns mounted and battery, excepting minor details, completed. **99**, 722.

Part 24, FNB. Site 3.—Three Emplacements for 12-inch Rifles, Disappearing Carriages.

1898. \$151,680 allotted. Work begun April, 1898; platforms ready for mounting guns; excavation completed; magazine work in progress. **98**, 595.

1899. \$36,000 allotted. Battery practically completed; 3 carriages on hand. **99**, 713, 721.

1900. \$23,800 allotted. Battery completed; guns mounted. **00**, 779, 780.

1901. Steps taken to transfer to Artillery. **01**, 722.

1902. Transferred, 1901. Minor repairs to battery. **02**, 643.

Part 25, FNB. Site 6.—Two Emplacements for 12-inch Rifles, Nondisappearing Carriages.

1898. \$4,800 allotted for communication for range-finding service. \$80,000 allotted. Survey on site; excavation begun. **98**, 596.

1899. \$27,000 allotted. Battery completed in all essential details. Part of 1 carriage received. **99**, 722.

1900. \$6,960.30 allotted. Work on slopes; installation of electric-lighting plant, permanent water supply, and minor work. **00**, 782.

1901. Trolleys, cranes, and railing completed. Work transferred to Artillery. **01**, 725.

Part 26, FNB. Site 1.—Two Emplacements for 12-inch Guns on Disappearing Carriages.

1899. \$123,000 allotted. Concrete work begun. **99**, 710.

1900. \$15,760 allotted. Emplacements completed excepting some work on platforms and mounting guns. **00**, 774.

1901. \$5,400 allotted. Platforms completed, armament mounted; tile drain laid; ammunition cranes installed. **01**, 718.

1902. \$477.48 allotted. Rooms in old fort cleared of material; walks repaired; connection made to electric motors. **02**, 641, 642.

Part 27, FNB. Site 1.—Three Emplacements for 15-pounder R. F. Battery.

1899 \$9,300 allotted. Site laid out ready for excavation. **99**, 711.

1900. \$3,450 allotted. Battery completed in all respects, electric-lighting system installed, and guns mounted; work turned over to the garrison. **00**, 775.

Part 28, FNB. Site 7.—Emplacements for Two 6-inch Rifles.

1901. \$25,000 allotted. Site surveyed, prepared for work, drains laid; forms erected and foundations laid. **01, 728.**

1902. \$7,000 allotted. Battery completed, except laying floors; hanging doors; installing ammunition hoists; grading and sodding parapet. \$10,100 withdrawn. **02, 646.**

Part 29, FNB. Site 7.—Emplacements for Four 10-inch B. L. Rifles.

1901. \$192,500 allotted. Plans prepared; plant purchased; railroad built; excavation begun. **01, 728.**

1902. (Called site 6 in 1902.) Excavation completed; drains, conduits, speaking tubes placed, for 3 emplacements. **02, 645, 646.**

Part 30, FNB. Site 7.—Three Emplacements for 6-inch R. F. Guns on Disappearing Carriages.

1899. \$65,000 allotted. Preparation of plans for wharf and general constr. plant in progress. **99, 715.**

1900. Excavation, and about one-half of concrete work completed. Two carriages received. **00, 784.**

1901. \$26,000 allotted. Concrete completed; parapet constr.; electric plant installed; water supply nearly completed; trolleys, handrails, doors placed; 1 carriage received and 3 carriages mounted. **01, 726.**

1902. \$1,500 allotted. Parados completed. \$4,900 withdrawn. **02, 646.**

Part 31, FNB. Site 6.—Two 5-inch R. F. Guns on Pillar Mounts.

1899. \$11,500 allotted. Excavation begun and concrete carried up to the ceiling level. **99, 715.**

1900. \$2,550 allotted. Battery completed, except setting handrails. Carriages mounted. **00, 783.**

1901. Handrails completed. Battery transferred to Artillery. **01, 726.**

Part 32, FNB. Site 2.—Two Emplacements for 15-pounder R. F. Guns.

1900. \$13,200 allotted. Work completed, excepting sodding slopes and providing ammunition lifts; no carriages or guns received. **00, 779.**

1901. \$5,580 allotted. Ammunition lifts installed, slopes sodded, bank graded, drain built, armament received and mounted. Battery transferred to Artillery, 1901. **01, 722.**

Part 33, FNB. Site 5.—Two Emplacements for 5-inch R. F. Guns, Pedestal Mounts.

1900. \$20,000 allotted. Battery completed ready for armament; neither guns nor carriages received. **00, 782.**

1901. \$3,800 allotted. Work completed; no armament received. **01, 725.**

Part 34, FNB. Site 7.—Emplacements for Three 15-pounder R. F. Guns.

1900. \$12,000 allotted. Plans prepared and survey of site made. **00, 784.**

1901. Work completed on 2 emplacements, except grading of parapet; \$9,000 allotted for constr. third emplacement au. Apr. 11, 1901; concrete work completed. **01, 727.**

1902. Parapet completed, except final grading and sodding. \$3,500 withdrawn. **02, 647.**

Part 35, FNB. Site 7.—Emplacements for Four 15-pounder R. F. Guns.

1901. \$19,000 allotted. Constr. au. Apr. 24, 1901; railroad constr., derrick, and engine installed; excavation completed, drains laid, forms erected, concrete work begun. **01, 728.**

1902. Battery nearly completed. \$5,000 withdrawn. **02, 647.**

MISCELLANEOUS.

Part 36, FNB. Underground Conduit System.

1900. Site 1.—\$9,250 allotted. Description of system. 3,000' of conduit laid. **00, 776.** Site 2.—\$3,000 allotted. Work completed. **00, 779.**

1901. Site 1.—Work completed. **01, 720;** Site 3.—\$780 allotted. Work completed. **01, 722.**

Part 37, FNB. Central Electric Lighting Plant.

1900. Site 1.—\$10,000 allotted. Description of plant, installation of which was completed. **00, 777.** Site 2.—\$6,300 allotted. Work completed.

Description of plant. **00, 779.**

1901. Sites 1 and 2 transferred to Artillery, 1900. **01, 720, 722.***

Part 38, FNB. Construction of Lighter.

1901. \$20,000 allotted. Plans and specifications prepared by naval architect. **01, 729.**

1902. Completed and delivered. **02, 647.**

Part 39, FNB. Construction of Storehouses.

1901. \$3,500 allotted for constr. of 2 storehouses, site 6. One storehouse nearly completed, material for second building purchased, site prepared. **01, 729.**

1902. Both storehouses finished. **02, 645.**

Part 40, FNB.**Roadway at Winthrop.**

1902. Letters and indorsements from Sec. of War, Chief of Engineers, Judge Advocate General, act of Congress. Deeds and conveyances referring to a strip of land purchased by U. S. for present site of Fort Banks. It is recom. that U. S. dedi-

cate to town of Winthrop another strip of land to be used as a public highway, and that \$200 be app. for grading and making roadway through middle of said strip. **02**, 651, etc.

Part 41, FNB.**Moving and Mounting Guns and Carriages.**

1900. Site 1.—\$1,100 allotted. Two 10-inch guns and carriages moved from wharf to emplacements, to be mounted by the garrison. **00**, 777. Site 6.—\$1,200 allotted. Two 12-inch carriages mounted; no guns on hand. **00**, 783.

1901. Site 1.—\$2,940 allotted for two 12-inch guns moved from wharf and mounted in emplacements by hired labor. **01**, 720. Site 6.—\$6,821.43 deposited to credit of Treasurer of U. S. **01**, 726.

Part 42, FNB.**Preservation and Repair of Fortifications.**

1898. \$275 allotted for repair of electric plant, mortar battery at Fort Banks. **98**, 595. \$800 allotted for cleaning and painting mine cases. **98**, 601.

1899. \$500 allotted for repairs at Fort Strong, \$415 for repairs at Fort Banks, \$365 for repairs at Fort Andrews, and \$365 for repairs at Fort Revere. \$800 allotted for repair of 10-inch and 12-inch emplacements and \$200 allotted for relaying flagging, Fort Warren. \$175 allotted for repairing bridge of old works, Fort Winthrop; and \$2,200 for repair of wharf, Fort Independence. **99**, 717, 718.

1900. \$675 allotted for general repair of batteries and their power plant, Fort Warren; \$300 allotted for general repairs of plant and \$4,250 allotted to prevent dampness in magazine at Fort Strong; \$210 allotted for demolition and removal of old buildings occupying ground required for other purposes, Fort Strong; \$800 allotted for care

and repair of plant, Fort Heath; \$330 allotted for repairs at Fort Banks; \$1,000 allotted for repair and care of Fort Andrews; \$1,860 allotted for general care and repair at Fort Revere; \$250 allotted for repairs at Fort Standish. **00**, 786-89.

1901. \$230 allotted for Fort Warren; repairs to lighting system; ammunition lifts; walls of power room painted. **01**, 730. \$790 allotted for Fort Strong; old engineer building demolished. Following allotments made: \$1,120 for Fort Heath; \$110 for Fort Banks; \$425 for Fort Andrews; \$220 for Fort Revere; \$100 for Fort Standish. **01**, 730, 731, 732, 733.

1902. Minor repairs made to buildings and batteries. Withdrawals: Fort Independence, \$9.87; Fort Warren, \$44.04; Fort Strong, \$0.03; Fort Banks, \$238.94; Fort Andrews, \$385.20. Allotted: Fort Warren, \$200. **02**, 649. Fort Heath, \$527.84 allotted, \$0.18 withdrawn. **02**, 643.

Part 43, FNB.**Range and Position Finders.**

1900. \$4,605 allotted. Commander's station completed; \$8,400 allotted for 2 additional range-finder stations, site 1. **00**, 776. Total of \$5,385 allotted for commander's station at site 2, completed **00**, 778. Site 3.—\$6,400 allotted. Work begun. **00**, 780.

1901. \$4,020 allotted. Two stations at site 1 completed. **01**, 719. Commander's station, site 2, transferred to Artillery, 1900. **01**, 721. Site 3.—\$2,600 allotted. Work completed. **01**, 722.

Part 44, FNB.

Sites.

Grovers Cliff. Fifty acres acquired in 1891. **92**, 9. Eight small lots acquired by purchase. **93**, 10. Total area acquired, 50 $\frac{1}{2}$ acres for \$263,-597.79. **94**, 13.

Peddocks Island. \$33,130 allotted for purchase of 33.13 acres. **98**, 599.

Deer Island. 23.34 acres transferred by Boston to the U. S.; more land wanted by U. S. City did not feel justified in transferring any more land at the time. **98**, 600; **99**, 719.

Nantasket Head. \$251,248.85 allotted. About 40 acres acquired by purchase. **98**, 600.

Nahant. Report, as to desirable land, to be submitted later. **98**, 600; **99**, 719. Description of land acquired. **99**, 718; **00**, 789. \$1,000 allotted for survey. **00**, 791.

1901. Acquisition of about 239,078.9 sq. f.; 49 lots paid for. **01**, 734.

1902. Part of tract purchased. **02**, 648.

Part 45, FNB.

Submarine Mines.

1891. Two mining casemates completed, one each at Forts Warren and Strong. **91**, 7.

1893. \$27,000 allotted. Work begun, third casemate, Fort Standish. **94**, 7.

1894. Masonry and entrance gallery completed; work on cable gallery and sand embankment, Fort Standish. **94**, 7.

1895. Masonry casemate and gallery of third casemate finished and sand cover nearly completed. **95**, 7.

1897. \$4,300 allotted. Work on cable tank at Fort Strong. **97**, 602.

1898. Cable tank nearly completed; \$1,035 allotted for removal of torpedo material from Fort Warren to base of operations at Fort Independence; \$25,000 allotted for purchase of additional torpedo material; \$68,700 allotted for planting mines. Description of mines, material, and the planting **98**, 597. \$800 allotted for cleaning and painting mine cases. **98**, 601.

1899. \$700 allotted for storehouse at Fort Independence; \$2,000 and \$2,700 for casemates, Forts Warren and Strong; \$2,000 for storage of material at Fort Independence. Storehouse completed; Fort Strong casemate begun; storage practically completed. \$76,847.18 allotted for planting and removing mines, and purchasing and cleaning torpedo material. Mines removed. **99**, 716, 723.

1900. \$850 allotted, for casemate, Fort Strong, completed; and one, Fort Warren, practically completed; \$1,600 allotted and torpedo material cleaned and stored at Fort Independence. \$600 withdrawn from \$2,000 allotment. **00**, 785, 787.

1901. Casemate completed. **01**, 729. \$7,000 allotted for cable tank extension, Fort Strong shed constr.; hoisting device partly constr. **01**, 730. \$605 allotted and unserviceable material shipped to Willets Point. **01**, 731.

1902. Cover for cable tank completed; trolleys purchased and installed. **02**, 647. Material for mines transferred to Fort Independence. \$47.99 withdrawn, \$100 allotted. **02**, 648.

Part 46, FNB. Supplies for Coast Defenses.

1900. \$1,000 allotted or purchase of electrical supplies; none purchased. **00**, 791.

1901. Supplies purchased and issued to commanders. **01**, 734.

1902. \$1,300 allotted. Electrical supplies purchased. **02** 648.

FNC. MASSACHUSETTS AND RHODE ISLAND FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1897-1902 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1902 |
| 4 | BE..... | 1882-1887 |
| 5 | In-charge..... | 1885-1901 |
| 6 | Assistants..... | 1893-1901 |
| 7 | Fort, etc.—Operations, allotments, etc..... | 1824-1902 |
| 8 | New Bedford, Mass.—Clarks Point (fort)..... | 1857-1886 |
| 9 | Fort Phoenix..... | 1866 |
| 10 | Mounting 8-inch converted rifles..... | 1898 |
| 11 | Two emplacements, 8-inch guns, disappearing carriages..... | 1897-1900 |
| 12 | Four emplacements, 5-inch R. F. guns..... | 1899-1902 |
| 13 | Four 15-pounder R. F. guns..... | 1901-1902 |
| 14 | Newport Harbor, R. I.—Fort Adams..... | 1824-1886 |
| 15 | Fort Green, R. I..... | 1885 |
| 16 | Narragansett Bay, R. I.—Dutch Isld..... | 1863-1886 |
| 17 | Conanicut Isld.—Dumplings Battery..... | 1870 |
| 18 | Emplacements, three 10-inch guns, disappearing carriages..... | 1897-1900 |
| 19 | Mortar battery, sixteen 12-inch mortars..... | 1897-1900 |
| 20 | Two emplacements, 10-inch rifles, disappearing carriages..... | 1898-1899 |
| 21 | Two emplacements, 4.7-inch R. F. guns, pedestal mounts..... | 1898-1899 |
| 22 | One emplacement, 8-inch B. L. rifle..... | 1898 |
| 23 | Mortar battery, eight 12-inch mortars..... | 1898-1901 |
| 24 | One emplacement, 6-inch R. F. gun..... | 1898-1899 |
| 25 | Two emplacements, 12-inch rifles, nondisappearing carriages..... | 1898-1900 |
| 26 | Two emplacements, 3-inch 15-pounder R. F. guns..... | 1899-1900 |
| 27 | Two 15-pounder R. F. guns..... | 1899-1900 |
| 28 | Three emplacements, 10-inch guns..... | 1901-1902 |
| 29 | Four emplacements, 6-inch R. F. guns..... | 1901-1902 |
| 30 | Two emplacements, 15-pounder R. F. guns..... | 1901-1902 |
| 31 | Emplacements, 6-inch and 12-inch R. F. guns..... | 1901 |
| 32 | Emplacements, three 12-inch guns..... | 1901 |
| 33 | Miscellaneous.—Electric-light plant; constructing wharf; fire control and searchlight..... | |
| 34 | Preservation and repairs..... | 1898-1902 |
| 35 | Range and position finders..... | 1898-1902 |
| 36 | Sea walls and embankments..... | 1901 |
| 37 | Sites..... | 1895-1902 |
| 38 | Submarine mines..... | 1892-1902 |
| 39 | Supplies..... | 1901 |

Part 1, FNC.

Contracts.

1897. Sand, \$1.25 per c. y.; small stone, \$1.81 per c. y.; Rosendale cement, 85¢ per barrel; Portland cement, \$2.12 per barrel. 97, 604. Three 10-inch emplacements, \$56,967 for 2. 97, 606.

1899. Rosendale cement, 68¢ per barrel; small stones, \$1.80 per c. y.; sand, \$1.35 per c. y.; Portland cement, \$2.15 per barrel. 99, 737.

1901. Crushed stone, \$1.57 per c. y.; sand, \$1.30 per c. y.; Giant Portland cement, \$2.26 and

\$1.80 per barrel; lumber, \$21 per M f. planed, \$17, per M f. rough. 01, 736. Conduit, switches, junction boxes, etc.; switchboards, covered cable, generating sets. 01, 739.

1902. Building sea walls. 02, 663. Book tiles; constr. wharf. 02, 665.

Part 2, FNC.

Engineering Features.

Asphalt, placing. 00, 809.

Cement, test. 96, 471.

Concrete, painting. 03, 2386.

Dampproofing. (See Waterproofing, below.)

Foundations. 03, 2384; 04, 3712.

Magazines, linings for. 02, 2458 (pl.); 03, 2385; 04, 3712.

Materials and work, cost of. 99, 726, 733, 735; 00, 803, 805, 809, 811.

Mining casemate. 96, 471.

Waterproofing. 00, 795, 799, 809; 02, 2458.

Part 3, FNC.

Engineers.

Chief of Engineers. **R.**, 66, 6; 67, 6; 68, 10; 17; 83, 13; 84, 19; 85, 12, 423; 86, 14; 93, 6; 94, 69, 10; 70, 15; 71, 11; 72, 8; 73, 8; 74, 9; 75, 9; 7; 95, 7, 503; 96, 12, 471; 97, 12, 603; 98, 16, 601; 76, 10; 77, 7; 78, 9; 79, 13; 80, 24; 81, 22; 82, 99, 18, 724; 00, 16, 791; 01, 16; 02, 18.

Part 4, FNC.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. **R.**, 82, 416. **R.** 1887, 87, 11.

Part 5, FNC.

Engineers in Charge.

Capt. H. M. Robert, 1865.
Maj. G. H. Mendell, 1866-67.
Capt. S. M. Mansfield, 1866.
Maj. D. C. Houston, 1866-70.
Capt. J. A. Smith, 1867-69.
Lt. Col. G. K. Warren, 1870-83.
Capt. A. H. Holgate, 1870.

Maj. J. W. Barlow, 1883.
Lt. Col. G. H. Elliot, 1883-86.
Capt. W. H. Bixby, 1893-95.
Lt. W. W. Harts, 1895-96.
Maj. D. W. Lockwood, 1896-1901.
Maj. G. W. Goethals, 1901.
Lt. R. P. Johnston, 1900-01.

Part 6, FNC.

Assistants.

Lt. W. H. Harts, 1893-95.
Capt. C. H. McKinstry, 1896-98.
Lt. W. B. Ladue, 1898-99.

Lt. W. J. Barden, 1898.
Capt. Harding, 1898-99.
Lt. R. P. Johnston, 1898-1901.

Part 7, FNC—

FORTS AND BATTERIES.

Part 8, FNC. New Bedford Harbor, Mass.—Clarks Point (Fort).

1857. Work begun for casemated fort. 80, 24.

1866. Work on scarp of water fronts, parade wall, square towers, excavation; minor work. 66, 6.

1867. Three casemates made ready for guns; masonry of 5 magazines completed, and 3 magazines made ready for powder. Work on scarp and parade walls. 67, 6.

1868. Scarp and parade walls completed, work on foundations for breast-height wall and gun platforms; mastic covering of roofs. 68, 10.

1869. Completion of first and second tiers, except quarters; mastic covering of roof surfaces and magazines, 3 barbette magazines, breast-height wall, parapet, and terreplein of gorge and 2 rectangular stairs. 69, 10.

1870. This casemated work completed except its barbette battery over the casemates. BE.

recom. that nothing further be done than to preserve it from deterioration, and that an earthen barbette battery for twenty-six 15-inch S. B. or equivalent rifled guns be erected on the hill in rear of the fort. Repair and preservation. 70, 15.

1874. Minor repair of buildings. 74, 9.

1875. Plans for heavy gun batteries completed; est., \$181,344.60. Minor repairs of plant. 75, 9.

1876-79. Preservation and repair. 76, 10; 77, 7; 78, 9; 79, 13.

1884. Painting ironwork, mowing slopes, repairing fences, buildings, etc. 84, 20.

1885. Storing engineer property; temporary doors provided for magazines. 85, 13.

1886. Repairs of buildings, magazine doors, and bridges. 86, 14.

Part 9, FNC. New Bedford Harbor, Mass.—Fort Phoenix.

1866. Magazine anteroom floored, and 2 doors hung. 66, 7.

Part 10, FNC. New Bedford Harbor, Mass.—Mounting 8-inch Converted Rifles.

1898. \$1,800 allotted. Work begun. 98, 602.

Part 11, FNC. New Bedford Harbor, Mass.—Two Emplacements for 8-inch Guns on Disappearing Carriages.

1898. \$50,000 allotted. Work begun, excavation completed, and platforms ready for guns. 99, 725
725

1900. Repairs of slopes. Batteries transferred to the Artillery. 00, 791.

1899. \$53,500 allotted. Guns mounted and

Part 12, FNC. New Bedford Harbor, Mass.—Four Emplacements for 5-inch R. F. Guns.

1899. \$13,300 allotted. Plans and est. approv. for pedestal mounts. 99, 729.

1900. \$4,200 allotted. Work begun, excavation completed, and concrete work in progress. 00, 792.

1901. \$4,000 allotted. Work on emplacements

completed; ready for guns and electric lighting 01, 735. Chief of Engineers decides to drop two 5-inch guns, substituting four 15-pounder R. F. guns instead. 01, 736.

1902. Repairing bombproof and angle of casing wall. 02, 659.

Part 13, FNC. New Bedford Harbor, Mass.—Four 15-pounder R. F. Guns.

1901. Substituted for two 5-inch R. F. guns. \$18,300 allotted. Both batteries practically completed. 01, 736.

1902. Doors hung and painted; emplacement repaired. 02, 659.

Part 14, FNC. Newport Harbor, R. I.—Fort Adams (Narragansett Bay).

1824. Work begun. 80, 24.

1866. Work on refacing 2 embrasures; repairs to slopes; replacing granite wall above the coping with earthen parapet; building 2 traverse magazines; and laying platforms for two 15-inch and two 10-inch guns. 66, 7.

1867. Relaying traverse circles; 4 additional platforms laid; 2 service magazines built. Work begun on exterior batteries to adapt them to an armament of 15-inch and heavy rifled guns; minor work. 67, 7.

1868. Wharf repaired, new postern gates built minor repairs to drains, coping, sidewalks, casemates, arches, etc. 68, 11.

1869. General repairs of masonry, sea wall wharf, and quarters. 69, 11.

1870. Modification plans approv. for an exterior barbette battery for heavy guns; est., \$132,000. Work on latrines, repairing wharf; minor work. 70, 16.

1871. Repairing wharf, quarters, southeast glacis; minor work. 71, 11.

1872. \$35,000 app. Repairs of roads, etc. Preparing for modification work. **72, 8.**

1873. \$65,000 app. Work begun on modification. Work on parapet, roads, and quarters. **73, 8.**

1874. \$20,000 app. Completion of concrete for 6 magazines—traverses. Work on parapet, terre-plein, wharf; drainage system completed. **74, 10.**

1875. \$15,000 app. Foundations for platforms for 6 heavy guns laid, and earth of 2 traverses, with bonnets, completed; work on and repairs of slopes. **75, 9.**

1876. Four platforms set; grading slopes; drainage work; preservation and repairs. **76, 10.**

1877. Care and preservation. **77, 8.**

1878. Fence built. **78, 10.**

1882. \$10,000 allotted in 1881 for repairs of wharf; \$1,000 allotted for waterproofing casemate; rebuilding bridges and repair of buildings. **82, 18.**

1883. Waterproofing work; casemates ventilated by removing the brick cheeks of the embrasures and loopholes; repair of buildings and wharf. **83, 14.**

1884. Preservation and repair—finishing wharfs, repairing facings of 6 embrasures, sea wall, walks, etc. **84, 20.**

1885. Work on waterproofing, sea wall, repairing facings of embrasures, drainage, and minor work. **85, 14.**

1886. Ironwork of 4 front pintle platforms for 15-inch or heavy rifled guns completed; flooring of 2 magazines; work on drainage, sea walls, breast-height walls, and waterproofing. **86, 14.**

Part 15, FNC. Newport Harbor, R. I.—Fort Green, R. I. (Narragansett Bay).

1885. Resolution of the Senate, Jan. 9, 1885, requested information concerning the possession and occupancy of Fort Green; report submitted

by officer in charge, recom. transfer of the land to the city of Newport for use as a public park. History. **85, 15, 423.**

Part 16, FNC. Dutch Island, Narragansett Bay, R. I. (Western End).

1863. Work begun on temporary defenses. **80, 24.**

1866. Site purchased, temporary work; upper and lower battery completed during year. Proj. being prepared for permanent defenses. **66, 7.**

1867. Work begun on permanent defenses in March—altering earthen battery built during the war. Minor work and repairs. **67, 7.**

1868. Work on altering upper battery to adapt it to an armament of 15-inch guns, on permanent wharf, and removing buildings. **68, 11.**

1869. Same as previous year, and general repairs to wharf, drains, and buildings. **69, 11.**

1870. Proj. for 3 detached barbette batteries for forty 15-inch S. B. or equivalent rifle guns; est., \$208,477. Work on buildings, wharf, etc. **70, 16.**

1871. \$121,998 reapp. Work begun, general repair of plant. **71, 12.**

1872. New plans approv. Work begun, foundations of 2 service magazines completed and 2 others begun. Minor work. **72, 9.**

1873. \$40,000 app. Concrete work of 4 magazines. **73, 9.**

1874. \$20,000 app. Traverses of 4 magazines covered in with sand and sodded; parapet connecting them completed for a breast height of 7'; work on water supply, drainage system, and on minor repairs of plant. **74, 10.**

1875. \$20,000 app. Work on water supply, drainage system, grading ground in front and rear of battery, and seeding same; foundations of 2 platforms laid and 2 platforms received. **75, 10.**

1876. Platforms for 4 guns laid, breast-height wall completed; work on parapet; and preservation and repair. **76, 11.**

1877-79. Care and preservation. **77, 8; 78, 10; 79, 13.**

1884. Preservation and repair—painting ironwork; renewing shot beds and skiddings for guns; repairs to ventilating chimneys of magazines, building, and dock etc. **84, 21.**

1885. Preservation and repairs—repairs of quarters, slopes. **85, 14.**

1886. Work on ironwork of 1 center pintle and 4 front pintle 15-inch or heavy rifled guns, and fitting up 2 service magazines by placing floors and doors; minor repairs of wharves, buildings, etc. **86, 15.**

Part 17, FNC. Conanicut Island, R. I.—Dumpling's Battery.

1870. On site of old Dumplings tower, proj. for a barbette battery for ten 15-inch S. B. or equivalent rifle guns on site of the ruins of an old case-

mated tower, built about the close of the last century on Conanicut Isld. opposite Fort Adams. Est., \$100,000. **70, 16; 74, 10.**

Part 18, FNC. Narragansett Bay, R. I.—Emplacements for Three 10-inch Guns on Disappearing Carriages.

1897. \$99,400 allotted. Work begun for constr., by contract, of 3 emplacements; excavating and concreting in progress. 97, 605.

1898. \$12,000 allotted. Two old magazines removed by contract; work of mounting guns and carriages completed; installing electric-lighting plant; cost of labor and materials. 98, 607.

1899. Storage battery installed. Battery turned over to the Artillery. 99, 737.

1900. New locking devices to ammunition lifts installed; dampness in magazines corrected. 00, 807.

Part 19, FNC. Narragansett Bay, R. I.—Mortar Battery for Sixteen 12-inch Mortars.

1897. \$125,500 allotted. Work begun. Necessary excavation done by contract. Work on platforms and walls in progress. 97, 603.

1898. \$10,000 allotted. Battery completed. guns and carriages mounted, storage battery in-

stalled, and turned over to the Artillery on June 6. 1898. 98, 603.

1899. \$240 allotted for repairs of slopes, parapet, and concrete floors. 99, 730.

1900. Building shelter for projectiles. 00, 798.

Part 20, FNC. Narragansett Bay, R. I.—Two Emplacements for 10-inch Rifles, Disappearing Carriages.

1898. \$74,000 allotted. Work begun; 1 gun and carriage mounted. 98, 604.

1899. \$18,620 allotted. Guns mounted and tested; battery completed except electric lighting; battery turned over to the Artillery. 99, 731.

Part 21, FNC. Narragansett Bay, R. I.—Two Emplacements for 4.7-inch R. F. Guns on Pedestal Mounts.

1898. \$12,000 allotted. Work begun, and platforms ready to receive guns by May 23. 98, 605.

1899. \$5,000 allotted. Guns mounted and tested; battery completed and transferred to the Artillery. 99, 733.

Part 22, FNC. Narragansett Bay, R. I.—One Emplacement for 8-inch B. L. Rifle.

1898. \$3,000 allotted. Work begun and completed for making the necessary changes in the

15-inch carriage for the 8-inch rifle (B. L.); carriage ready for mounting rifle. 98, 606.

Part 23, FNC. Narragansett Bay, R. I.—Mortar Battery for Eight 12-inch Mortars.

1898. \$2,500 allotted. Survey of site made; plans and est. being prepared. 98, 608.

1899. \$125,000 allotted. Work begun and about 40% completed. 99, 737.

1900. \$15,900 allotted. Work about 95% completed. 00, 808.

1901. Transferred to Artillery, Jan. 22, 1901. 01, 744; 02, 665.

Part 24, FNC. Narragansett Bay, R. I.—One Emplacement for 6-inch R. F. Gun.

1898. \$8,000 allotted. Work done by contract completed and gun mounted; cost of labor and materials. 98, 608.

1899. \$250 allotted. Minor repairs of parapet, etc. 99, 739.

Part 25, FNC. Narragansett Bay, R. I.—Two Emplacements for 12-inch Rifles, Nondisappearing Carriages.

1898. \$40,000 allotted. Work begun on excavation. 98, 609.

plant; some embankment and sodding work, and minor details. 99, 742.

1899. \$93,708.44 allotted. Guns mounted, and battery completed, except installation of electric

1900. General repairs. 00, 802.

Part 26, FNC. Narragansett Bay, R. I.—Two Emplacements for 3-inch 15-pounder R. F. Guns.

1899. \$10,000 allotted. Plans and est. approv. 99, 740.

guns dismounted and, with their carriages, removed from site of work; excavation in progress. 00, 812.

1900. Work begun. Two old S. B. 15-inch

Part 27, FNC. Narragansett Bay, R. I.—Two 15-pounder R. F. Guns.

1899. \$11,065 allotted. Work begun, excavation completed; concrete completed, except loading platforms. 99, 741.

1900. Guns and carriages not received. 00, 804.

Part 28, FNC. Narragansett Bay, R. I.—Three 10-inch Gun Emplacements.

1901. \$122,500 allotted. Road built, objectionable grades reduced; temporary storage structures begun. 01, 741.

1902. \$55,800 allotted. Buildings completed; walls practically completed to ceiling level. 02, 663, 664.

Part 29, FNC. Narragansett Bay, R. I.—Four 6-inch R. F. Guns.

1901. \$35,000 allotted. Road built; grading; storage structures built. 01, 742.

for guns. \$33,880 allotted for second battery; excavation for emplacements completed. 02, 664.

1902. One battery practically completed, ready

Part 30, FNC. Narragansett Bay, R. I.—Emplacements for two 15-pounder R. F. Guns.

1901. \$15,000 allotted. Work on temporary structures, roadway, grading, etc., begun. 01, 742.

with Shawnee brick, and 6-inch air spaces. 02, 665.

1902. Battery practically completed; lined

Part 31, FNC. Narragansett Bay, R. I.—Emplacements for 12-inch and 6-inch R. F. Guns.

1901. \$500 allotted.

Land surveyed, plans and est. submitted. 01, 743

Part 32, FNC. Narragansett Bay, R. I.—Emplacements for Three 12-inch Guns.

1901. \$240,000 allotted. Timber wharf built; excavation completed; rooms finished to ceiling level; gun platforms finished. \$3,500 withdrawn. 02, 668.

Part 33, FNC.

Miscellaneous.

Electric-light plant:

1901. \$48,200 allotted for plant at Narragansett B., R. I.; conduit laid. 01, 738, 739.

1902. \$5,000 allotted. Completed. 02, 661.

1901. \$37,950 allotted. Electric-light plant at mortar battery; site surveyed and plans prepared. 01, 744.

1902. Interior wiring of batteries completed. 02, 661.

Constructing wharf:

1901. \$28,500 allotted for building permanent wharf on site of old temporary wharf, Narragansett

B. All old material removed; 2,700 tons st., 400 y. r. placed. 01, 742.

1902. Wharf completed. 02, 667.

Fire-control system and searchlight:

1902. New Bedford. \$3,400 allotted for installing the telautograph and cables for a 24-inch searchlight. 02, 660.

Narragansett B. \$9,700 allotted. Survey made. 02, 668. \$3,500 allotted for cable switches, receptacle boxes, etc., for searchlights borrowed for use of maneuvers to take place in fall. 02, 669.

Part 34, FNC. Preservation and Repair of Fortifications.

1898. \$7,700 allotted. Rebuilding breast-height wall; parapet work completed; repairing brick walk, break in sea wall, and platforms of 8-inch converted rifles. 98, 606.

1899. \$400 allotted for New Bedford H. 99, 729. Narragansett B.—\$6,495.50 allotted. Repairing sea wall and parade wall and buildings; minor repairs. 99, 735. \$1,879.82 allotted for repairing bracket hangers and for minor work. 99, 740

1900. \$420 allotted for minor repairs; \$600 allotted for storing mining material at New Bedford H. 00, 798. \$1,165 allotted for correcting dampness in magazine, care of mining material, wiring mining casemates, repairs of quarters, repairing ventilators and culvert, and minor work. 00, 800. \$975 allotted for correcting dampness in dynamo room. 00, 805. \$1,730 allotted for correcting dampness in 10-inch battery. 00, 813.

1901. New Bedford. \$186 allotted. Painting and scraping I beams and ironwork. 01, 736.

Narragansett B. \$3,760 allotted. Observations of dampness made, bulging casemate wall removed, care of torpedo material, buildings painted, etc. 01, 740. \$543.20 allotted. Engine room waterproofed; painting and scraping 12 and 15 pound gun emplacements. 01, 743. \$1,015 allotted. Roadway, rear of three 10-inch gun battery, macadamized and rolled; at 6-inch battery, leaks in magazine stopped, ironwork painted and scraped. 01, 744, 745.

1902. New Bedford H., Mass. Painting, minor repairs, and magazine lined. 02, 659.

Narragansett B. \$1,725 allotted for general repair work; \$600 allotted for care of torpedo material; \$1,200 allotted for salary of electrician; \$1,325 allotted for storage shed for projectiles. 02, 666.

Part 35, FNC. Range and Position Finders.

1898. \$2,300 allotted for a tower for temporary installation of a Lewis range finder at Narragansett B., R. I.; completed and sheathed with 12 inches of timber and steel plates. 98, 604.

1899. \$90 allotted for installation of 2 range finders; \$2,420 allotted for constructing a battery-commander's station. 99, 736. \$30 allotted for installing 2 range finders; \$4,950 for constructing a battery-commander's station. 99, 740.

1900. \$25 allotted for installing a range finder, location not definitely decided upon. 00, 797. \$335 allotted for revised work on battery-commander's station; work begun and completed, and turned over to the Artillery. 00, 799. Battery-commander's station completed, and

turned over to the garrison; total cost, \$4,044.33. 00, 810.

1901. Narragansett B. Battery-commander's station painted and iron ring put around base. 01, 739.

1902. New Bedford. \$2,365 for erection of range-finder station. 02, 660.

Narragansett Bay—\$2,277 allotted for constr. fire-commander's station at eastern entrance, practically completed. \$3,200 allotted for battery-commander's station for 12-inch gun battery, practically completed. \$2,153.80 allotted for fire-commander's station at western passage, completed. 02, 667. \$5,026 allotted for battery-commander's station. completed. 02, 668.

Part 36, FNC. Sea Wall and Embankments.

1901. \$13,000 allotted for rebuilding sea wall at Narragansett B. 01, 739.

1902. Completed. 02, 662.

Part 37, FNC.

Sites.

Fort Adams—Narragansett B. Suit of ejectment begun against occupant of three-fourths acre; judgment rendered in favor of defendant; suit begun to determine and fix the U. S. boundaries at this disputed locality. 95, 13, 503. Fort Wetherill—Description of sites acquired by condemnation proceedings. 98, 611. Condemnation proceedings instituted against owners of land needed for fortification purposes. 99, 746. A total of \$261,555.94 allotted

for purchase and survey of land; 32 acres of one site and 31.67 acres of another site acquired by condemnation proceedings. 00, 806, 807.

1901. Narragansett B. \$65,000 allotted for purchase of land; \$1,000 allotted for survey. 01, 746.

1902. \$16,000 allotted toward purchase of about 20½ acres. 02, 669.

Part 38, FNC.

Submarine Mines.

1892. Plans and est. for 2 mining casemates for defense of Narragansett B. in preparation. 92, 8.

1893. Work of excavation begun on 1 casemate at Narragansett B. 93, 6.

1894. Completion of 1 casemate and work on the other at Narragansett B. 94, 7.

1898. \$5,000 allotted for planting mines in New Bedford H. 98, 602. Cable tank completed at Narragansett B. \$11,000 allotted for planting mines in Narragansett B. 98, 610.

1899. \$13,500 allotted for mining casemate at New Bedford H. 99, 729. \$3,400 allotted for cable tank at New Bedford H.; excavation nearly finished. 99, 729. Mines not planted in New Bedford H., as enough material and supplies had not been received before operations were suspended. 99, 730. Narragansett B.—\$1,000 allotted for caring for and storing mining material. \$6,700 allotted for a torpedo storehouse. 99, 736. \$11,080 allotted for a mining casemate that would be free from dampness. 99, 740. \$10,000 allotted for planting and removing and caring for torpedo material. 99, 746.

1900. Work on mining casemate at New Bedford H. 00, 794. Cable tank completed.

00, 794. \$300 allotted for readjusting the discharge pipe leading from the cable tank; work completed. 00, 800. Mining casemate nearly completed 00, 811.

1901. New Bedford. \$4,500 allotted. Torpedo storehouse practically completed. 01, 738. \$150 allotted for transfer of torpedo material; cable to be tested. 01, 738.

Narragansett B. \$250 allotted. Overhauling torpedo material; transferred to Artillery. 01, 741. \$4,000 for constr. torpedo storehouse. 01, 745. \$4,000 allotted for constr. cable tank; practically completed. 01, 746.

1902. New Bedford. Cable tested; transferred to Artillery. 02, 659. Mining casemate lined; transferred to Artillery. 02, 660. Torpedo storehouse entirely completed; transferred to Artillery. 02, 660.

Narragansett B. Torpedo storehouse completed. 02, 666, 667. Cables tested. 02, 667.

Part 39, FNC. Supplies for Seacoast Defenses.

1901. \$800 allotted for Narragansett B. 01, 746; 02, 668.

FND. CONNECTICUT FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1897-1902 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1902 |
| 4 | BE..... | 1882-1893 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1897-1902 |
| 7 | Forts, etc.—Operations, allotments, etc..... | 1838-1902 |
| 8 | New London, Conn.—Fort Trumbull, at "Fort Point"..... | 1838-1902 |
| 9 | Battery at Fort Griswold, Groton, Conn..... | 1840-1902 |
| 10 | Bridgeport, New Haven, New London, at Stonington—Temporary defenses..... | 1898-1899 |
| 11 | New Haven, Conn.—Fort Hale..... | 1866-1882 |
| 12 | Emplacements, two 12-inch guns, disappearing carriages..... | 1896-1901 |
| 13 | Emplacements, two 10-inch rifles, disappearing carriages, and mining casemate..... | 1897-1901 |
| 14 | Emplacements, eight 12-inch B. L. mortars..... | 1897-1901 |
| 15 | Emplacements, two 10-inch B. L. rifles, disappearing carriages, model 1896..... | 1898-1901 |
| 16 | Emplacement, 4.7-inch R. F. gun..... | 1898-1900 |
| 17 | Emplacements, two 8-inch B. L. rifles, barbette carriages (15-inch S. B. converted)..... | 1898-1901 |
| 18 | Emplacements, 6-inch R. F. guns, disappearing carriages..... | 1899-1901 |
| 19 | Emplacements, two 8-inch B. L. rifles, disappearing carriages, and 2 emplace- ments for 5-inch R. F. guns, balanced pillar mounts..... | 1899-1901 |
| 20 | Emplacements, two 12-inch B. L. rifles, disappearing carriages (1897); two 10-inch B. L. rifles, disappearing carriages (1896); three 6-inch R. F. guns, disappearing carriages..... | 1899-1901 |
| 21 | Emplacements, two 5-inch R. F. wire-wound guns, with parados..... | 1899-1901 |
| 22 | Emplacements, two 5-inch R. F. wire-wound guns..... | 1900-1901 |
| 23 | Emplacements, 5-inch wire-wound guns..... | 1900-1901 |
| 24 | Emplacements, eight 12-inch B. L. steel mortars..... | 1901 |
| 25 | Emplacements, two 6-inch R. F. guns..... | 1901 |
| 26 | Various sites (Nos. 1, 2, 3, 4, 5), miscellaneous works..... | 1902 |
| 27 | Miscellaneous (protection of dynamite battery; care of electric plant)..... | 1901 |
| 28 | Preservation and repairs..... | 1899-1901 |
| 29 | Range and position finders..... | 1899-1901 |
| 30 | Sea walls and embankments..... | 1901 |
| 31 | Sites..... | 1898-1900 |
| 32 | Submarine mines..... | 1898-1901 |

Part 1, FND. Contracts.

1897. Two 12-inch emplacements and wharf, \$106,628.80. 97, 609.

1898. Entire electric plant for two 12-inch emplacements, \$5,290. 98, 613. Two 10-inch emplacements with casemate and wharf, \$102,427. 98, 615. Electric apparatus complete for 10-inch emplacement, \$2,710.38. 98, 615. Hornsby-Akroyd oil engine and belt, \$1,695. 98, 615.

1899. Small stone, \$1.18 and \$1.24 per c. y.; proposals for constr. materials. 99, 753.

1900. Electric-light plant for mortar battery, \$6,482. 00, 818. Six-inch emplacements—5 hoists and doors, \$2,765; 10-inch emplacements—2 hoists and doors, \$1,807; 12-inch emplacements—2 hoists and doors, \$1,847. 00, 820, 825. Electric-light plant for two 8-inch and 2 5-inch emplacements \$1,451. 00, 821.

1902. Building repairs, \$183. 02, 670. Constr. sheet-pile revetment, \$6 l. f. 02, 671. Electric accumulators and accessories, \$975. 02, 674.

Part 2, FND. Engineering Features.

Bricks; tests, etc. 04, 3718.
Concrete mixing and placing. 98, 620, 622; 99, 751; 00, 821, 823.

Concrete plant, arrangement of. 98, 620.
Condensation, reducing. 03, 2389.
Dampproofing. 03, 2387.
Electric plant, installing of. 00, 824.
Linings, rooms, etc. 04, 3717.
Mixer, "gravity." 99, 751; 00, 821.
Mounting guns and carriages. 00, 824.

Plant, approx. value of. 99, 761; 00, 827.
Plant, description of. 00, 823.
Sea wall, stability of, movement of bar. 99, 757; 00, 822.
Submarine mines, preparation of material, novel features, operation, and testing. 98, 616, 618.
Ventilation; hot-air circulation. 04, 3713 (pl.); 04, 3716 (pl.).
Waterproofing methods. 00, 815, 816, 821, 824.
Exposed concrete. 04, 3718.

Part 3, FND.

Engineers.

Chief of Engineers. R., 66, 7; 67, 7; 69, 11; 83, 15; 84, 21; 85, 15; 86, 15; 96, 13; 97, 13, 608; 70, 16; 71, 12; 72, 9; 73, 9; 74, 10; 75, 10; 76, 98, 18, 612; 99, 19, 747; 00, 17, 814; 01, 17; 02, 19, 11; 77, 8; 78, 10; 79, 13; 80, 25; 81, 23; 82, 19;

Part 4, FND.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. R., 82, 418.

Rs., 90, 7; 93, 15.

Part 5, FND.

Engineers in Charge.

Capt. S. M. Mansfield, 1866-67.
Maj. D. C. Houston, 1867-70.
Maj. G. K. Warren, 1870-74.
Capt. A. H. Holgate, 1870.
Maj. J. W. Barlow, 1875-83.

Lt. Col. W. McFarland, 1883-86.
Lt. Col. D. C. Houston, 1886.
Maj. S. S. Leach 1896-1901.
Maj. C. F. Powell, 1902.

Part 6, FND.

Assistants.

Lt. W. J. Barden, 1897-1900.

Lt. E. H. Schulz, 1900-02.

Part 7, FND—

FORTS AND BATTERIES.

Part 8, FND. New London Harbor, Conn.—Fort Trumbull, at "Fort Point."

1838. Work begun on casemated work. 80, 25
1848. Work completed. 82, 19.
1866. Care of fort keeper. 66, 7.
1867. Care and preservation. 67, 7.
1869. Repointing the parade wall. 69, 11.
1870. Modification plans for twelve 15-inch guns or equivalent rifles. Est. cost, \$58,000. Minor work. 70, 17.
1874. \$25,000 app. Minor repairs. 74, 11.
1875. \$20,000 app. Modification work begun. Work on north exterior battery. 75, 10.
1876. North exterior battery completed, except setting platform irons and placing the magazine lamps. 76, 11.
1877-79. Care and preservation. 77, 8; 78, 10; 79, 13.
1880. History of fort; care and preservation. 80, 25.

1881. Repairs to recess and embrasure arches parapet, and roads. 81, 24.
1882. Preservation and repairs. 82, 19.
1883. Work on sea wall. 83, 16.
1884. History and description; work on sea wall. 84, 21.
1885. Drainage work. 85, 15.
1886. History and description. 86, 15.
1898. Two 15-inch S. B. guns mounted. 98, 612.
1899. Sewer laid by city of New London. 99, 747.
1900. Description of fort. 00, 814.
1902. Repairs to oil engine electric-power plant. 02, 670.

Part 9, FND. New London Harbor, Conn.—Battery at Fort Griswold, Groton, Conn.

1840. This barbette earthen work begun. 80, 26.

1870. Modification plans prepared for nine 15-inch guns. Est. cost, \$40,000. Work on shot beds. 70, 17; 83, 16.

1876. Survey made of the boundaries of the U. S. lands. 76, 11.

1877. Merestones replaced. 77, 8.

1878. Sea wall repaired; some fencing done. 78, 10.

1879. Care and preservation. 79, 14.

1880. History of fort. 80, 26.

1882. Care and preservation. 82, 20.

1884-86. History and description of work. 84, 22; 86, 16.

1898. \$33.50 allotted for renewing coal bin parapet steps; eleven 10-inch guns with theirriages removed from the work. 98, 612.

1900. Description of fort; repairing retaining wall and parade. 00, 814.

1901. \$185 for care and preservation. 01,

1902. Repairs to ordnance sergeant's quarters. 02, 670.

Part 10, FND. Temporary Defenses at Bridgeport, New Haven, New London, and Stonington.

1898. \$20,000 allotted. Four 10-inch S. B. Rodman guns mounted at Bridgeport, 6 at New Haven, and 1 at Stonington; 3 platforms for 15-inch S. B. guns prepared at New London. 98, 616.

1899. \$4,600 allotted. Batteries at the several places dismantled and guns and carriages stored where the batteries were on private property; premises were restored where necessary. 99,

Part 11, FND. New Haven Harbor, Conn.—Fort Hale.

1866. Work begun about the close of the Civil War. Work on embankments, sluiceway setting 5 granite pinto blocks; 1 platform laid 6 embrasures cut and revetted and drawbr. built. 66, 8.

1867. Work completed, plant sold at auction, and fort placed in charge of a fort keeper. 67, 7.

1869. Making and hanging a gate at entrance to reservation. 69, 11.

1870. Repairs to sea wall br., and road. 70, 17.

1871. Negotiations pending concerning purchase of additional land. 71, 12.

1872. Fort dismantled. 72, 9.

1874. Fort abandoned. 74, 11.

1878. Proj. to modify the sea front for modification of ordnance and to make permanent bombproof est. cost, \$23,600. 78, 10.

1879. Care and preservation. 79, 14.

1880. History of fort. 80, 26.

1882. Importance of site. 82, 20.

Part 12, FND. Emplacements for Two 12-inch Guns on Disappearing Carriages.

1896. Plans prepared. 96, 13.

1897. \$132,000 allotted. Work begun by contract; excavation completed. 97, 609.

1898. Work delayed; time extended, and battery completed ready for armament by June 30. 1898. 98, 612.

1899. \$1,500 allotted. Installation of electric light and power plant completed. \$2,500 allotted. One carriage received and mounted; 2 guns re-

ceived. \$2,470 allotted for preservation and repairs. 99, 747.

1900. \$2,500 allotted. Guns mounted; battery completed and turned over to the Artillery May 22, 1900. \$2,000 allotted for waterproofing. \$2,500 allotted for alteration and repair; ironwork painted. 00, 814.

1901. False slab ceiling installed; base re-leveled and reset. 01, 748.

Part 13, FND. Two Emplacements for 10-inch Rifles, Disappearing Carriages, and a Mining Casemate.

1897. \$10,000 allotted for the emplacements and \$11,000 allotted for 1 mining casemate, both to be built under 1 contract. 97, 609.

1898. \$99,000 allotted for emplacements and \$2,750 allotted for moving and mounting guns. Work under contract begun; 1 carriage mounted and work about half done; extension of time granted. Summary of work. 98, 614.

1899. \$2,500 allotted for emplacements; work nearly completed. \$318.17 allotted for finishing

the mounting of guns and carriages; completed. Mining casemate completed. \$2,004 allotted for a battery-commander's range-finding station. \$310 allotted for preservation and repair. 99, 748.

1900. Battery-commander's station finished and battery transferred to the Artillery on Mar. 31. \$250 allotted for repairs. 00, 817.

1901. Casemate wired and minor repairs to battery. 01, 749, 750.

Part 14, FND. Emplacements for Eight 12-inch B. L. Mortars.

1897. \$110,000 allotted. Work begun, excavation finished, and concrete work in progress. \$2,004 allotted for a battery-commander's range-finder station. 99, 750.

1900. Battery completed; armament to be mounted by the garrison; battery-commander's

station begun and completed; proposals for electric plant received. Summary of work. 00, 818.

1901. \$2,000 allotted. Battery completed; electric plant installed; 2 mortars and carriages mounted; transferred to Artillery Mar. 4, 1901. 01, 750.

Part 15, FND. Emplacements for Two 10-inch B. L. Rifles on Disappearing Carriages, Model 1896.

1898. \$100,000 allotted. Work begun and these emplacements nearly completed by June 25; résumé of work. \$3,000 allotted for transporting guns. 98, 619, 621.

1899. Guns and carriages received and mounted; electric light and power plant installed, and battery

practically completed; searchlight temporarily installed. 99, 759.

1900. Platforms covered with asphalt; slopes sodded, and minor work; battery completed; to the Artillery May 12. 00, 816.

1901. \$500 for sodding on slopes. 01, 748.

Part 16, FND. Emplacement for a 4.7-inch R. F. Gun.

1898. \$9,000 allotted. Work begun, gun and carriage mounted; work nearly finished. 98, 622.

1899. Work postponed in view of the probable necessity of raising the gun about 2' on account of change in the type of emplacements near by. 99, 760.

1900. Gun mounted work completed, and formally transferred to the Artillery, Mar. 31 1900. 00, 820.

Part 17, FND. Emplacements for Two 8-inch B. L. Rifles on Barbette Carriages (15-inch S. B., Converted).

1898. \$65,000 allotted. Work begun and platform nearly completed. Summary of work. 98, 622.

1899. \$12,100 allotted. Battery completed except mounting guns. Work on sea wall. 99, 759.

1900. Interior floors concreted. Terroplein graded; guns and carriages not yet mounted. 00, 822.

1901. Minor repairs made. 01, 752.

Part 18, FND. Two Emplacements for 6-inch R. F. Guns on Disappearing Carriages.

1899. \$50,000 allotted. Work begun; excavation in progress. 99, 750.

1900. Work practically completed, except consolidation of slopes and electric lighting. Carriages on hand. 00, 819.

1901. \$2,000 allotted for searchlight; electric system installed and tested; entire battery transferred to Artillery Mar. 4, 1901. 01, 750.

Part 19, FND. Two Emplacements for 8-inch B. L. Rifles on Disappearing Carriages, and Two Emplacements for 5-inch R. F. Guns on Balanced Pillar Mounts.

1899. \$75,000 allotted for emplacements. Work begun, dock completed, plant installed, and work carried up to ceiling level. 99, 751. Five-inch emplacements; \$11,600 allotted. Work begun and nearly completed; mounts not received. 99, 751.

1900. Two carriages and 1 gun mounted; platforms asphalted; electric-light plant installed. Five-inch emplacements—Two carriages mounted;

both batteries completed and ready to turn over to the Artillery; \$1,650 allotted for repair and preservation. 00, 821.

1901. Electrical system maintained and painting of ironwork; batteries transferred to troops Feb. 18, 1901. \$1,500 allotted for care and preservation for waterproofing drainage, etc. 01, 752.

Part 20, FND. Emplacements for Two 12-inch B. L. Rifles on Disappearing Carriages, Model 1897; Two 10-inch B. L. Rifles on Disappearing Carriages, Model 1896; and Three 6-inch R. F. Guns on Disappearing Mounts.

1899. Twelve-inch and 10-inch emplacements—\$220,000 allotted. Work begun, excavation completed, and concrete work in progress. 99, 752. Six-inch emplacements—\$78,000 allotted, work begun, excavation in progress. 99, 752.

1900. Ten-inch emplacements completed and guns and carriages mounted; 12-inch emplacements well advanced and 6-inch emplacements expected to be completed by Oct. 1. Summary of

work. \$2,000 allotted for preservation and repair. 00, 823.

1901. Entire battery for 10-inch and 12-inch emplacements completed, chain ammunition lifts placed, temporary range-finder's station and tide gauge built. At 6-inch emplacements lifts placed carriages mounted; batteries transferred to Artillery Mar. 7, 1901. 01, 754.

Part 21, FND. Emplacements for Two 5-inch R. F. Wire-wound Guns, with Parados.

1899. \$39,630 allotted. Work begun, concrete work nearly completed; mounts not received. \$2,195 allotted for repair to sea wall; work in progress. 99, 757.

1900. Plans changed, emplacements completed, except mounting guns not yet received; parados

finished and \$1,060 allotted for repairs to sea wall, etc. 00, 822.

1901. \$3,000 allotted for strengthening sea wall; \$1,810 allotted for care and preservation. 01, 753.

Part 22, FND. Emplacements for Two 5-inch R. F. Wire-wound Guns.

1900. \$14,000 allotted. Battery begun and completed, except mounting armament, electric wiring, and sodding slopes. 00, 822.

1901. Electric wiring installed, slopes sodded battery transferred to Artillery Feb. 18, 1901. \$100 allotted for care and preservation. 01, 752.

Part 23, FND. Emplacements for 5-inch Wire-wound Gun.

1900. \$6,500 allotted. Work nine-tenths completed. 00, 820.

transferred to Artillery, Mar. 4, 1901. \$150 allotted for care and preservation. 01, 751.

1901. Work finished; electric wiring installed;

Part 24, FND. Emplacements for Eight 12-inch B. L. Steel Mortars.

1901. \$115,000 allotted. Material purchased track laid, excavation begun. \$400 allotted for care and preservation. 01, 754.

Part 25, FND. Emplacements for Two 6-inch R. F. Guns.

1901. \$25,000 allotted. 01, 748.

Part 26, FND. Various Sites.

Site 1. 1902. Bulkhead built on south shore: wharf repaired; power house built; at 8-inch battery steam-heating plant installed; repairs. 02, 670. \$1,700 allotted for searchlight; \$750 allotted for 3 base stations; \$200 allotted for wharf. 02, 671.

Site 2. 1902. Electric installation at 3 batteries completed; transferred to Artillery, Dec. 7, 1901. 02, 671. Repairs to heating system. 02, 671. Mortar battery constr. and electric installation completed, base rings set, survey for dynamite-gun emplacements made; work on post-lighting system completed, fire-commander's station partly built. 01, 672, 673. Searchlights and accessories received. 01, 673. \$19,200 allotted for range-finding station; \$2,450 allotted for searchlights; \$9,020 allotted for post-lighting system; \$820 allotted for care and preservation; \$12,275 allotted for searchlights for H. defenses. 02, 674.

Site 3. 1902. Position-finding station transferred to Artillery; bank ripped; fire-commander's station moved back; battery magazines

lined. 02, 674. Steam-heating plant put in to reduce condensation; parapet of 10-inch battery sodded; work on new 6-inch battery in progress: 4,725 tons granite placed in sea wall; temporary power house for operations of searchlight built. 02, 675. \$7,960 allotted for fire-commander's station; \$7,862 allotted for battery-commander's station; \$3,840 allotted for searchlights; \$783.02 allotted for care and preservation; \$500 allotted for supplies for seacoast defenses. 02, 676.

Site 4. 1902. Steam-plant alterations and imp. of drainage at mortar battery made; minor repairs at 10-inch battery; foundation of fire-commander's station laid; temporary power house for searchlights built; repairs to steam plant at mortar battery; arrangements made for 2 additional searchlights at south reservation; \$4,800 allotted for fire-commander's station; \$2,425 allotted for searchlights; \$7,260 allotted for searchlights for H. defenses. 02, 677.

Site 5. 1902. Repairs, etc. 02, 678.

Part 27, FND.

Miscellaneous.

Protection of dynamite battery. 1901. \$66,000
allotted. Materials delivered. 01, 755.

Care of electric plants. 1901. \$2,500 allotted
for repairs. 02, 678.

Part 28, FND.

Preservation and Repairs.

1899. \$2,180 allotted. Electric plant cared for;
dismounted guns from temporary batteries dis-
posed of; and minor work. 99, 758.

1900. \$300 allotted for supplies for seacoast

defenses. Repairs made to the several electrical
plants. 00, 826.

1901. \$900 allotted. 01, 756.

Part 29, FND.

Range and Position Finder Station.

99, 749, 750; 00, 818.

1901. \$7,000 allotted. Practically completed.

01, 748.

Part 30, FND.

Sea Walls and Embankments.

1901. \$12,000 allotted. Constr. sea wall; 330
l. f. built. \$1,900 allotted. Care and preservation.

01, 749. \$2,600 allotted for bank revetment; no
work done. 01, 752.

Part 31, FND.

Sites.

1898. \$5,650 allotted for purchase of 3 tracts,
about 60 acres. Condemnation proceedings insti-
tuted to acquire another site of about 225 acres.
98, 623.

1899. \$175,000 allotted. Site acquired. 99,
761.

1900. \$50 allotted for services in making ab-
stracts of title to land already acquired. 00, 826.

Part 32, FND.

Submarine Mines.

1898. \$29,000 allotted. Mines planted in
Stonington, New London, and New Haven Hs.
98, 616. \$1,150 allotted for searchlight. 98, 621,
623.

1899. Mines unloaded as removed and dyna-
mite stored; orders received to complete the dis-
mantling of the systems and final disposition of the
material; work completed. \$300 allotted for
electric-light plant and operating searchlight;

supplies purchased and machinery cared for.
99, 757, 760.

1900. \$500 allotted for storing and caring for
mining material, and building a partition wall in
mining casemate to separate battery from instru-
ment room. 00, 826.

1901. \$50 allotted. Inspection of torpedo
materials. 01, 756.

FNF. NEW YORK, N. Y., FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912. See also the Note on p. 1793 of this index.)

(See also Misc. 171 on p. 2134 of this index.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1883-1902 |
| 2 | Engineering features..... | 1892-1904 |
| 3 | Engineers—Chief of Engineers..... | 1866-1908 |
| 4 | BE..... | 1882-1890 |
| 5 | In charge..... | 1866-1908 |
| 6 | Assistants and civilian electricians..... | 1880-1902 |
| 7 | Forts, etc.—Operations, allotments, etc..... | 1812-1912 |
| 8 | Southern entrance—Fort Lafayette..... | 1812-1878 |
| 9 | Fort Hamilton..... | 1824-1886 |
| 10 | Mortar battery..... | 1871-1886 |
| 11 | Redoubt..... | 1866-1871 |
| 12 | Governors Isld..... | 1831-1886 |
| 13 | Fort Columbus..... | 1866-1878 |
| 14 | New barbette battery..... | 1875 |
| 15 | Castle William..... | 1866-1870 |
| 16 | South battery..... | 1867-1874 |
| 17 | Bedloes Isld..... | 1841-1886 |
| 18 | Staten Isld., N. Y.—Battery Hudson..... | 1841-1901 |
| 19 | Fort Wadsworth..... | 1847-1886 |
| 20 | South Cliff battery..... | 1858-1886 |
| 21 | Fort Tompkins..... | 1858-1886 |
| 22 | North Cliff battery..... | 1862-1886 |
| 23 | New casemated battery..... | 1866-1870 |
| 24 | Glacis mortar battery..... | 1871-1886 |
| 25 | South mortar battery..... | 1872-1886 |
| 26 | Glacis gun battery..... | 1872-1886 |
| 27 | Two-gun battery..... | 1883-1886 |
| | Southern entrance— | |
| 28 | Five-gun battery..... | 1891-1899 |
| 29 | Two 2-gun batteries for 10-inch guns..... | 1897-1899 |
| 30 | Battery, three 10-inch and four 12-inch guns..... | 1897-1900 |
| 31 | Two emplacements, 8-inch B. L. rifles, modified 15-inch gun carriages..... | 1898-1899 |
| 32 | Twelve-inch emplacements, Battery Richmond..... | 1898-1899 |
| 33 | Twelve-inch emplacements, Battery Hudson..... | 1898-1900 |
| 34 | Temporary batteries..... | 1898 |
| 35 | Rapid-fire gun..... | 1898 |
| 36 | Two emplacements, 15-pounder R. F. guns..... | 1899 |
| 37 | Two emplacements, 6-inch R. F. guns, pedestal mounts..... | 1899 |
| 38 | Two emplacements, 6-inch guns, disappearing carriages..... | 1899-1900 |
| 39 | Miscellaneous defense work..... | 1901-1902 |
| 40 | Sandy Hook, N. J..... | 1857-1885 |
| 41 | Mortar battery No. 1 (with ditch defenses)..... | 1890-1900 |
| 42 | Gun-lift battery No. 1..... | 1891-1899 |
| 43 | Ten-inch battery..... | 1897-1899 |
| 44 | Five-inch R. F. battery..... | 1897-1900 |
| 45 | Pneumatic-gun battery..... | 1898-1900 |
| 46 | Six-inch R. F. battery..... | 1898-1899 |
| 47 | Fifteen-pounder R. F. emplacement..... | 1899-1900 |
| 48 | Miscellaneous defenses..... | 1901-1902 |
| 49 | Long Isld.—Seven-gun battery..... | 1893-1900 |
| 50 | Twelve-inch mortar battery..... | 1898-1900 |
| 51 | R. F. guns..... | 1898-1899 |
| 52 | Twelve-inch battery No. 1..... | 1898-1900 |
| 53 | Twelve-inch battery, Stone Fort..... | 1899-1900 |
| 54 | Six-inch battery..... | 1899-1900 |
| 55 | Two 15-pounder R. F. guns..... | 1899-1900 |
| 56 | Miscellaneous defenses..... | 1900-1902 |
| 57 | Eastern entrance—Fort Schuyler, East R..... | 1833-1885 |
| 58 | Fort at Willets Point..... | 1863-1888 |
| 59 | Gun battery, south side of entrance..... | 1891-1900 |
| 60 | Battery for sixteen 12-inch mortars..... | 1891-1900 |
| 61 | Mortar battery, eight 12-inch modern mortars..... | 1897-1899 |
| 62 | Two emplacements, 10-inch rifles, disappearing carriages..... | 1897-1899 |
| 63 | Emplacement 1; 12-inch rifle, disappearing carriage..... | 1897-1899 |
| 64 | Platforms for target practice..... | 1896-1900 |
| 65 | Two emplacements, 5-inch R. F. guns..... | 1898-1900 |
| 66 | Two emplacements, 15-pounder R. F. guns (south)..... | 1899-1900 |
| 67 | Two emplacements, 15-pounder R. F. guns (north)..... | 1899-1900 |
| 68 | Two emplacements, 5-inch R. F. guns (north)..... | 1899-1900 |
| 69 | Emplacement 2, 12-inch rifle (north)..... | 1899-1900 |
| 70 | Two emplacements, 5-inch R. F. guns..... | 1900-1901 |
| 71 | Two emplacements, 6-inch R. F. guns..... | 1901-1902 |
| 72 | Miscellaneous works (south)..... | 1901-1902 |
| 73 | Miscellaneous works (north)..... | 1901-1902 |

New York, N. Y., Fortifications—Continued.

| Part. | Title. | Period. |
|-------|----------------------------------|-----------|
| 74 | Preservation and repairs..... | 1897-1902 |
| 75 | Range and position finders..... | 1896-1902 |
| 76 | Searchlights..... | 1901-1903 |
| 77 | Sea walls and embankments..... | 1889-1911 |
| 78 | Sites..... | 1892-1902 |
| 79 | Submarine mines..... | 1891-1902 |
| 80 | Supplies..... | 1901-1902 |
| 81 | Mastic works—Governors Isld..... | 1880-1882 |

Part 1, FNF.**Contracts.**

1883. Sea wall, \$18.72 per l. f. **83, 385.**
 1889. Sea wall, concrete foundation, 375 c. y., \$14.70 per c. y.; wall, 1,450 c. y., \$15 per c. y.; and dowels, 25¢ per pound. Embankment, 24,000 c. y., 22½¢ per c. y. **89, 461.** Riprap, 9,050 tons, \$1.50 per ton; capping stone, 980 l. f., \$7 per l. f. Embankment, 35,000 c. y., 40¢ per c. y. **89, 458.**
 1891. Sea wall, 1,000 c. y. of foundation, \$11 per c. y.; 1,510 l. f. wall, \$19 per l. f.; 43,000 c. y. filling, 29¢ per c. y. **91, 527.**
 1897. Small broken stone, 5,000 c. y., \$1.07 and \$1.29 per c. y.; 100 c. y. fine sea-washed silica, \$2.50 per c. y. Rosendale cement, 12,000 barrels, 74.8¢ per barrel. **97, 617.** Concrete battery for three 10-inch guns, \$78,202.50. **97, 627.**
 1898. Rosendale cement, 18,000 barrels, 66.6¢ per barrel. Riprap stone, 47,500 tons, \$1.19 per

s. t. Broken stone, \$1.04 per c. y. **98, 633.**

1900. Portland cement, 25,000 barrels, \$1.99 per barrel. Broken stone, 21,000 c. y., 84¢ per c. y. Sand, 11,000 c. y., 34¢ per c. y. **00, 836.**

1901. Rock, 79¢ per c. y. American Portland cement, \$1.532 per barrel, in bags. **01, 766.**

1902. Building sea wall, \$10.75 per l. f., 28¢ per yard for material. **02, 684.** Atlas Portland cement, \$1.10 per barrel. **02, 686.** Trap rock (broken), 72¢ per c. y. **02, 687.** Trap rock (broken), 84¢ per c. y. **02, 689.** American Portland cement, \$1.47 per barrel. **02, 689.** Furnishing steel doors, shutters, gratings, flues, etc., \$1,879. **02, 689.** American Portland cement, \$1.63 per barrel. **02, 692.** Broken trap rock, 89¢ per c. y. **02, 692.**

Part 2, FNF.**Engineering features.**

Ammunition for a gun lift, handling of. **93, 610.**
 Ammunition lifts, test of. **97, 619.**
 Anchor bolts, method of setting. **94, 453.**
 Battery, 10-inch, cost in detail. **97, 616, 621.**
 Ceilings, linings of. **03, 2390 (pl.).**
 Concrete in place, cost of. **92, 5; 93, 602, 605, 609; 94, 458; 00, 835. 837.** Mixing, description. **97, 620.** Surfaces of, coloring. **04, 3720.**
 Construction costs, 12 inch empl. **01, 765.**
 Dampproofing—various methods. **03, 2390, 2396 (pl.).** Walls. **03, 2390, 2396 (pl.).** Chambers. **03, 2393, 2396 (pl.).** Cartridge rooms. **03, 2398 (pl.).** Magazines. **04, 3719.**
 Electric-conduit system, cost. **00, 837.**
 Electric-light plant description. **93, 611.**
 Electricity, installation. **04, 3721.**
 Embankments, cost per c. y. in place. **92, 603.**
 Embankment, methods of placing sand. **93, 605.**
 Excavation, sand, cost of, by hand and by grapple. **93, 603.**
 Firing, experimental, result on concrete. **93, 612, 614.**
 Fire, test of rapidity of. **97, 619.**
 Gun, 12-inch, method of mounting. **93, 615; 94, 453.**
 Gun-lift mechanism, test of. **93, 613.**

Leaks, stopping. **03, 2391, 2396 (pl.).**
 Materials, cost. **93, 602, 605; 94, 454, 458; 97, 763, 769.**
 Mortar platforms, method of excavation for foundation. **94, 450.**
 Pavements, cost of. **97, 616.**
 Plant, arrangement of. **93, 605; 99, 763, 766, 774.**
 Platforms, settlement of. **97, 612.**
 Quoins, granite, cost of. **97, 616.**
 Sand, drifting; cinder layers to prevent. **01, 920.**
 Stone (large) in place, cost of. **92, 5.**
 Torpedo shed, description and detailed cost. **93, 617; 94, 448.**
 Ventilation—various methods. **03, 2393, 2396 (pl.).**
 Walls, counterscarp and gallery; a smooth and apparently waterproof surface, securing. **93, 605.** Whitening (methods and advantages). **01, 920.**
 Waterproofing and cost of. **00, 828, 829, 831, 839.**
 Details of various methods. **01, 917.** Laying felt. **01, 919.** "Without leaks." **01, 919.**
 Water-supply system. **93, 613.**

Part 3, FNF.

Engineers.

Chief of Engineers. R., 66, 8, 11; 67, 7; 68, 11; 69, 11; 70, 17; 71, 12; 72, 10; 73, 9; 74, 11; 75, 11; 76, 11; 77, 8; 78, 10; 79, 14, 233; 80, 27, 292; 81, 25, 385; 82, 20; 83, 16; 84, 22; 85, 16; 86, 5, 17; 87, 5; 89, 6, 458, 459; 90, 5, 381; 91, 7, 9, 525; 92, 5, 12, 457; 93, 6, 599; 94, 7, 449; 95, 7, 504; 96, 8, 473; 97, 13, 610; 98, 18, 624; 99, 20, 762; 00, 19, 827; 01, 19; 02, 20; 03, 9, 14, 16; 04, 5, 9, 10; 05, 5; 06, 5; 07, 5; 08, 9; 9, 10; 10, 12; 11, 8; 12, 7.

Part 4, FNF.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number. if any, could be dispensed with. R., 82, 403. Est. 87, 11; 90, 6.

Part 5, FNF.

Engineers in Charge.

W. P. Trowbridge, U. S. agent, 1866.
Lt. Col. H. L. Abbot, 1866-86.
Capt. F. Harwood, 1866.
Lt. Col. J. C. Duane, 1866-68.
Maj. F. E. Prime, 1866.
Capt. C. N. Turnbull, 1866.
Maj. N. Bowen, 1866-69.
Lt. Col. J. Newton, 1866-77.
Col. J. G. Barnard, 1866-67.
Col. Q. A. Gillmore, 1867-86.
Capt. J. Mercer, 1877-78.
Col. H. W. Benham, 1878-82. R., 79, 234; 80 293.
Col. G. L. Gillespie, 1883-97.
Capt. J. C. Post, 1883.
Lt. Col. C. B. Comstock, 1886.
Lt. Col. W. MacFarland, 1886.
Col. D. C. Houston, 1886-93. R., 92, 459.
Lt. Col. W. R. King, 1891-95.
Lt. Col. H. M. Robert, 1893-96.
Lt. T. H. Rees, 1893.
Lt. R. McGregor, 1895.
Maj. W. T. Rossell, 1896.
Maj. J. G. D. Knight, 1896-1900.
Maj. H. M. Adams, 1896-1900.
Lt. Col. W. Ludlow, 1897-98.
Lt. Col. W. H. H. Benyard, 1900.
Maj. W. L. Marshall, 1900-08.
Maj. J. G. D. Knight, 1901.
Maj. Wm. M. Black, 1901-

Part 6, FNF. Assistants and Civilian Electricians.

Lt. E. Griffin. R., 80, 293.
Lt. H. Taylor, 1891-92.
Lt. J. G. Warren, 1892-94.
Lt. T. H. Rees, 1893.
Lt. W. P. Craighill, 1894-96.
Lt. R. McGregor, 1894-99.
Lt. R. R. Raymond, 1897-99.
Lt. J. F. McDindoe, 1898-1901.
Lt. E. R. Stuart, 1898-99.
Lt. J. J. Morrow, 1899-1900.
Lt. J. A. Woodruff, 1898-1901.
Lt. W. L. Guthrie, 1902.
Civilian electricians. 1902. \$1,200 allotted for pay of electrician. 02, 680. \$7,020 allotted for pay of electrician, steam engineers, and stokers. 02, 687.

Part 7, FNF—

FORTS AND BATTERIES.

Part 8, FNF. Southern Entrance—Fort Lafayette.

1812. Work begun. 80, 23.
1866. Important modification required. 66, 10.
1868. Test borings on proposed site of new work. Fort injured by fire in December, 1868. 68, 13.
1878. Proj. for heavy armament; est., \$784,212 78, 13.

Part 9, FNF. Fort Hamilton and Additional Batteries.

1824. Work begun. 80, 29.

1866. Work on north, south, and small traverse magazines; setting pintle and traverse stones, traverse irons, and pintles; breast-height wall and earth in parapet. Traverse magazines 1, 2, and 4 completed; 3 and 5 suspended. 66, 10.

1867. Work on south magazine; taking up platforms to make room for traverse magazines; revetment and platform flags; traverse stones rebbed; embankment and minor work. Condition of work. 67, 9.

1868. One traverse magazine lengthened, 5 nearly completed. The north and south magazines now completed, except minor work. Over 2000 feet drain work done. 68, 12.

1869. North and south magazines nearly completed, 9 magazine traverses finished; 3,464 l. f. drain built; 991 l. f. sea wall rebuilt; 3,407 sq. y. slopes repaired. Est. cost of additional batteries for heavy guns, \$135,000. 69, 12.

1870. Completion of north and south magazines and traverse magazines; repairs made to slopes and parapet; terreplein and public road graded; repairs to sea wall and drainage. 70, 18.

1871. \$25,000 app. Work begun on cofferdam, 483' long, on water battery 1. 71, 14.

1872. \$40,000 app. Sea wall ready for coping and in rear filled with earth to 2' below top. 72, 11.

1873. \$40,000 app. Sea wall of battery 1 completed; magazines 1 and 2 nearly finished; work on magazines 3 and 4; 8,464 c. y. of earth placed in parade. 73, 10.

1874. \$26,000 app. Battery 1—magazines 1, 2, 3, and 4 completed and sodded. Drain placed, terreplein graded, and parapet raised to proper level. 15-inch gun battery—5-inch pintles taken out and replaced with 6-inch ones. 74, 13.

1875. \$10,000 app. Battery 1—2 wooden platforms and 6 stone platforms nearly finished, raising breast-height wall. 75, 13.

1876. Battery 1—platforms and breast-height wall completed; parapet and end of traverse: raised and rear slopes sodded. 76, 14.

1877-78. Repair of gates and slope. 77, 10; 78, 12.

1881. Waterproofing terrepleins and casemates; repair of slopes and fences. 81, 28.

1882. Waterproofing terrepleins and casemates; drainage work, sea wall, and minor repairs. 82, 24.

1883. Work on relaying brick pavements, wooden br., drainage, slopes, and buildings. 83, 20.

1884. Repair of slopes, chimneys, drains, etc. 84, 25.

1885. Repair of platforms, breast-height, sustaining and sea wall; placing additional traverse stones in platforms, relaying pavements, and replacing stone flagging of parade. 85, 18.

1886. 1,190 c. y. riprap stone placed against sea wall; hanging 12 magazine doors; setting pintles in platforms. 86, 19.

Part 10, FNF. Mortar Battery, Fort Hamilton.

1871. Work begun. 80, 29.

1872. Funds derived from general app. for mortar batteries. Six traverse magazines, including 3 service magazines, built; terreplein and parapet also completed except draining and sodding. 72, 11.

1873. Earth placed on magazines and traverses and sodded; exterior and interior slopes graded and sodded; drainage begun. 73, 11.

1874. Main drain completed, exterior slopes sodded, 3 magazines supplied with doors, 5 wooden

platforms laid, and concrete foundations for the remaining 8 put down. 74, 13.

1875. Seven wooden platforms placed and exterior slope partly sodded. 75, 13.

1876. Drainage. Terreplein graded and soil placed on slopes. 76, 14.

1886. Furnishing and hanging 3 exterior doors. 86, 20.

Part 11, FNF. Fort Hamilton and Redoubt.

1866. Condition to be considered by a BE 66, 10.

1867. Embrasures cut down and shot furnaces removed. Condition of work. 67, 9.

1868. Part of counterscarp wall rebuilt; over 2,000' of drain work completed; minor work on buildings. 68, 13.

1869. Altering embrasures on the east and north fronts; pointing scarp and counterscarp walls and repairing slopes; and minor repairs. 69, 12.

1870-71. Repairs; and embrasures altered in officers' quarters. 70, 18; 71, 13.

Part 12, FNF. Defenses of Governors Island.

1831. Fortifications on Governors Isld. begun 80, 28.

1879. Est. for a sea wall 1,800 l. f. long, 8' high, \$36,000; including wall on west shore, cost, \$40,000. Extracts from letters from Maj. Gen. Hancock, Capt. J. P. Sanger, Col. and Surg. Cuyler, and Col. Benham in reference to explanation of the ests. for sea wall. 79, 15, 233; 80, 28, 293.

1881. Scarp wall color-washed and terreplein covered with asphalted felting. Sea wall est. 81, 26, 393.

1882. Br. across ditch at Fort Columbus repaired. 82, 22.

1883. Exterior slopes of southwest bastion of Fort Columbus repaired and resodded; first and second interior galleries at Castle Williams partly rebuilt, repaired, and painted. 83, 18.

1884-86. Preservation and repair. 84, 24; 85, 17; 86, 18.

Part 13, FNF. Governors Island—Fort Columbus.

1866. Flagging the walks of the parade; repairing the pump drain, and relaying the platform around the pump. 66, 9.

1867. Work on flagging the walks and curb of parade; removing old cobblestone covering of postern and ramp, and placing Belgian pavement; general repairs and minor work. 67, 8.

1868. Pointing the scarp; relaying flagging; drainage work; repairing slopes, roads, and glacis and minor work. 68, 11.

1869. Repairing glacis, slopes, roads, and banks, drawbr., magazines; and minor repairs. Est., earthen battery for heavy guns, \$104,000. 69, 12.

1871. Eight traverse magazines built in new battery; work on parapet, excavation for the

terreplein, road, and remaining 8 magazines. 71, 13.

1872. Six shot beds built and 8 more begun; in new barbette battery, 6 magazines coated outside with Portland cement; parapet completed and terreplein reduced to proper level. 72, 10.

1873. Fifty-four shot beds built and 1,027 l. f. sea wall laid. 73, 10.

1874. Replacing draw floor in drawbr. 74, 12.

1875. Repairing drains. 75, 12.

1876-77. Repairing drawbr. and wharf. 76, 13; 77, 9.

1878. Repairing slopes, etc. 78, 12.

Part 14, FNF. Governors Island—New Barbette Battery at Fort Columbus.

1875. Repair of magazine doors; surface drain and 8 temporary magazine doors built. 75, 12.

Part 15, FNF. Governors Island—Castle Williams.

1866. Steps of the towers repaired, 255 sq. f. of flagging laid. 66, 9.

1867. Tower steps finished; renewing the 3 galleries of communication of the casemates; repairing magazine doors and buildings, etc. 67, 8.

1868. Repairing galleries, doors, and embrasure shutters; 10 casemates repaved; repairing mastic covering of terreplein; and minor work. 68, 12.

1869. Brick floors of ground tier relaid; repairing casemates of upper tier; galleries and railing of second and third tiers and terreplein of barbette tier and magazines repaired. 69, 12.

1870. Covering the terreplein with mastic. 70, 18.

Part 16, FNF. Governors Island—South Battery.

1867. Slight repair of scarp walls. 67, 8.
 1868. Flagging of parade taken up and relaid; repair of sally port and drains. 68, 12.

1870. 150' dry stone sea wall built. 70, 18.
 1874. Extension of permanent drain to beach. 74, 12.

Part 17, FNF. Bedloes Island—Fort Wood.

1841. Work begun. 80, 28.
 1867. Drainage work. Isld. quarantined because of cholera. 67, 8.

1868. Repairing exterior walls and coping of magazines; coping of parade wall; mason work of steps, posterns, and brick walls of barracks. 68, 12.

1869. Pavement in sally port relaid and masonry of sea wall pointed. Modification of exterior earthen battery for heavy guns cost \$3,200. 69, 12.

1870. Two magazines supplied with conductors and connections for the rods. 70, 18.

1871. In the new water battery, 5 traverse magazines built, parapet built entire length of battery, and terreplein raised to the proper height 71, 13.

1872. \$17,000 app. Entrances to magazines in exterior water battery completed; part of parapet raised to proper height. 72, 11.

1873. Raising parapet, pointing and cementing magazines of the exterior battery. 73, 10.

1874. Grading and sodding magazines, raising parapet, and drainage. 74, 12.

1875. Five temporary magazine doors built and magazines covered with earth. 75, 12.

1876. Terreplein graded and parapet filled in on the exterior water battery. 76, 13.

1877. Site selected for pedestal of the Statue of Liberty presented by citizens of the French Republic. 77, 10.

1883. Minor repairs. Erection of the Statue of Liberty begun. 83, 20.

1884. Minor repairs. Concrete foundation for the Statue of Liberty completed. 84, 25.

1885. Doors provided for 3 magazines. Pedestal for the Statue of Liberty completed; height, 93' 8" above m. l. w. 86, 18.

1886. Placing magazine doors. Statue of Liberty being placed. 86, 19.

Part 18, FNF. Staten Island—Battery Hudson.

1841. Work begun. 80, 31.

1866. Repairs to slopes and minor work. 66, 11.

1867. Catch basin and trap built; drainage. 67, 10.

1868. Cleaning drains and traps; cutting grass. 68, 13.

1869. Entire slope in rear of battery washed into terreplein, slope repaired, lining with wood begun on the two principal magazines; modification of battery for heavy guns and an earth extension; est. cost, \$62,000. 69, 13.

1870. Furring with wood the 2 principal magazines and repair of slopes; building a dry stone wall over the casemated arch of the experimental casemate target. 70, 19.

1871. \$16,000 app. Two service magazines built. Excavation to form the rear slope; filling over the magazines. 71, 15.

1872. \$17,000 app. Platform and parapet for King's carriage and entrance retaining walls built. In Battery Hudson extension—principal magazines and rear slope sodded; excavation for terreplein; earthwork of 2 traverse magazines formed; modification approv. 72, 12.

1873. \$29,000 app. Old lighthouse removed, three 10-inch guns dismounted, and platforms removed; one 15-inch front pintle platform nearly finished. In the extension—earthwork of 2 traverse

slopes and the retaining wall changed to a more gentle slope. 73, 12.

1874. \$13,000 app. Removal of 6 guns and platforms of old armament; 5 front pintle platforms placed. In the extension—5 timber platforms with high traverse rails laid. 74, 14.

1875. \$15,000 app. Work on earth cover of n. and s. principal magazines finished; seven 200-pounder Parrot rifle guns dismounted and old 10-inch platforms and breast-height wall removed; center pintle platforms replaced with front pintle platforms. In extension—5 timber platforms removed; work on breast-height wall, bombproof shelter, and retaining wall. 75, 15.

1876. Work on breast-height wall and platforms. In extension—work on breast-height wall, bombproof, and retaining wall, platforms. 76, 15.

1877. Work on platforms and parapet. In the extension—work on the parapet; outer traverse rails laid on five 15-inch gun timber platforms; work on earthen slopes. 77, 12.

1878. Repair of slopes. 78, 14.

1879. 250' of fence built; repairs. 79, 18.

1880-85. Care and preservation. 80, 31; 81, 30; 82, 27; 83, 24; 84, 28; 85, 21.

1886. Two wooden front pintle platforms for 8-inch converted rifles built and guns mounted. 86, 22.

Part 19, FNF. Staten Island—Fort Wadsworth (Formerly Fort Richmond).

1847. Work begun. 80, 30.
1866. Work on granite walls; 16 floor girders placed, filling carried up to the height of exterior walls, and ditch three-fourths excavated. 66, 10.
1867. Guardhouse and 2 cisterns finished, ditch excavated, and 2 sluiceways completed. 67, 9.
1869. 330 c. y. earth, washed from main slope into road, removed. 69, 12.
1870-71. Repair of slopes in rear of work. 70, 19; 71, 14.
1874. Replacing old pintles with new 4-inch ones in the 6-inch barbette guns' platforms. 74, 13.
1875. \$5,000 app.; no work. 75, 13.
1876. Torpedo work and repair of storeroom roofs. 76, 14.
1878. Painting ironwork in embrasures; minor work. 78, 13.
1879. Wooden approach to drawbr. built; iron railing and portcullis painted; slopes repaired. 79, 16.

1880-81. Ten-inch S. B. guns on first tier replaced with 8-inch rifles. 80, 30; 81, 29.
1882. Arch built over reservoir; repair of masonry of sea wall; stone steps built at the wharf; painting barbette railing, ironwork of embrasures portcullis, etc.; 2 concrete shot beds built on parade. 82, 25.
1883. Sea wall repaired; stationary part of drawbr. renewed; minor work. 83, 21.
1884. Painting guardhouse and magazine roofs. 84, 26.
1885. Replacing old pintles with new 4-inch pintles with keys; resodding revetment on top of breast-height wall, painting storeroom roof, etc.; minor repairs. 85, 19.
1886. Repointing gun platforms and breast-height wall, and a rough, low retaining wall built halfway down the long slope. 86, 20.

Part 20, FNF. Staten Island—South Cliff Battery.

1858. Work begun. Importance. 80, 33.
1866. Slopes in rear of terreplein formed and sodded; n. end battery finished; work on s. end of battery. 66, 11.
1867. Main slopes completed; new magazine constructed; minor work. 67, 10.
1868. Work on roads, gutters, and slopes. 68, 14.
1869. Repair of slopes; platform 5, injured in experimental firing, repaired; est., proposed modifications, \$17,000. 69, 13.
1870. Platform damaged by experimental firing repaired; repair of parapet; sodding slopes. 70, 19.
1871. Slopes repaired and cesspools cleaned. 71, 5.
1873-74. Care and preservation. 73, 12; 74, 15.
1875. Bluestone revetment above breast-height wall and part of old armament removed preparatory to beginning modifications. 75, 15.

1876. Proj. modified. Work on traverse magazine front wall; removal of platforms; excavation for drains. Eight guns mounted. 76, 16.
1877. Est., completion, according to approved plans, \$37,100. Minor work and repairs. 77, 12.
1878. Minor repair of slopes, etc. 78, 15.
1879. Repair of roof of traverse magazine and slopes. 79, 18.
1882. Retaining wall built near entrance to principal magazine; large slope in rear of battery repaired and regraded. 82, 29.
1883. Repair of slopes. 83, 25.
1884. Repair of doors, slopes, and gun platforms, etc. 84, 30.
1885. Replacing 5-inch pintles with new 6-inch pintles; placing 3 inner traverse circles; laying floor; painting doors; minor work. 85, 23.
1886. Repair of slopes. 86, 24.

Part 21, FNF. Fort on Site of Fort Tompkins.

1858. Work begun. Description. 80, 30.
1866. Fourteen platforms built; parapet and terreplein filled and sodded; barbette traverse magazine floors concreted; 9 casemate floor arches turned; work on lining casemates with brick; minor work. 66, 10.
1867. Five casemates furred, 21 floored, and 9 fitted up for quarters; work on the road and repair of slopes; platforms for the guns on the 4 land fronts finished. 67, 9.

1868. Work on latrines and outlet drains and roads, etc. 68, 13.
1869. Drainage and repair of slopes. 69, 13.
1870. Repair of slopes; building a picket fence. 70, 19.
1871. \$52,000 app. Constr. piers and arches of 17 bombproofs and scarp wall between sally ports; work on parade wall, sewers, connecting cisterns, and minor work. 71, 14.
1872. \$33,000 app. Completion of masonry of

7 gateways and 2 sally-port arches, walls and arches of passageways over sally ports; scarp wall n. and s. of sally port lowered 5' and coping relaid; granite parade wall nearly finished; mastic placed on casemates and sally-port arches; minor work. 72, 11.

1873. \$30,000 app. Swamp filled in and drained; glacis n. and nw. of fort graded; work on earth filling of cover face on chan. front; earthwork of casemates, and masonry and earthwork of traverses between guns completed; minor work. 73, 11.

1874. \$30,000 app. Ten timber platforms laid and masonry breast-height wall built; completion of interior finish of casemate quarters in s. half of work; drainage; magazine doors finished; minor work. 74, 13.

1875. \$20,000 app. Eight casemates prepared for quarters; walk, drainage, and slope work. 75, 14.

1876. Covered reservoir built; latrine work; hanging doors; minor work. 76, 14.

1877. Repair of earthwork; minor repairs; osts. in detail for completion. 77, 11.

1878. Repair of slopes and roads; drainage. 78, 13.

1881. Casemate floors raised and casemates prepared for storage of torpedo cases. 81, 29.

1882-83. General preservation and repair. 82, 25; 83, 22.

1884. Repairing walls, parade ground, roads, and slopes. 84, 27.

1885. Bonnet on se. angle of fort completed; 5 storm doors built; lamp closet fixtures supplied; repair of masonry of walls of ditch, roads, slopes; torpedoes painted. 85, 20.

1886. Pointing of masonry on scarp and counterscarp walls; painting torpedoes and exposed ironwork; repairing slopes; macadamized road leading from s. sally port of the fort to lighthouse begun. 86, 21.

Part 22, FNF. Staten Island—North Cliff Battery.

1862. Work begun. Importance. 80, 32.

1866. Seven platforms for 15-inch guns and breast-height wall built; n. traverse magazine built; drainage, embankment, and road making in progress. 66, 11.

1867. Completion of 5 platforms and breast-height wall; earth covering of n. traverse finished and the traverse completed; work on s. end of battery; excavation for large magazine in u. end of battery; some drainage. 67, 10.

1868. Principal magazine completed; work on filling above it; filling of parade in s. end; work on parados. 68, 13.

1869. Work on entrance walls; clearing the terreplein and roads of the slope washings; minor work. Est., proposed modifications of battery for heavy guns, \$27,000. 69, 13.

1870-71. Slight repair of slopes. 70, 19; 71, 15.

1872. Masonry in principal and 2 traverse magazines completed; work on wall of covered passage in solid traverse; removal of old breast-height wall and platforms of s. end of battery. 72, 12.

1873. Earthwork and sodding over the 2 principal magazines completed; grading and sod-

ding of large slope in rear completed; work on the additions to wing walls and earth cover of old traverse magazines and arch passageways. 73, 12.

1874. Foundations of 4 timber platforms and platforms laid; completion of additional masonry and earthwork to traverse magazines s. of the n. principal magazine. 74, 15.

1875. Two timber gun platforms laid; repair of earthwork. 75, 15.

1876. Slopes repaired. 76, 16.

1877. Est., modifications, \$34,700. Minor work and repairs. 77, 12.

1878. Stone drain 60' long built; work on slope. 78, 15.

1879. Work on slopes. 79, 18.

1881. Fifteen-inch gun from platform 1 dismounted and sent away. 81, 3.

1883. Repair of slopes, drains, etc. 83, 24.

1884. Repair of roads, drains, doors, and slopes. 84, 21.

1885. Replacing 5-inch pintles with new 6-inch pintles; work on doors, floors, and slopes. 85, 23.

1886. Repair of slopes 86, 23.

Part 23, FNF. Staten Island—New Casemated Battery.

1866. Work on test boring; 3,993 c. y. of ashlar cut for foundation courses and casemate piers and 4,919 c. f. of stone broken for concrete. 66, 11.

1867. Cutting stone in progress. Work on main battery proper not begun. 67, 10.

1868. Work on stone cutting and constr. of wharf. 68, 13.

1869. Work on wharf and care and preservation. 69, 13.

1870. Unexpended balance transferred to fort on site of Fort Tompkins. 70, 20.

Part 24, FNF. Staten Island—Glacis Mortar Battery (South of Fort on Site of Fort Tompkins).

1871. Earthwork and sodding completed; 2 service magazines nearly completed and granite coping laid on the entrance retaining walls; battery nearly completed. 71, 15.

1872. Battery completed except hanging doors and laying platforms. 72, 12.

1873. Battery finished except inner magazine doors and lamp closets. 73, 12.

1874. Armament mounted. Work on magazine doors and lamp closets. 74, 14.

1875. Work on lamp closets, etc. 75, 14.
1876-79. Slopes repaired. 76, 15; 77, 11; 78, 14; 79, 17.

1880. Importance of battery. 80, 34.

1885. Principal magazine floored slopes repaired, and minor work done. 85, 21.

1886. Repair of slopes and painting doors. 86, 22.

Part 25, FNF. Staten Island—South Mortar Battery (in Rear of Battery Hudson Extension).

1872. Work begun; importance of battery. 80, 32.

1873. Masonry and earthwork of s. branch and concrete foundations for 4 platforms completed. 73, 12.

1874. Work on magazine doors and picket fence. 74, 15.

1885. Painting doors and repairing slopes. 85, 22.

1886. Repairs of slopes. 86, 23.

Part 26, FNF. Staten Island—Glacis Gun Battery (on Site of Fort Tompkins).

1872. Work begun and battery finished except hanging doors and laying breast-height wall and timber platforms. 72, 12.

1873. Battery completed and made ready for armament. 73, 10.

1874. Magazine doors and lamp closet not yet completed. 74, 14.

1875. Minor work done on doors, slopes, etc. 75, 14.

1878-79. Minor repair of slopes. 78, 14; 79, 17.

1880. Importance of battery. 80, 31.

1885. N. service magazine floored, doors completed and hung; top revetment over breast-height wall resodded; and minor work. 85, 21.

1886. Repairing slopes and painting doors. 86, 22.

Part 27, FNF. Staten Island—Two-gun Battery (Near Southeast Angle of Channel Front of Fort on Site of Fort Tompkins).

1883. Description. Built toward the close of the Civil War. 83, 26.

1884-86. Repair of slopes. 84, 30; 85, 24; 86, 24.

Part 28, FNF. Southern Entrance—Five-gun Battery, Staten Island.

1891. 16,620 c. y. excavated and placed in embankment. 91, 7.

1892. 8,485 c. y. concrete placed; minor work. 92, 5.

1893. Concrete work and earth parapet nearly completed; terreplein roughly graded; ditch excavated and paved and rear earth slope graded. 93, 7.

1894. Minor work done; awaiting the adoption of a gun carriage. 94, 8.

1895. 968 c. y. of earth placed in parapet; masonry of fifth emplacement and of 4 platforms well advanced. 95, 7, 504.

1896. Concrete and earthwork completed. Five guns and carriages received and mounted; latrines built, range finder and relocater house built; battery completed, except hoists, trolley, cranes, handrails, and lights. Battery transferred to commanding officer of the post. 96, 477.

1897. Handrails placed; cranes, trolleys, and hoists erected; battery now complete. 97, 613.

1898. Painting superior slope concrete. 98, 629.

1899. Minor repairs. 99, 773.

Part 29, FNF. Southern Entrance—Two 2-gun Batteries for 10-inch Guns, Staten Island.

1897. Work begun in July, 1896, on 2 batteries, each with 2 positions for 10-inch rifles. Platforms ready for carriages by December, 1896; parapet and magazines completed; 1 carriage being assembled. Artillery fire control—work begun on stations for range finder, observation, and searchlight. 97, 613.

1898. Ammunition lifts, trolley, and cranes provided; magazine doors hung; superior slopes painted; 4 telephone booths built and electric-light plant installed. Batteries turned over to the commanding officer. 98, 629.

1899. Minor repair of ammunition lifts and drainage system. 99, 773.

Part 30, FNF. Southern Entrance—Battery of Three 10-inch and Four 12-inch Guns, Staten Island.

1897. Work begun by contract on emplacements for three 10-inch guns on disappearing carriages. Excavation and concrete work; 2 emplacements for 12-inch guns to be built by hired labor. 97, 622, 623.

1898. Three 10-inch emplacements adopted in lieu of 1 of the originally proposed 2 iron casemates; battery completed under contract. Work begun on 12-inch emplacements. 9,732 c. y. concrete

placed, magazines built, and 2 platforms ready for armament; work begun on the other 2 emplacements. 98, 631, 632.

1899. Electric plant installed at 10-inch emplacement, completing same; 12-inch emplacement nearly completed; 2 guns and carriages received. Cost of work. 99, 778, 779.

1900. Four 12-inch guns mounted; some waterproofing. 00, 839.

Part 31, FNF. Southern Entrance—Two Emplacements for 8-inch B. L. Rifles on Modified 15-inch Gun Carriages, Staten Island.

1898. \$6,000 allotted. No alteration required for platforms and magazines of old battery; 1 altered carriage nearly completed. 98, 629.

1899. Work completed; guns received and mounted in August. 99, 775.

Part 32, FNF. Southern Entrance—Twelve-inch Emplacements, Battery Richmond, Staten Island.

1898. The allotment from "National defense" for 2 emplacements, excavations nearly completed; platforms ready for armament; parapet and walls built to level of magazine ceilings. **98, 629.**

1899. Battery completed; machinery and lights installed; 1 base ring set. Range-finder house built. Cost of work. **99, 773.**

Part 33, FNF. Southern Entrance—Twelve-inch Emplacements, Battery Hudson, Staten Island.

1898. Excavation begun for 2 emplacements for 12-inch guns on disappearing carriages L. F. model 1896. **98, 629.**

1899. Magazines and platforms nearly completed; carriages received. Cost of work. Ar-

rangement of plant shown on tracing. Range-finder house built. **99, 766, 774.**

1900. Emplacements completed, except small amount of sodding on slopes; armament being mounted. **00, 836.**

Part 34, FNF. Southern Entrance—Temporary Batteries, Staten Island.

1898. \$5,000 allotted. Work begun in May for battery for three 8-inch converted rifles; platforms

sand parapet, and magazines completed; battery ready for armament. **98, 629.**

Part 35, FNF. Southern Entrance—Rapid-fire Guns, Staten Island.

1898. \$6,000 allotted for 2 emplacements for 4.7-inch guns to protect mine fields; work begun;

platforms completed; guns mounted; emplacement completed except minor work. **99, 629.**

Part 36, FNF. Southern Entrance—Two Emplacements for 15-pounder R. F. Guns, Staten Island.

1899. Work begun in February and completed in June, 1899. **99, 775.**

Part 37, FNF. Southern Entrance—Two Emplacements for 6-inch R. F. Guns on Pedestal Mounts, Staten Island.

1899. Work begun in September, 1898; concrete work completed and guns mounted in December. **99, 775.**

Part 38, FNF. Southern Entrance—Two Emplacements for 6-inch Guns on Disappearing Carriages, Staten Island.

1899. Work begun in March. Emplacement 2 nearly completed; cost of work. 99, 774.

1900. Emplacements nearly completed, except a small amount of parapet constr. 00, 836.

Part 39, FNF. Southern Entrance—Defenses of Staten Island.

1901. \$99,015 allotted. 01, 767. Two 12-inch guns. Transferred to commanding officer Aug. 18, 1900. 01, 764. Two 6-inch guns. Transferred Oct. 29, 1900. 01, 764. Two 12-inch guns. Work begun, detailed statement of work accomplished given. 01, 765. Work completed. 02, 688. Electric-power station. \$20,000 allotted. Excavation begun; awards made for furnishing boiler and other machinery. 01, 764. Constr. completed. 02, 688.

1902. \$117,250 allotted. 02, 689. New battery for two 12-inch guns on disappearing carriages, model 1901; excavation begun; 36,936 c. y. concrete work completed. 02, 688. Peace Storage Magazine. Constr. begun; building nearly completed. 02, 688. Miscellaneous work, such as installing electric plant, implement racks, telephone booths, constr. concrete pedestals, etc. done. 02, 688.

Part 40, FNF. Fort Hancock, Sandy Hook, N. J.

1857. Work begun. Importance. 80, 33.

1866. Work on scarp and casemate arches of the water fronts. 66, 11.

1867. Work on scarp of ne. bastion, piers of nw. front, walls of service magazines; excavation for foundations of scarp and piers of the new terrace; work on jetties. 67, 11.

1868. Work on the se., s., and sw. land front; minor work; repair of jetties 1, 2, and 4; jetty 6 commenced; minor work. 68, 14.

1869. Work on land fronts continued. 69, 14.

1870. Care and preservation. 70, 20.

1871. \$13,500 allotted. Work on additional jetties. 71, 15.

1872. Two jetties built of sheet piling, each 150' long. 72, 13.

1873. Two jetties built, 1 of sheet piling and 1 of cedar piles and brush. 73, 12.

1874. One jetty 109' long built. 74, 15.

1875. Care and preservation. 75, 16.

1876-77. Repair of jetties and plant. 76, 16; 77, 12.

1878. Sand box bulkhead 1,300' long built. 78, 15.

1883. \$17,500 allotted. 766' of concrete jetties built on the sites and remains of old jetties. 83, 26.

1885. \$5,000 allotted for stone revetment between jetties 8, 9, and 10; work completed; 57 shot beds made; repair of buildings. 85, 24.

Part 41, FNF. Southern Entrance—Mortar Battery 1, with Ditch Defenses, Sandy Hook Defenses.

1890. \$201,000 allotted. Work begun in November, 1890. 93, 600.

1891. 30,000 c. y. excavated. 91, 7.

1892. 13,025 c. y. concrete placed. 92, 6.

1893. \$53,000 allotted. 13,827 c. y. concrete masonry built and 118,478 c. y. sand filling placed; drainage system completed and 4 carriages received. 93, 600.

1894. \$20,000 allotted. Masonry and sand filling completed; mortar platforms built and carriages assembled, and mortars mounted and tested. 94, 449.

1895. Final battery firing made; results shown. Proj. for electric-lighting system approv. and installed; description, with cost. R. by Col H. C.

Abbot upon volley practice with mortars. 95, 8, 505 519.

1896. Overhead traveler for handling ammunition adjusted; minor repairs to embankment and repainting doors. 96, 480.

1897. Total cost of battery, \$270,724.67. 97, 618.

1898. Eight platforms dismantled and provided with index rings of the new pattern. 98, 631.

1899. Eight more platforms dismantled and provided with new index rings. A pier built for emergency range finder. 99, 778.

1900. Alterations completed. 00, 839.

Part 42, FNF. Southern Entrance—Gun-lift Battery 1, Sandy Hook Defenses.

1891. \$9,087.43 app. Excavation begun and nearly completed; 3,500 c. y. concrete placed; foundation for accumulator pit, 5' below water, laid; and minor work. 91, 7.

1892. \$53,912.57 app. 29,875 c. y. concrete placed; mechanism placed. Est., battery for two 12-inch guns, \$457,000. 92, 6.

1893. \$458,500 allotted (1891-93). Est. of cost. 8,292 c. y. masonry constr.; 5,185 c. y. sand placed in embankment, gun mounted and tested, and battery practically completed. 93, 607.

1894. Ammunition service completed, bullet-proof entrance doors completed and hung, gun tested. 94, 456.

1895. Second gun mounted, completing this battery; final drawing of completed battery made. Cost of constr. 95, 8, 506.

1896. History; cost and ests. Rapidity of fire tested by B.E.; results. Preservation and repair. 96, 480.

1897. Description of battery; constr., expenses, and testing guns and mechanism. 97, 619.

1898. Condenser for disposing of exhaust steam installed. Two range-finder piers for portable instruments built. 98, 631.

1899. Three Gatling guns mounted for gorge defense; alterations made in pillars for emergency range finders. 99, 778.

Part 43, FNF. Southern Entrance—Ten-inch Battery, Sandy Hook.

1897. \$100,000 allotted for 1 battery of two 10-inch guns. Work begun, 1896. Battery completed, except ammunition lifts. No carriages received. 97, 620.

1898. Two emplacements built on site originally proposed at a second gun-lift battery; am-

munition lifts erected, electric lighting completed, and the battery turned over to the commanding officer. 98, 631.

1899. Doors repaired; 2 concrete pillars built for emergency range finders. 99, 778.

Part 44, FNF. Southern Entrance—Five-inch R. F. Battery, Sandy Hook Defenses.

1897. \$4,000 allotted for 1 emplacement. 97, 623.

1898. Work begun in September, 1897, and completed Apr. 21, 1898. 98, 632.

1899. Alteration of platforms completed and gun mounted. 99, 779.

1900. Alteration of platform made. 00, 839.

Part 45, FNF. Southern Entrance—Pneumatic Gun Battery, Sandy Hook Defenses.

1898. Emplacements for two 15-inch and one 8-inch gun to be built by contract. Sand parapet built of sandbag retaining walls, nearly completed. 98, 632.

1899. Sandbag retaining walls completed.

Pillar erected for an emergency range finder. 99, 779. Board walk built to connect with 10-inch battery, No. 2. 99, 780.

1900. Concrete retaining walls and bombproof begun. 00, 839.

Part 46, FNF. Southern Entrance—Six-inch R. F. Battery, Sandy Hook Defenses.

1898. \$16,000 allotted. Plans approv. and railroad track to site of battery built. 98, 632.

1899. One-third concrete work completed. Site interfered with ordnance proving ground; work suspended. 99, 779.

Part 47, FNF. Southern Entrance—Fifteen-pounder R. F. Emplacements, Sandy Hook.

1899. Work begun in February for 2 emplacements and completed; awaiting arrival of carriages. 99, 780.

1900. Carriages not yet received. 00, 839.

Part 48, FNF. Southern Entrance—Defenses at Sandy Hook.

1901. \$54,958.37 allotted. 01, 769. Battery No. 2, 15-pounder R. F. guns. Work begun July, completed November. 01, 768. Pneumatic dynamite-gun battery—temporary parapet and magazines removed and replaced by permanent ones. 01, 768. Water supply system work completed. 01, 768. Galleries, constr. of, for 10-inch emplacements, work completed. 01, 768. Implement racks constr. and erection steel implement racks. Work completed except those for gun-lift battery. 01, 768.

1902. \$100,000 allotted. 02, 692. Emplacements for 6-inch R. F. guns, pedestal mounts; work begun, plant erected, 1,864 c. y. concrete in place. 02, 690. Emplacements for two 12-inch guns; operations in progress. 02, 691. Electric light and power plant; work begun, brick building constr., switchboard set up and connected. 02, 691.

Part 49, FNF. Southern Entrance—Seven-gun Battery, Long Island.

1893. \$82,000 allotted. Work begun; 2,700 c. y. earth removed; constr. plant nearly completed. 93, 7.

1894. 10,867 c. y. earth excavated and 10,362 c. y. concrete placed. 94, 456.

1895. Pavement on superior slope nearly completed; drainage system put in; doors made and hung; and casemates prepared for R. F. guns. Table of cost of work. 95, 7, 505.

1896. \$72,600 allotted. Emplacements completed, awaiting arrival of carriage. Revised plans. 96, 479.

1897. \$45,000 allotted. Projs. Work on modification of 4 traverse magazines for 6-pounder R. F.

guns; ammunition service and electric-light plant installed. 97, 614.

1898. \$100,000 allotted. Emplacements 4, 5, 6, and 7 completed; guns mounted and turned over to the commanding officer; work on emplacements 1, 2, and 3 begun and platforms for 2 and 3 completed. 98, 627.

1899. Emplacements 1, 2, and 3 completed, and 3 carriages and 1 gun mounted. Cost of work. 99, 768.

1900. Two remaining guns mounted and galleries connecting loading platforms built. 00, 833.

Part 50, FNF. Southern Entrance—Mortar Battery, 12-inch Mortars, Long Island.

1898. Plans being prepared. 98, 627.

1899. Work begun and excavation in progress. 99, 771.

1900. 8,562 c. y. concrete placed; base rings for platforms set; work on parapet and slopes. 00, 832.

Part 51, FNF. Southern Entrance—Rapid-fire Guns, Long Island.

1898. \$6,000 allotted for two 4.7-inch R. F. guns; platforms 7 and 8 of 15-inch gun battery (water battery) altered for the R. F. guns; emplacement completed and guns mounted. 98, 27.

1899. Drains cleaned. 99, 77.

Part 52, FNF. Southern Entrance—Twelve-inch Battery No. 1, Long Island.

1898. \$30,000 allotted from "National defense" for 2 barbette emplacements. Excavation in progress. Allotment from "Gun and mortar batteries" for 12-inch emplacements for disappearing carriages. 98, 627.

1899. Emplacements 1 and 2 completed. Mounting carriages; cost of work. Allotment for emplacements 3 and 4 for two 12-inch B. L. rifles on disappearing carriages. Work begun in August,

1898. Excavation completed and concrete work in progress. Cost of work. 99, 770.

1900. 7,489 c. y. masonry placed, completing concrete work. Battery nearly completed, guns mounted at 1 and 2, and carriages in 3 and 4. \$5,000 allotted for raising two 12-inch delivery tables to adapt them to ammunition trucks issued by Ordnance Department. 00, 833.

Part 53, FNF. Southern Entrance—Twelve-inch Battery in Stone Fort, Long Island.

1899. Plans approv. for two 12-inch B. L. rifles on disappearing carriages on the water face of the old stone fort. 99, 770.

1900. 5,998 c. y. old masonry removed, 3,712 c. y. excavated, and 2,745 c. y. concrete placed. 008, 33.

Part 54, FNF. Southern Entrance—Six-inch Battery, Long Island.

1899. Plans approv. for 2 emplacements for 6-inch B. L. rifles on disappearing carriages. 99, 771.

1900. 3,604 c. y. old masonry removed, 2,121 c. y. excavated, and minor work. 00, 833.

Part 55, FNF. Southern Entrance—Two 15-pounder R. F. Guns, Long Island.

1899. Two 8-inch converted rifles dismantled from platforms 1 and 2 of old water battery and work begun on new work; 290 c. y. earth excavated. 99, 771.

1900. 659 c. y. concrete placed, 532 c. y. earth excavated, 400 c. y. placed in slopes; work nearly completed, ready for its armament. 00, 832.

Part 56, FNF. Southern Entrance—Miscellaneous Defense Work.

1900. Allotment made and work begun. 00, 840.

1901. \$53,800 allotted. 01, 763. Seven 10-inch guns; rear ditch widened; slopes sodded; retaining wall built; electric-light conduits laid. 01, 762. Four 12-inch guns; emplacements 3 and 4 graded and sodded; doors hung; electric lights installed; guns mounted. 01, 762. Mortar battery; 656 c. y. concrete placed; 5,529 c. y. earth embankment sodded; ditch macadamized, etc.; lighting system installed; battery completed; turned over Mar. 4, 1901. 01, 762. Two 12-inch emplacements; 8,493 c. y. concrete placed; other work done; platforms completed; ready for armament. 01, 762. Two 6-inch emplacements; 428 c. y. masonry removed;

4,317 c. y. concrete placed; parapets graded, doors hung, etc. 01, 763. Installation electric-light plants. \$30,000 allotted. Machinery ordered; constr. begun. 01, 763. Four emplacements, 6-inch R. F. guns on pedestal mounts; pre. work in progress. 01, 763.

1902. Long Island defenses: \$250 allotted. Two 12-inch and two 6-inch—Battery completed; misc. work of grading, sodding, etc., done. One 6-inch carriage and gun mounted; two 12-inch carriages and guns mounted 02, 685. Four 6-inch R. F. guns; work begun; platforms ready for mounts. 02, 686. Installation of electric lights; work completed. 02, 686.

Part 57, FNF. Eastern Entrance—Fort Schuyler, East River (North Side of Eastern Entrance).

1833. Work begun. 80, 27.

1866. Work on service magazines; glacis repaired, paving in sally port renewed, sea wall repaired, and buildings repaired and altered. 66, 8.

1867. Two service magazines completed; work on 2 others; 15-inch gun platforms; stone parapet and breast-height walls; repair of buildings. 67, 7.

1868. Two service magazines completed; laying two 15-inch gun platforms on the cover face; modifying casemates of lower tier of main work to adapt them for new iron carriages of 10-inch guns and repair of wharf and buildings. 68, 11.

1869. Completing new magazines and gun platforms of the cover face, modifying casemates of second tier for 8-inch gun carriages (iron), placing gratings and shutters, and minor repairs. Est. cost of modifications, \$308,000. 69, 11.

1870. Care and preservation. 70, 17.

1871. \$57,500 app. Modification work begun, emplacements for 4 heavy guns completed on cover face; in the place-of-arms the parados, covering 2 magazines and a large bombproof, completed; new battery for 3 modern guns, at n. end of covered way, completed; minor repairs of sea wall, buildings, etc. 71, 13.

1872. \$85,000 app. Three brick arches, 1 heavy abutment pier, part of the new parade wall, and new coping to scarp wall built; bridge across both ditches completed; and minor work. 72, 10.

1873. \$65,000 app. Two large and 2 small brick arches built in n. front of main work; all arches covered with concrete and mastic; 1 traverse magazine built and partly covered with sand; new parade wall completed; removal of old stone parapet and parade wall in ne. front; 1 abutment and 2 intermediate piers built, and another abutment pier nearly completed; 2 stone arches turned. In 10-gun battery emplacements for 3 heavy guns

provided, 4 traverse magazines built; 2 traverses—part of the parados and half of parapet built. 73, 9.

1874. \$25,000 app. Main work: North front—earthen parapet embanked and exterior slope graded; 2 center pindle platforms for 15-inch guns laid; traverse magazine No. 1 completed and partly sodded; traverse magazine No. 2 built, covered with mastic; minor work. Northeast front—parade wall finished and coping of scarp wall set; pier completed; casemate arches covered with mastic; minor work. Southeast front—abutment pier completed, 2 others built, and work on a third; old parade wall, stone parapet, and gun platforms removed, and minor work. Ten-gun battery—parapet, epaulement, and parados graded and sodded, and minor work. 74, 11.

1875. \$25,000 app. Main work: North face—work on earth and sand filling and completing platforms. Northeast face—work on traverse magazines 3 and 4. Southeast face—2 piers built, work on communicating arches, and all coping on this face backed with concrete. Ten-gun battery—bonnet with its retaining wall built; work on parapet. Torpedo casemate completed and 141 l. f. of torpedo gallery finished. 75, 11.

1876. Main work: North face—work on earth parapet and minor work. Northeast face—magazine No. 4 completed; work on retaining wall and slopes. Southeast face—brick revetment built on coping of scarp wall; asphalt and lime mortar applied to large arch and coping of scarp wall; work on parapet. South face—old stone parapet and 1 platform removed, torpedo gallery completed. Ten-gun battery—work on rubblestone wall. 76, 12.

1877-85. Care and preservation. 77, 9; 78, 11; 79, 14; 80, 27; 81, 25; 82, 20; 83, 16; 84, 22; 85, 16.

Part 58, FNF. Eastern Entrance—Fort at Willets Point.

1863. Work begun. Importance. 80, 27.

1866. Drain pipes laid under casemate floors of first tier: flagging laid for casemate floors and for terreplein outside of casemates; embrasure iron put in place; work on scarp walls, flagging, and traverse stones, on drain gallery and cut stone; basin finished. Minor work. 66, 8.

1867. Work on scarp wall; completion of piers, casemate floors, second tier, nw. drain gallery; ne. drain gallery begun. 67, 8.

1868. Completion of arch over service magazine in second tier, and of drain gallery in rear of ne. retaining wall, arch over salient casemate and 2 flank casemates in chan. bastion; excavation for storage magazine completed. 68, 11.

1869. Work on storage magazine; fitting up service magazine for storage of powder; care and preservation. Est., earthen barbette battery for heavy guns, \$180,000. 69, 11.

1870. Work on storage magazine, breaking stone; drainage. 70, 17.

1871. \$45,000 app. Underground passage 270 long from the new bluff batteries to the water battery completed. Work on large storage magazine, 6 service magazines, and parapet, covering emplacement for 12 heavy guns. Battery ready for guns. 71, 13.

1872. \$76,500 app. Storage magazine completed; Little B. battery (2 guns), and w. battery (6 guns), with their 5 traverse magazines, essentially completed; excavation for mortar battery made; concrete stone prepared; extensive repairs of wharf. 72, 10.

1873. \$40,000 app. W. battery, with emplacements for 6 guns and 3 service magazines, completed, including most of its sea walls. Work on middle battery (10 guns), 4 guns could be mounted; e. battery (7 guns) begun; mortar battery (16 heavy mortars) ready for mortars. 73, 10.

1874. W. battery—work on concrete foundation for one 15-inch front pindle gun platform and sea wall completed. Middle battery—3,000 c. y.

earth placed in parapet; sodding exterior slopes completed; platforms ready for four 15-inch guns; sea wall completed; 4 storage casemates completed; minor work. E. battery—6,000 c. y. earth placed in parapet; 1 traverse magazine built and covered with earth, 2 others built and partly embanked; mortar battery completed, and platforms nearly ready for mounting four 13-inch mortars on hand 74, 12.

1875. \$25,000 allotted. W. battery—one 15-inch platform completed; sodding exterior slope. Middle battery—work on traverse circles; platforms for two 15-inch guns completed and guns mounted; some sodding done; 3 storage casemates built; drainage and minor work. Mortar battery—4 wooden platforms for 13-inch mortars placed 75, 121.

1876. Torpedo casemates prepared. Mortar battery—minor work on slopes, 2 new storage casemates finished, some drainage. Sea wall built in front of little battery. 76, 12.

1877. Sea wall extended; slopes repaired; storage casemates covered with earth; wharf strengthened, general repairs. 77, 9.

1878. Earth placed on parapet and storage casemates; sea wall extended 543 l. f.; and minor repairs. 78, 11.

1879. Repair of slopes, sea walls; earth covering of storage casemates; minor work. 79, 15.

1880-86. Care and preservation. 80, 26; 81, 27; 82, 22; 83, 17; 84, 23; 85, 16; 86, 17.

Part 59, FNF. Eastern Entrance—Gun Battery, South Side of Entrance.

1891. Excavation for 1 magazine for 8-inch guns and its approaches completed and concrete work begun. 91, 7.

1892. One magazine and part of parapet connecting it with next emplacement completed and the second magazine begun. 92, 6.

1893. 10,093 c. y. concrete placed, 10,628 c. y. earth excavated, and 4,384 c. y. placed in embankment; and minor work. 93, 8.

1894. Work completed as far as possible; awaiting adoption of carriage. 94, 9.

1895. Wharf repaired. 95, 8.

1896. \$20,540 allotted. One 10-inch emplacement completed, including mounting of carriage and gun. Work on the other emplacement. 96, 475.

1897. \$45,000 allotted. Another emplacement,

No. 6, authorized April 22. Minor work and installation of trolleys—hoists and cranes for first 3 emplacements; 55 t. of granite and iron placed on gun platforms for settlement. Three 15-inch Rodman guns dismounted from site of emplacement 6; work begun. 97, 612.

1898. Emplacements 1, 2, and 3 completed; emplacement 6, concrete work finished and earthwork nearly completed; ammunition lift, trolley, and cranes in place. \$5,600 allotted for waterproofing. \$100,000 allotted for two 12-inch gun emplacements 4 and 5; excavation begun. 98, 626.

1899. Excavation for emplacements 4 and 5 completed; concrete work nearly finished. 99, 765.

1900. Emplacements 4 and 5 nearly completed; guns mounted. Emplacement 6—rear roadway graded and side banks sodded. 00, 830.

Part 60, FNF. Eastern Entrance—Battery for Sixteen 12-inch Mortars.

1891. 400 c. y. r. and 1,600 c. y. earth removed. 91, 7.

1892. Buildings erected and wharf built; 7,379 c. y. earth excavated and 3,462 c. y. placed in embankment. 92, 7.

1893. 1,939 c. y. r. removed; 2,166 c. y. earth excavated and placed in embankment; 1,860 c. y. stone crushed and 1,952 yards concrete laid. 93, 8.

1894. Four platforms in progress, and anchoring bolts set; filling one-half completed; 4 carriages on hand. 94, 9.

1895. Four carriages and mortars mounted in 1 pit; excavation of 3 other pits completed; 4 mortars and carriages on hand; floors placed in magazines, loading rooms, and one-half of galleries. 95, 8.

1896. \$32,106.79 allotted for battery, and \$2,085.87 allotted for mounting guns and carriages;

all platforms completed; 8 mortars and carriages received and mounted; work on retaining walls and embankment. 96, 473.

1897. \$9,700 allotted. Concrete slopes and pavements completed, embankment nearly finished, all carriages and mortars mounted and turned over to the troops. \$5,200 allotted for electric-light plant building; completed. 97, 610.

1898. \$5,500 allotted for constr. of parapet and 1 emplacement for 8-inch B. L. rifle; earth parapet and magazines built. 98, 624.

1899. \$8,150 allotted. Platforms altered for new type of azimuth circle. Eight-inch B. L. rifle mounted on altered 15-inch S. B. carriage. Supplies purchased for electric plant. Imp. drainage completed. 99, 762.

1900. New azimuth circles received and set. 00, 828.

Part 61, FNF. Eastern Entrance—Mortar Battery for Eight 12-inch Modern Mortars, South Side of Entrance.

1897. \$14,000 allotted. Plans for 8 platforms prepared. Cut stone ordered and excavation for drains begun. 97, 612.

1898. \$3,000 allotted. Platforms built and mortars and carriages mounted. 98, 626.

1899. Shot trolley service installed. 99, 766.

Part 62, FNF. Eastern Entrance—Two Emplacements for 10-inch Rifles on Disappearing Carriages, North Side of Entrance.

1897. Work begun in August, 1896. Wharf built and concrete plant set up. Excavation and embankment mainly done by contract. Platforms ready for the carriages. 97, 611.

1898. 2,864 c. y. concrete placed. Guns and carriages mounted and battery completed, except

minor work. Battery turned over to the commanding officer May 5, 1897. \$75 allotted for introduction of water supply. 98, 625.

1899. Water-supply system and electric lights installed. 99, 763.

Part 63, FNF. Eastern Entrance—Emplacement 1, for 12-inch Rifle, Disappearing Carriage, North Side of Entrance.

1897. \$50,000 allotted. Supplies purchased; rr. from wharf to site of battery nearly finished. 97, 611.

1898. Concrete work of the parapet, platform, and magazines, and the earthwork of the parapet completed; cranes and trolley for handling ammunition set up. 98, 625.

1899. Earthwork completed, machinery and electric lights installed, carriage and gun mounted, and emplacement completed. Electric plant installed, brick wall built at foot of slope, and drain put in. 99, 763.

Part 64, FNF. Eastern Entrance—Platforms for Target Practice.

1896. Platforms for 2 practice guns—1 for 15-inch S. B. front pintle and 1 for 8-inch converted rifle completed; entire cost, \$1,950. 96, 474.

1900. Earthen barbette and temporary magazines built. 00, 828.

Part 65, FNF. Eastern Entrance—Two Emplacements for 5-inch R. F. Guns, South Side of Entrance.

1898. \$9,000 allotted. Work begun; platforms and magazine walls completed. 98, 626.

1899. Change in carriages, necessitating change in platforms, completed; battery completed in May, 1899. 99, 766.

1900. Slopes graded and sodded; electric wires placed; carriages received but not assembled. 00, 830.

Part 66, FNF. Eastern Entrance—Two Emplacements for 15-pounder R. F. Guns, South Side of Eastern Entrance.

1899. Work begun in February, excavations completed, drains installed, and 258 c. y. concrete placed. 99, 756.

1900. Emplacements completed and armed. Waterproofing. 00, 831.

Part 67, FNF. Eastern Entrance—Two Emplacements for 15-pounder R. F. Guns, North Side of Eastern Entrance.

1899. Work begun in April; magazines completed. 99, 764.

1900. Emplacements completed; guns not mounted. 184 c. y. concrete laid and 2,040 c. y. embankment built. 00, 829.

Part 68, FNF. Eastern Entrance—Two Emplacements for 5-inch R. F. Guns, North Side of Eastern Entrance.

1899. Work begun in August, 1899, and completed, awaiting arrival of carriages. 99, 764.

1900. Carriages received, base rings set, platforms paved, and roadway graded. Guns not received. 00, 829.

Part 69, FNF. Eastern Entrance—Emplacement No. 2 for 12-inch Rifle, North Side of Eastern Entrance.

1899. Work begun in July, 1898. Platform completed. 99, 763.

1900. Emplacement completed, except sodding. Carriage and gun mounted. 00, 829.

Part 70, FNF. Eastern Entrance—Two Emplacements for 5-inch R. F. Guns.

1900. \$20,000 allotted. Work begun in August, 1899; emplacements nearly completed; magazines covered with asphalt waterproof course; cost of work. 00, 828.

1901. Emplacements completed; turned over to commanding officer. 01, 757.

Part 71, FNF. Eastern Entrance—Two Emplacements for 6-inch R. F. Guns.

1901. \$27,500 allotted. Excavation and clearing site begun. 01, 757.

1902. Practically completed. 02, 679.

Part 72, FNF. Southern Side of Eastern Entrance.

1901. \$5,600 allotted. Two emplacements for 5-inch R. F. carriages received, set, and grouted; pavements finished; emplacements turned over Dec. 11, 1900. Disappearing gun battery: Two emplacements for 12-inch guns completed; hoists and magazines painted; electrical connections finished. Roads graded, etc.; iron galleries built;

installation for electric-light plant completed and turned over Oct. 30, 1900. 01, 760.

1902. \$11,750 allotted for addition to building School of Submarine Defense; work in progress; 900 c. y. earth excavated; 100 l. f. 8-inch drain laid. 02, 682.

Part 73, FNF. Northern Side of Eastern Entrance.

1901. \$475 allotted. One emplacement for 12-inch gun (No. 2); grading done; drains made; turned over to Artillery Aug. 15, 1900. Two emplacements for 15-pounder R. F. guns; base rings set; guns mounted; turned over to commanding officer Dec. 22, 1900. Iron gallery to connect loading platforms of 10-inch battery; erected, painted,

and completed; length, 55'. Electric tide indicator; constr. completed; turned over to commanding officer May 11, 1901. **01, 758.**

1902. \$1,200 allotted. Repairs to 5-inch, 3-inch, and 12-inch emplacements No. 2; slope wall of 5-inch battery relaid; 5-inch guns received and mounted. **02, 680.**

Part 74, FNF. Preservation and Repair of Fortifications.

1897. \$2,000 allotted for eastern entrance. Repairing sea wall and wharf. **97, 612.** Southern entrance to H.—roof of torpedo shed repaired and ironwork painted. Cost, \$240.97. \$790 allotted for gun-lift battery. **97, 623.**

1898. Eastern entrance—\$2,561.58 allotted for electric supplies and correction of defective drainage in mortar battery; \$350 allotted for repair of gallery and for platform for 8-inch converted rifle. **98, 625.** \$1,550 allotted. 1,493 c. y. riprap placed along base of sea wall; wharf, buildings, and sewers repaired. **98, 628.** Southern entrance—sea wall in front of 10-inch battery repaired, and platforms 3, 4, 5, and 6 of water battery altered for 8-inch converted rifles; carriages and guns mounted, and slopes repaired and sodded. **98, 628.** Staten Isld.—\$4,945 allotted. Repairs to old forts, sea walls, manholes in sewer; iron fence built; five 15-inch gun platforms altered to adapt them to carriages for 8-inch converted rifles. **98, 630.** Sandy Hook—ironwork and doors of mortar battery painted, and slopes repaired; electric wiring removed from wooden conduits and placed in iron pipes; minor work and repairs at gun-lift battery. **98, 632.**

1899. North side of eastern entrance—search-light installed. South side of eastern entrance—wharf repaired; waterproofing and drainage of disappearing-gun battery. **99, 766.** Southern entrance—repair of electric plant; drainage surfaces of platforms of 10-inch guns and superior slope repaired. **99, 77.** Staten Isld.—old forts and new works repaired. **99, 776.** Sandy Hook—batteries and buildings repaired. **99, 780.**

1900. Eastern entrance—\$284.80 allotted; storm doors built; minor work. **00, 878.** North side of eastern entrance—\$200 allotted for repair of search-light and constr. shelter. \$700 allotted for waterproofing magazines and for minor repairs. **00, 829.** Long Isld.—\$1,700 allotted. Minor repairs of

slopes, cranes, hoists, pavements, drainage, etc. **00, 834.** Staten Isld.—\$2,814 allotted. Repair of lifts, concrete platforms, drainage, mining material, etc. **00, 838.** Sandy Hook—\$4,546.70 allotted. Rosendale cement pavement over magazine replaced with Portland. Sand slopes of mortar battery regraded to a slope of 1 upon 2; minor repair of other batteries. **00, 840.**

1901. Eastern entrance—\$400 allotted. Retaining wall, new manhole built, and drains cleaned; minor repairs. **01, 757.** North side of eastern entrance—\$1,700 allotted for rewiring and waterproofing 10-inch and 12-inch batteries. **01, 758.** South side of eastern entrance—painting done; repairs made; \$600 allotted. **01, 760.** Long Isld.—\$2,500 allotted. Various repairs made. **01, 763.** Staten Isld.—\$3,900 allotted. Material cared for and cleaned; mining casemates, building, etc., transferred to Artillery Mar. 6, 1901. **01, 764.** Sandy Hook—\$11,630 allotted. At gun-lift battery, flagstone replaced with waterproof course; new electric-light equipment installed at mortar battery; repairs to drains. **01, 768.**

1902. Eastern entrance—ground cleaned up, etc. **02, 679.** North side eastern entrance—repairs to ammunition hoist; new drainage outlet made; new drains laid, etc. **02, 681.** South side eastern entrance—\$1,558 allotted. Slopes cleaned; repairs to roadway, engineer wharf; doors painted, and misc. work. **02, 682.** Long Isld.—doors hung; racks placed; slopes repaired. **02, 686.** Staten Isld.—\$1,044 allotted. Removing arch; repairs to steps, windows; constr. new br.; painting roofs, etc.; paving. **02, 689.** Sandy Hook—areas rear of batteries covered with cinders; instrument room and ventilating doors built; waterproofing done; railroad tracks moved; and pneumatic gun battery dismantled. **02, 691.** Fort Columbus—\$5,000 allotted for necessary repairs. **02, 683.**

Part 75, FNF. Range and Position Finders.

Eastern entrance. **96, 477; 97, 613.** Artillery fire control. **97, 613; 98, 629; 99, 776.** Four range-finder houses built and turned over to the Board on Regulation of Seacoast Artillery Fire. **98, 630, 631; 99, 776.** Southern entrance to H. **99, 771, 779.** Sandy Hook. **99, 780; 00, 840.** North side of eastern entrance; 2 stations built. **00, 829.** Long Isld.—two stations built and turned over to commanding officer. **00, 833.**

Long Isld.—one fire commander and two battery commander stations au.; materials purchased; work begun. **01, 763.** Completed and turned over; temporary concrete platforms constr. **02, 686.** Sandy Hook—two range-finder towers built by contract. **01, 768.** Southern side of eastern entrance—\$14,000 allotted. Constr. 4 range-finder shelters; work begun; change of location considered; work suspended. **02, 682.**

Part 76, FNF.

Searchlights.

1901. \$88,700 allotted (\$26,900 transferred to electric plant) for purchasing searchlights at southern entrance. **01**, 769; **02**, 693. Searchlights re-assembled for shipment to service schools. **01**, 770.

Long Isld. defenses—\$11,500 allotted. **01**, 764. Staten Isld.—\$21,000 allotted. **01**, 767.

Act Mar. 1, 1901, app. \$150,000 for searchlights. N. Y. H. **03**, 14.

Part 77, FNF. Sea Walls and Embankments.

Bedloes Isld. (eastern entrance)—est. cost of 580 l. f. of new sea wall, \$25,000. **94**, 14; **96**, 478.

1901. Sea wall at Bedloes Isld.—\$20,000 allotted. Building masonry wall to be 714' l., 8.4' above m. l. w. proposed; no work done. **01**, 762.

1902. Wall completed; 723' l., 8.4' above m. l. w. **02**, 684.

David's Isld. (eastern entrance)—slight repairs. **94**, 14. Repairs made to riprap and coping, and 750 c. y. riprap placed back of wall. **96**, 477. \$47,000 allotted for sea wall and earth embankment. Plans. Work begun in May; 4,046 tons of riprap placed and 625 c. y. of embankment placed, **89**, 458. 5,022 t. of riprap and all capping placed, completing the wall; 27,650 c. y. of material placed in embankment, nearly completing contract. **90**, 382. 3,555 c. y. of earth placed in embankment, completing same. Survey made 1891. **91**, 521. Report of a survey made of David's Isld., by Col. Houston; with design for constr. of a sea wall. **92**, 460.

1901. Eastern entrance—\$10,000 allotted for constr. sea wall; materials purchased; plant prepared. **01**, 757.

1902. Work continued; 375 l. f. built. **02**, 679.

Willet's Point, Ft. Totten (eastern entrance)—\$2,500 app. 1888, for repairs to wharf and sea wall at Willet's Point. **11**, 16.

Fort Schuyler (eastern entrance)—Repairs. **86**, 17. \$4,225 allotted for repairs; completed. **96**, 477; **97**, 611; **98**, 625. \$2,400 allotted for protection of shore north of barracks. **99**, 764. \$10,000 allotted for sea wall on the north shore of reservation. **00**, 830.

1901. North side eastern entrance—\$15,000 for constr. 800 l. f. sea wall; in addition to 1,343' of wall on north shore of reservation, 50 l. f. built. **01**, 759. \$4,600 allotted. Work in progress. **02**, 681.

Governors Isld. (southern entrance)—107 c. y. of cut stone, 172 c. y. of concrete foundations, and

162 c. y. of concrete backing laid in sea wall; 47' of coping placed. **66**, 9. \$54,000 app. Proj. of 1865 provided for inclosing the entire isld. with a sea wall 1,750' l., 8' h. Work begun in May, 1883, to complete sea wall; 300 l. f. built; work done by contract. **83**, 19, 385. \$500 allotted. 206' of wall built. **84**, 25; **86**, 18. \$50,000 allotted, 1888. Plans. Foundation completed for 261' from the Castle Williams wall; 180' of cut stone wall built. **89**, 460. 319 c. y. of concrete foundation, and 1,421 c. y. of masonry wall laid; 21,447 c. y. of earth placed in embankment. **90**, 384. \$50,000 app. History of work. 144 c. y. concrete foundation placed and 153 l. f. masonry wall built. **91**, 525. \$6,597.86 transferred from David's Isld. Total of work done to date—659 c. y. of concrete foundation and 1,499 l. f. of masonry wall laid; 1,856 c. y. of embankment placed behind n. wall, and 39,544 c. y. behind w. wall; description of sea walls around entire isld. **92**, 461. \$4,000 transferred from David's Isld. 396 l. f. wall built, 685 c. y. riprap placed, and minor work. **93**, 631. Riprapping completed, pointing of masonry finished, embankment back of w. sea wall protected with broken stone for a width of 12'; proj. completed. **94**, 14.

1901. Sea wall, Governors Isld.—\$250 allotted. Washout repaired. **01**, 761.

1902. \$1,000 allotted for misc. repairs. **02**, 684.

Sandy Hook (southern entrance)—\$7,500 allotted. Sea wall to protect pneumatic guns completed in 1894. 4,546 t. of stone placed; cost, \$5,298.03. **96**, 483. \$75,000 app. Violent storm, 1897, broke through sand spit of Hook and closed up chan. of Shrewsbury R., threatening the only land communication with the fortifications at Sandy Hook. Riprap wall to close the breach built under contract; 57,165 t. of riprap placed. **98**, 633.

1901. Sandy Hook—\$2,000 allotted for work on sea wall; operations in progress. **01**, 768.

1902. Sea wall completed; jetty built near dynamite-gun battery. **02**, 692. \$75,000 app. 1902, for riprap stone wall eastern beach. **11**, 7. \$40,000 app. 1905, for sea wall, north beach. **11**, 17.

Part 78, FNF.**Sites.**

Coney Isld.—After ex., new site selected. 92, 9. Plumb Isld.—50 acres acquired by condemnation proceedings; \$99,547.76 paid. 92, 9. Fort Hamilton—56.54 acres acquired by condemnation proceedings; \$302,768.13 entire cost. 92, 9. Act of State legislature; land acquired adjacent to reservation ceded to U. S. 93, 10. Bayside (near Keansburg), N. J.—25.3 acres purchased for \$200 an acre. 92, 9. Staten Isld.—Tract No. 1 of the King property purchased for \$60,000. 98, 630. Site purchased for \$51,000 in 1898. 99, 776. \$95,000 allotted for purchase of 3 tracts of land; proceedings

instituted. 00, 838. Fort Wadsworth, west of—14 acres purchased for \$110,000. Condemnation proceedings instituted for acquisition of 115 acres. 92, 9. 82 acres acquired by condemnation proceedings; price, \$599,497.30. 93, 10. 6½ acres purchased for \$53,680. 95, 504. Sandy Hook, N. J.—28 acres acquired at cost of \$25,000. 93, 11. Staten Isld. defenses. Condemnation proceedings instituted for acquisition of 2 properties. 01, 766.

1902. Staten Isld.—\$18,100 allotted for purchasing land. 02, 689.

Part 79, FNF.**Submarine Mines.**

1891. \$9,000 allotted. Five mining casemates completed. 91, 7.

1892. Two special storage sheds completed. 92, 9.

1893. Description of torpedo shed. 93, 617; 94, 456.

1894. Torpedo shed completed; cost, \$3,323.51. 94, 447.

1898. Southern entrance to H.; \$30,000 allotted. Staten Isld.—mining casemate, torpedo storehouse, and tank built in 1897; oil engine installed in casemate; water supply introduced and a passage opened from the casemates to the chan.; movable hoist and traveling crane set up; minor work. \$23,250 allotted for planting mines. 98, 628. Sandy Hook—2 storage tanks constr. by remodeling 2 cisterns in the old stone fort; mines planted, 2 searchlights installed, one 5-inch siege rifle, one 7-inch siege howitzer, and one 4.7-inch R. F. gun mounted on temporary emplacements. 98, 632. Eastern entrance to H.—description of mines placed. 98, 635.

1899. South side of eastern entrance—mining casemate built. 99, 766. Eastern entrance—all torpedo defense removed from mine fields; mines exploded; second mining casemate built and turned over to the commanding officer. 99, 767.

Southern entrance—supplies for electric lighting and searchlights purchased. 99, 771. Staten Isld.—mines and cables taken up, cleaned, and stored; 2 additional cable tanks built. 99, 773.

1900. Defenses of the Narrows—mines and cables taken up, cleaned, and stored; 2 mines lost; repair of electric plant. Sandy Hook—2 cable tanks built; cranes installed and cable stored; new water tank built; casemates wood-lined and waterproofed; mines taken up, cleaned, and stored. North side of eastern entrance—searchlights to be reassembled and sent to one of the service schools. 99, 829. Staten Isld.—electric conduit system laid to connect battery commanders' and fire commanders' stations; reassembling portable searchlight outfits. 00, 836. Sandy Hook—\$3,000 allotted for reassembling portable searchlights; stored cable overhauled and examined; repairs to instruments made. 00, 840. Eastern entrance—mining material moved to Willets Point, N. Y.; plans placed in charge of c. o. post. 01, 761. Sandy Hook—mining material cared for. 01, 768. \$152 allotted. 02, 693. Southern side, eastern entrance—\$6,500 allotted. Extension of shed to laboratory; engine repaired; magazines connected; addition to mining casemate. 02, 682.

Part 80, FNF. Supplies for Seacoast Defenses.

1901. \$1,000 allotted. Purchases made and articles issued. 01, 770.

1902. Staten Isld.—\$3,200 allotted. 02, 690. \$1,000 allotted. 02, 694. *

Part 81, FNF. U. S. Mastic Works on Governors Island, New York Harbor.**ENGINEERS.**

Chief of Engineers. R., 80, 62; 81, 63; 82, 62.

In charge. Col. J. Newton. 1880-82.

OPERATIONS.

1880. 236,170 pounds mastic and 65,760 pounds bitumen procured some years since for covering the arches of casemates of fortifications. This material

was transferred January 24 to the post quartermaster on Governors Isld. for storage, subject to requisition. 80, 62.

1881. 1,980 pounds of mastic and 4,275 pounds of bitumen sold to officers for public works. 81, 63.

1882. 9,447 pounds of mastic and 1,669 pounds of bitumen sold to officers for public works. 82, 62.

FNH. DELAWARE RIVER FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1895-1902 |
| 2 | Engineering features..... | 1896-1905 |
| 3 | Engineers—Chief of Engineers..... | 1866-1902 |
| 4 | BE..... | 1882-1894 |
| 5 | In charge..... | 1865-1902 |
| 6 | Assistants..... | 1892-1900 |
| 7 | Forts, etc.—Operations, allotments, etc..... | ..... |
| 8 | Philadelphia, Pa..... | ..... |
| 9 | Fort Mifflin, Pa..... | 1866-1899 |
| 10 | Mortar battery..... | 1871-1886 |
| 11 | Red Bank, N. J..... | 1873-1897 |
| 12 | Fort Delaware, Del..... | 1866-1899 |
| 13 | Fort Mott, N. J. (Finns Point)..... | 1866-1886 |
| 14 | Finns Point, mortar battery, N. J..... | 1872-1882 |
| 15 | Fort Du Pont, Del., earthen barbette battery..... | 1866-1886 |
| 16 | Mortar battery, near Delaware City, Del..... | 1872-1885 |
| 17 | Battery, Delaware shore..... | 1879 |
| 18 | Delaware Breakwater, fort near..... | 1866-1869 |
| 19 | Three-gun lift battery (three 12-inch guns, disappearing carriages)..... | 1895-1901 |
| 20 | Battery, three 10-inch and three 12-inch disappearing guns..... | 1896-1901 |
| 21 | Battery, two 5-inch R. F. guns, balanced-pillar mounts..... | 1897-1901 |
| 22 | Mortar battery..... | 1897-1901 |
| 23 | Two emplacements, 8-inch disappearing guns..... | 1898-1900 |
| 24 | Two emplacements, 12-inch B. L. rifles, barbette carriages..... | 1898-1900 |
| 25 | Emplacements, two 4.72-inch R. F. guns..... | 1898-1899 |
| 26 | Emplacements, 15-pounder R. F. guns (12-inch disappearing-gun battery)..... | 1899-1901 |
| 27 | Emplacements, two 5-inch R. F. guns, wire wound (10-inch and 12-inch battery)..... | 1900-1901 |
| 28 | Emplacements, two 5-inch R. F. guns, wire wound (between river and mortar battery)..... | 1900-1901 |
| 29 | Emplacements for two 15-pounder R. F. guns..... | 1901-1902 |
| 30 | Magazine for 3-inch R. F. gun..... | 1901 |
| 31 | Converting old magazines into casemates..... | 1901-1902 |
| 32 | Preservation and repairs..... | 1898-1902 |
| 33 | Range and position finders..... | 1900-1902 |
| 34 | Sea walls and embankments..... | 1866-1899 |
| 35 | Sites..... | 1871-1896 |
| 36 | Submarine mines..... | 1875-1902 |
| 37 | Supplies..... | 1901-1902 |

Part 1, FNH.**Contracts.**

1895. Engines, boilers, generators, switch-board and testing apparatus of electric plant, \$2,975; electric locomotive, \$1,200; 2 electric derrick motors, \$1,800; 2 pile drivers, \$812; 2 concrete mixers, \$482; 1 naphtha launch, \$1,950. **95, 508.**

1896. 15,000 barrels Rosendale cement, 85¢; 10,000 c. y. small broken st., \$1.02; 3,000 t. large broken st., 85¢; 4,000 c. y. sand, 45¢. **96, 487.**

1897. 25,000 c. y. small broken st., \$1.32; 9,000 t. large broken st., 90¢; 18,000 c. y. sand, 29½¢; electric plant, \$5,089; 6 ammunition hoists, \$4,335. **97, 636.**

1898. 150,000 c. y. embankment sand, 23½¢; asphalt waterproofing, \$1.26 per sq. y., in place; 15,000 c. y. small broken st., \$1.23; 25,000 barrels Rosendale cement, 71¢; 7,500 c. y. building sand, 28¢; 2,000 t. large broken st., 85¢; 1,300 barrels Portland cement, \$2.15; 6,000 barrels Rosendale cement, 80¢; 1,250 barrels Portland cement, \$2.20. **98, 645, 650, 653.**

1899. 36,000 barrels Rosendale cement, 68¢; 24,000 c. y. small broken st., 98¢; 5,000 t. large broken st., 73¢; 9,000 c. y. washed sand, 28¢; 18,000 c. y. unwashed sand, 24¢; 163,659 pounds steel beams, 1.4375¢; 4,000 barrels Portland cement, \$2.10; 127 barrels Portland cement, \$2.50. **99, 788, 789, 800.**

1900. 9,000 c. y. unwashed sand, 22¢; 1,700 c. y. small broken st., \$1.37; 1,000 barrels Portland cement, \$2.21; 217 sq. y. asphalt pavement, 1 inch thick, \$1.44; 1,006 sq. y. asphalt pavement, 1½ inches thick, \$1.62; 3 chain ammunition hoists for 12-inch guns, \$1,080; 2 double chain ammunition hoists for 15-pounder guns, \$984; 1,600 c. y. small broken st., \$1.56. **00, 847, 852, 857, 864.**

1902. Materials for constr. of a steel tower, \$5,250. **02, 693.**

Part 2, FNH.**Engineering Features.**

Air spaces in concrete side walls. 97, 631; 99, 786; 00, 849.

Ammunition hoists, electric. 97, 631; 99, 784 (drawing), 795 (drawing); 00, 853, 857; 05, 3008 (pl.).

Asphalt pavement. 00, 849, 852.

Cables; clamps. 05, 3008 (pl.).

Ceiling, constr. of. 99, 786, 798; 00, 843, 859.

Concrete, cost of. 97, 634; 98, 640, 642, 647, 652; 99, 792, 796, 799; 00, 854.

Concrete of superior slope. 97, 630; 98, 651; 99, 798; 00, 848, 854.

Concrete-mixing plant. 97, 629; 99, 792 (drawing).

Materials, cost of, and of handling. 97, 633; 98, 640, 646, 652; 99, 792, 799; 00, 853.

Cranes, ammunition. 00, 850 (drawing).

Dampness in magazines corrected. 00, 843, 859.

Doors, steel and brass. 99, 791 (drawing).

Earth and sand filling, cost of. 97, 634; 98, 640, 642, 647; 99, 792, 796, 799; 00, 854.

Electric plant, light and power. 99, 795 (drawing); 00, 850.

Electric plant used in constr. work, unloading and transporting materials. 96, 485.

Employees, distribution in gangs on work. 97, 632.

Excavation, cost of. 97, 634; 98, 640, 647; 99, 796, 799; 00, 855.

Expanded metal. 99, 787; 00, 843, 859.

Latrines. 99, 798.

Magazines: Peace storage of smokeless powder. 05, 3007.

Mounting mortars, cost of. 98, 645.

Mounting 12-inch barbette guns and carriages. 00, 861.

Mounting 12-inch disappearing guns and carriages. 98, 638.

Piles in place, cost of. 00, 854.

Plant, constr. 99, 792 (drawing).

Switchboard. 00, 850 (drawing).

Temperatures, outside and inside emplacement. 05, 3007.

Tile for ceiling and walls. 99, 788; 00, 849.

Ventilating, system of. 99, 787; 00, 860.

Waterproofing, methods of. 98, 645, 652; 99, 783, 798; 00, 849; 05, 3007.

Wiring, electric. 98, 644; 00, 850.

Work, amount of accomplished per gang (unloading, excavating, mixing concrete, etc.). 97, 633

Part 3, FNH.**Engineers.**

Chief of Engineers. R., 66, 12; 67, 12; 68, 14; 69, 14; 70, 20; 71, 16; 72, 13; 73, 13; 74, 15; 75, 16; 76, 16; 77, 13; 78, 15; 79, 19; 80, 33; 81,

33; 82, 30; 83, 26; 84, 31; 85, 25; 86, 25; 93, 8; 94, 9; 95, 8; 96, 15; 97, 14; 98, 20; 99, 22; 00, 6, 20, 35; 01, 21; 02, 21.

Part 4, FNH.**Boards of Engineers.**

1882. Constituted to consider and report upon the condition of fortifications and what number, if any, could be dispensed with. R., 82, 420.

1887. The BE. est. that one 16-mortar battery and two 12-inch disappearing guns could be built

on Pea Patch (isd.) for \$210,000; also est. for 2 mining casemates. 87, 11.

1894. Report of board constituted to consider and report upon price to be fixed for land in vicinity of Fort Mifflin au. to be sold. 94, 461.

Part 5, FNH.**Engineers in Charge.**

Col. H. Bache, 1865.

Lt. Col. C. S. Stewart, 1865-70.

Lt. Col. J. D. Kurtz, 1870-77.

Capt. Wm. Ludlow, 1877.

Col. J. N. Macomb, 1877-82.

Maj. Wm. Ludlow, 1882.

Lt. Col. G. Weitzel, 1882-84.

Lt. T. L. Casey, 1884.

Maj. W. H. Heur, 1884-85.

Lt. Col. H. M. Robert, 1885-90.

Lt. Col. C. W. Raymond, 1890-1902.

Lt. S. Cosby, 1900.

Col. J. A. Smith, 1902.

Part 6, FNH.

Assistants.

Lt. A. M. D'Armit, 1892.
Capt. S. Cosby, 1894-1902.
Lt. S. Cheney, 1897-98.

Lt. F. W. Altstaetter, 1898.
Lt. J. B. Cavanaugh, 1900.

Part 7, FNH—

FORTS AND BATTERIES.

Part 8, FNH.

Philadelphia, Pa.

General description of the defenses and the necessities for them. 73, 13.

Part 9, FNH. Fort Mifflin, Pa. (Old Stone Fort).

1866. Platforms altered, magazine built, and sundry repairs made. 66, 12.

1867. Magazine completed, new traverse stones put in platforms, and ditch cleaned. 67, 11.

1868. Changes made in and about magazine; ditches cleaned; wharf, sluice, etc., repaired; operations contemplated for future. 68, 14.

1869. Necessary small repairs made; alterations proposed, at an est. cost of \$107,000, to furnish additional emplacement and to construct a new earthen battery for heavy guns. 69, 14.

1870. App. made to carry out proposed plans and work to be carried on rapidly; no expend. during year, except for care of property. 70, 20.

1871. Two small service magazines completed; various repairs made to dikes, roads, brs., ditches, 15-inch platforms, buildings, etc.; new sluice constructed; future work specified 71, 16.

1872. 1,700' of dike reconstructed; minor work and repairs executed. 72, 13.

1873. St. revet. placed along dike of back chan.; constr. material received; minor repairs and work executed; app. of \$55,000 asked for; work proposed for ensuing 2 fiscal years. Fort will be prepared during the year to mount 17 large guns 73, 13.

1874. S. battery of demilune completed; dike along s. boundary finished; exterior battery partly embanked and graded; various repairs executed. 74, 15.

1875. Exterior battery for 9 guns embanked and slope graded; 6 st. platforms made ready. 75, 16.

1876. Nine wooden platforms laid; masonry of part of breast-height walls and of 2 magazines completed; 700 c. y. of sand embanked in battery; dike, slopes, and moat repaired. 76, 16.

1877. A few minor repairs executed; no app. made. 77, 13; 78, 15.

1879. Breaches in dike and other damages caused by severe storm repaired; plans for adapting

works for modern heavy ordnance were prepared by B.E., but only partly completed. 79, 19.

Report made Nov. 13, 1878, by Col. J. N. Macomb, on the storm of Oct. 23, 1878, which was, in severity, almost without parallel. The tide attained the unprecedented height of 11 f. 3 in. above l. w., accompanied with wind blowing from ene., veering to ese. and to s., with a velocity of 49 to 72 m. per hour. Dikes breached and badly washed, 4 brs. lifted from position and floated away, many buildings were destroyed, floor of main magazine, torpedo casemate, and other magazines submerged. The greatest d. of water on the parade ground of the fort was 4 f. 9 in.; \$6,600 was est. as the total cost for protection from overflow of the sites of fortifications. 79, 237.

1880-81. Short history of fort given; present condition described; no work done except for protection and repair. 80, 33; 81, 33.

1882. Extensive repairs made to dikes; sluices, parapet, brs., and buildings repaired; fog bell erected on wharf. 82, 30.

1883-86. General repairs made. 83, 27; 84, 31; 85, 25; 86, 25.

1894. Sale of land in vicinity au. and board appointed to report upon price and conditions of sale. 94, 9, 461.

1896. Damage done to wharf and banks by storms in 1893, 1894, and 1896; portion of reservation assigned to Navy Department for magazine purposes, another portion leased to Mrs. M. M. Black; \$3,000 to be expended from R. and H. app. in rebuilding and enlarging dike. 96, 487.

1897. Work on dike placed under contract and completed. 97, 639.

1898. 280' of dike repaired and sluice renewed. 98, 657.

1899. Washout in 1,080' of bank filled in; 370' raised and revetted; total cost, \$1,196. 99, 794.

Part 10, FNH. Fort Mifflin, Pa. (Mortar Battery).

1871. \$21,000 apportioned to the H. of Philadelphia for emplacement of 6 mortars. 71, 26. Proposed to build battery for 6 mortars s. of fort. 71, 16.

1872. Masonry for 2 service magazines carried forward. 72, 13.

1873. Magazines loaded to test soil; sand placed in parapet. 73, 13.

1874. Minor work and repairs executed. 74, 16.

1875-79. No work done for lack of funds. 75, 16; 76, 16; 77, 13; 78, 16; 79, 19.

1880-86. Site of battery and work done described; no work since 1874. 80, 34; 81, 34; 82, 31; 83, 27; 84, 32; 85, 26; 86, 25.

Part 11, FNH. Red Bank, N. J. (Site for the Defenses at).

1873. Site surveyed and plot prepared. Act giving consent of State of New Jersey to purchase of land approved. Position of great importance 73, 13, 14.

1874-78. Repairs made to dikes, buildings, sluices, and fences. 74, 16; 75, 16; 76, 17; 77, 13; 78, 16.

1879. No works constructed on site for lack of funds; dikes injured by storms and partly repaired. 79, 19.

1880-81. Site described and history mentioned; dike repaired. 80, 35; 81, 34.

1882-83. Site described. 82, 31; 83, 27.

1884. Site and conditions described. 84, 32.

1885. Dikes repaired and shore protected. 85, 26; 86, 26.

1896. Meadow banks breached by storm in 1893, no injury to Government property; reservation leased to Mr. C. Whitall; \$2,500 from R. and H. app. to be spent in rebuilding dike. 96, 488.

1897. Work on dike placed under contract and completed. 97, 639.

Part 12, FNH. Fort Delaware, Del. (Stone Fort).

1866. Various minor works of constr. carried on, dock wall built for 195', glacis completed. 66, 12.

1867. Dock wall extended 158'; repairs made to parade wall, glacis, embankment of the isld., quarters, etc. 67, 11.

1868. Dock walls, and ditches extended, sluiceways finished, embankment and quarters repaired. 68, 14, 15.

1869. Minor repairs made to platforms, wharves, etc.; proposed to modify bastions of work to furnish emplacements for heavy guns. 69, 14.

1870. Slight repairs made; app. made by Congress to carry out approved proj.; work required permanent wharf; dock walls to be completed, and large repairs to levees. 70, 20.

1871. Six magazines for large guns constructed of concrete; traverses begun; levee rebuilt for 2,450'; st. revet. relaid and main ditch repaired. Future works specified. 71, 16.

1872. Nine magazines and traverses finished on terreplein; minor work and repairs executed; observations on force and direction of current completed. 72, 13.

1873. Two barbette platforms for 15-inch guns, with breast-height walls, completed; wharf head temporarily rebuilt; proposed work mentioned. 73, 14.

1874. Three remaining platforms for 15-inch guns put down; extensive work done on magazines; iron balconies, etc., of barbette; iron shield used for experimental firing removed; ditches, dike, and wharves repaired. 74, 16.

1875. Breach made by experimental firing repaired; iron balconies built in rear of traverses; st. superstr. commenced for eastern wharf. 75, 16.

1876. Small amount available applied to repairs most necessary on wharves, flagging, buildings, etc. 76, 17.

1877. Damages to wharf and dike caused by severe storm repaired; temporary repairs made to upper wharf. 77, 13.

1878. Operations confined to care and preservation of property and slight repairs. 78, 16.

1879. Isld. submerged and great damage done by storm; dikes repaired; ditches cleaned; brs., sluice gate, etc., rebuilt. 79, 19.

Report made Nov. 6, 1878, by Col. J. N. Macomb, on the storm of Oct. 23 1878. The wind blew from the s. and e. with a velocity at times of 70 m. per hour, and the water rose to a height of 11 f. 7 in. above 1 w., causing the highest tide ever known. Of the 31 buildings exterior to the fort 12 were destroyed and the remainder much damaged. All brs. except 1 were destroyed. \$11,850 was est. as the total cost for protection of this site from overflow. Record of occasional full tides since 1871. 79, 238, 243.

1880-82. Site of work and condition described, also repairs needed; modifications urged; minor repairs made. 80, 35; 81, 35; 82, 32.

1883. Site and importance described; nothing done. 83, 28.

1884. General repairs made. 84, 33.

1885. Repairs made to brs., slopes, fences, buildings, and masonry of platforms; 25 barbette platforms modified to adapt them to modern iron carriages. 85, 26.

1886. Two platforms modified and 7 leveled; small repairs to grounds and ditches. 86, 26.

1898. Special allotment of \$6,000 made to clean moat and ditches of isld., work deferred. 98, 643.

1899. Au. obtained to do work by hired labor. 14,110 c. y. removed from ditches and 6,120 c. y. from moat; methods described. 99, 802.

Part 13, FNH. Fort Mott, N. J. (Finns Point)—Barbette Earthen (10-gun) Battery, Opposite Fort Delaware.

1866-67. Slight repairs made. 66, 12; 67, 11.
1869. Proposed to construct earthen battery for guns of largest caliber. 69, 14.

1870. App. granted for proj. for powerful earthen battery. 70, 20.

1871. Constr. delayed for want of act of cession of jurisdiction by New Jersey. 71, 16.

1872. Jurisdiction to site perfected; preparations for active operations begun. 72, 13.

1873. Wharf nearly completed, temporary buildings built; roads, fences, and dikes worked on; embankment of battery commenced. 73, 14.

1874. Wharf completed; embankment of parapet continued; magazine begun; dike extended; 2 temporary platforms for 15-inch guns and 3 for 10-inch guns placed. 74, 16.

1875. Magazine and shelter room completed; 2 wooden platforms laid, and constr. of 2 st. plat-

forms begun; embankment continued; sea wall extended. 75, 17.

1876. Two st. platforms completed and 2 others begun; 1 magazine built; embankment continued; sea wall rebuilt; fences extended. 76, 18.

1877. Two st. platforms finished; small amount of work done on sea wall, breast-height wall, and slopes. 77, 14.

1878. A few minor repairs made. 78, 17.

1879. Great damage done by October storm; partial repairs made to dike and retaining walls. 79, 20.

1880-82. Works in poor condition; small necessary repairs made. 80, 36; 81, 35; 82, 32.

1883-84. Part of sea walls repaired and raised; continuation of work urged. 83, 28; 84, 33.

1885-86. St. placed along shore where eroded. 85, 27; 86, 27.

Part 14, FNH. Mortar Battery at Finns Point, N. J.

1872. \$20,000 allotted for 6 mortars. 72, 24.

1873. Work commenced 1872; terreplein partly embanked, foundations of 2 magazines put in, and side walls brought up 2'; funds derived from the general app. for mortar batteries. 73, 14.

1874. Sea wall completed; terreplein embanked; masonry of 2 magazines finished; positions of 3 platforms temporarily occupied by 10-inch guns. 74, 17.

1875-78. No operations for want of funds. 75, 17; 76, 18; 77, 14; 78, 17.

1879. Report made Nov. 6, 1878, by Col. J. N. Macomb, on the storm of Oct. 23, 1878. The wind

blew from the s. and e. with a velocity of 70 m. per hour. The water rose to the unprecedented height of 11 f. 5 in. above l. w. Sea walls, wharf, and buildings partly destroyed. Est. cost of repairs and modifications, \$19,560. Record of occasional full tides since 1871. 79, 240, 243.

1879-81. Résumé of work done; magazines in good condition, but sea wall and embankments badly damaged. 79, 20; 80, 36; 81, 36.

1882-86. Work remains in incomplete condition. 82, 33; 83, 29; 84, 34; 85, 27; 86, 27.

Part 15, FNH. Fort Du Pont, Del. (New Fort Opposite Fort Delaware)—Earthen Barbette Battery.

1866-68. Study of defenses for this position to be entered upon. 66, 12. Commencement of operations deferred. 67, 11; 68, 15.

1870. Proj. for earthen battery to mount 20 guns prepared and approved. App. asked for acquisition of site and completion of work. 70, 21.

1871. Measures taken to acquire site; proposed work specified. 71, 17.

1872. Site acquired; temporary buildings, etc., erected and wharf begun. 72, 14.

1873. Wharf and roadway leading to it built; dike nearly completed; embankment of battery commenced. 73, 14.

1874. Dike completed; right wing of battery partly constr.; wooden platforms for two 15-inch guns laid; embankment in front of battery continued; fencing completed; 3 temporary platforms for 10-inch guns constr. 74, 17.

1875. Breast-height wall and parapet partly finished; 2 magazines completed; 4 wooden platforms laid; embankment raised for 400'. 75, 17.

1876. Two magazines completed; breast-height wall continued; torpedo casemate and cable gallery constr.; ramp formed; embankment continued. 76, 18.

1877. Operations of little importance beyond care and preservation of property. 77, 14.

1878. Severe storm entirely swept away top of dike; no work done except for care and preservation. 78, 17.

1879. Résumé of work accomplished to date; fences and br. carried away by storm tide rebuilt; slight repairs executed. 79, 21.

1880. App. recom. for continuing work; well dug; property cared for. 80, 37.

1881. Wharf repaired. 81, 36.

1882. Buildings repaired. 82, 33.

1883-84. No work done. 83, 29; 84, 34.

1885-86. Slight repairs made. 85, 28; 86, 27.

Part 16, FNH. Mortar Battery Near Delaware City, Del.

1872. \$20,000 allotted to fort opposite Fort Delaware for 6 mortars. 72, 24.

1873. Work commenced in December, 1872. Embankment begun, foundations of magazines put in, and side walls commenced. 73, 15.

1874. Terreplein formed; 2 magazines nearly completed; parapet nearly embanked; three 10-inch guns mounted temporarily. 74, 17.

1875-76. No work for lack of funds. 75, 18; 76, 18.

1877. Two unfinished magazines completed. 77, 14.

1878. No work done for lack of funds. 78, 17.

1879-84. Résumé of work accomplished to date; no work done for lack of funds. 79, 21; 80, 37; 81, 36; 82, 33; 83, 30; 84, 34.

1885-86. Work incomplete and damaged. 85, 28; 86, 28.

Part 17, FNH. Battery on Delaware Shore.

1879. Report made Nov. 6, 1878, by Col. J. N. Macomb, on the storm of Oct. 23, 1878. The wind blew from the s. and e. with a velocity of 70 m. per hour. The water rose to the unprecedented height of 11 f. 5 in. The fencing and brs. were

carried away and the wharf and roadway injured. A vessel of 80 t. was beached upon the outer slope of the battery. \$5,030 was the est. cost of repairs and modification. Record of occasional full tides since 1871. 79, 238, 242.

Part 18, FNH. Delaware Breakwater (New Fort Near),

1866. Fort to be made subject of study by board. 66, 12.

1867-68. Work soon to be begun. 67, 11; 68, 15.

1869. Proj. to be prepared. 69, 14.

1873. Extract from laws of Delaware, vol. 14, p. 247—The State of Delaware au. Commission to be app. to meet U. S. Comrs. to arrange for a cession to U. S. of lands on Delaware Bay, s. e. of old U. S. mole * * * the cession to be made on condition that defenses be constructed thereon. 73, 13.

Part 19, FNH. Three-gun Lift Battery (Battery for Three 12-inch Guns on Disappearing Carriages).

1895. \$260,000 allotted for constr. Old works on site removed and contracts entered into for material and plant; drawings nearly completed. 95, 8. Pre. work done; contracts made for concrete plant, pile drivers, piles, engines, etc.; trolley line constr. and naphtha launch purchased. 95, 508.

1896. \$120,000 withdrawn from allotment. 10,922 c. y. excavated for foundations; 3,810 piles driven; officers' quarters torn down; work suspended during summer; electric plant described 96, 483.

1897. Proj. for battery of three 12-inch disappearing guns to replace gun-lift battery approved; est. cost, \$357,200; pile driving practically completed, 4,582 piles in all being driven; large part of plant used on other work. 97, 636.

1898. \$58,000 allotted to complete concrete foundations, \$10,000 withdrawn; remaining piles driven; slip dredged; pile heads cut off; 10,338 c. y. of concrete placed in foundation; sewer built; 3,970 c. y. of sand placed in filling; detailed table given showing cost of concrete and filling. 98, 641.

1899. Allotment made of \$150,000 for constr. of battery; plans remodeled and contracts for materials entered into; concrete work prosecuted vigorously, 13,682 c. y. being placed; ceiling and

side-wall constr., ventilating and water-supply systems described; 2,385 c. y. sand and 3,020 c. y. of other filling placed; part of 1 gun carriage received; abstract of proposals given. 99, 785.

1900. \$12,500 allotted to complete battery; concrete work completed, 30,811 c. y. in all being placed; 2,509 sq. y. of superior slope carefully paved; walls faced with tile; asphalt waterproofing placed; filling in front completed, 17,646 c. y. material being used; electric wiring installed, also ventilating system, trolley, drainage and water-supply systems, ammunition cranes, iron stairways and balconies; electric plant moved to permanent power house; tracks laid; parade graded and flagstone pavements laid; many doors hung; 3 guns and carriages received, unloaded, and mounted at total cost of \$3,858; old ordnance sold; detailed tables given showing cost of materials and handling and of work. 00, 847. Ammunition hoists contracted for. 00, 853.

1901. Boiler and new switchboard set up, electric plant tested, storage battery received, engines overhauled and repaired, chain ammunition hoists completed. 01, 774. Electric plant cared for, guns and carriages cleaned; detailed statement of amount and cost of work given. 01, 775, 776.

Part 20, FNH. Battery of Three 10-inch and Three 12-inch Disappearing Guns.

1896. \$70,000 allotted for constr.; site surveyed and test pits dug; machinery, derricks, cars, tracks, tools, lumber, and concrete material purchased; wharf and meadow bank repaired; concrete plant constr.; 1,500 c. y. excavated for foundations; 1,706 c. y. concrete placed; wharf extended. 96, 486.

1897. Est. cost of three 12-inch emplacements, \$168,400; of three 10-inch emplacements, \$120,000; of parados, \$13,750; of road, \$3,500; addl. allotment made of \$274,680, from which \$25,000 withdrawn; wharf described; battery proper completed; general description given of emplacements, 10-inch containing 15,606 c. y. of concrete, and 12-inch 21,918 c. y.; plant for mixing and placing concrete described in detail; composition of concrete, ceiling constr., air spaces in walls described; roadway begun and parados projected; systems for handling ammunition and for electric lighting and power described; three 10-inch guns and carriages mounted; detailed tables given showing distribution of employees on work and cost of labor and materials. 97, 628-636.

1898. Roadway, electric system, ammunition hoists, latrines, and telephone booths completed;

33,984 c. y. of earth and sand placed in parados; constr. plant torn down and removed; three 12-inch guns and carriages received and mounted; method of mounting described; troops for garrison arrived. 98, 637.

1899. 6,379 c. y. material placed in parados; work twice interrupted; sluiceway of ditch extended; minor work done on battery; leakage into shot chambers stopped; 5 guns fired, but no target practice; drawing shown of 10-inch ammunition hoist. 99, 782.

1900. Battery turned over to Artillery Jan. 6, 1899; parados completed, containing 44,500 c. y., and slopes graded; minor work of mainten. done on battery. 00, 842. Expanded metal ceilings hung to correct dampness in magazines; bracketed gallery erected to connect the 6 platforms; board fence built in rear; tools and supplies purchased. 00, 843. Slopes of parados repaired; electric plant cared for. 00, 844.

1901. Various repairs made; trees set out to hide battery; electric lights placed. 01, 771.

Part 21, FNH. Battery for Two 5-inch R. F. Guns on Balanced Pillar Mounts.

1897. Battery to be built beyond western end of main battery at est. cost of \$20,000; excavation for foundations nearly completed. 97, 636.

1898. Completed in August, 1897; general features of battery and of electric system described; 2 emplacements contain 2,266 c. y. of masonry and embankment 6,944 c. y. of earth; total cost, \$19,529; table given showing cost in detail. 98, 639.

1899. Installation of searchlight plant completed. 99, 784.

1900. Guns and carriages not yet received; platforms cut down and paved. 00, 842. Expanded metal ceilings placed in magazines. 00, 843.

1901. Carriages received and mounted; hoists, wires, beams, etc., painted. 01, 771.

Part 22, FNH. Mortar Battery.

1897. Battery for sixteen 12-inch mortars to be built at est. cost of \$247,180; \$175,000 allotted; proposals issued; wharf extended 336'. 97, 638.

1898. Wharf repaired and extended and transfer br. built; site of battery prepared; methods of handling st., sand, and concrete described; 22,082 c. y. placed in embankment; masonry practically completed, 15,511 c. y. of concrete being placed; electric-lighting system, waterproofing, and pump room completed; 16 carriages and 8 mortars mounted at cost of \$4,619; detailed tables given showing cost of materials and handling. 98, 643.

1899. Height of earth cover reduced and est. of cost revised; \$17,500 allotted and \$25,344 transferred from another work; storage battery set up; metal doors, telephone circuits, and observation

station erected; 91,650 c. y. sand placed in embankment and faced with earth; blast aprons built; arrangement of constr. plant described; battery practically completed; list of expend. given. 99, 790.

1900. Embankment completed; main drain extended and valve placed at outlet; grounds graded and tracks laid; iron stairway and water tank erected; surface drain laid to prevent flooding of galleries; expanded metal ceilings constr. in magazines and electric fans installed; storage battery used. 00, 858.

1901. Four mortars mounted; bedplates grouted; storage battery cared for; turned over to Artillery. 01, 779. \$400 allotted for clearing grounds adjacent. 01, 781.

Part 23, FNH. Two Emplacements for 8-inch Disappearing Guns.

1898. \$74,000 allotted for constr. from app. for "National defense;" agreements entered into for open-market purchase of materials required; work begun Mar. 21, 1898; 944 c. y. excavated for foundations; concrete rapidly placed, platforms constr. first, and both guns and carriages mounted by May 18; masonry completed June 8; 8,340 c. y. concrete being placed; waterproofing and electric system completed; expend. given in detail. **98, 650.**

1899. \$6,000 withdrawn from allotment; embankment begun and completed, 10,737 c. y. sand and earth being placed in it; electric plant and hoists installed and described; battery reported completed Jan. 1, 1899, and turned over to Artillery January 12; rifles and carriages tested, 1 carriage damaged; cost of battery shown in detail. **99, 794.**

1900. Electric plant cared for; earthen slopes repaired; ironwork painted. **00, 862.**

Part 24, FNH. Two Emplacements for 12-inch B. L. Rifles on Barbette Carriages.

1898. \$30,000 allotted for constr. from app. for "National defense;" est. cost, \$93,000; delivery of constr. materials arranged for; 1,330 c. y. excavated for foundations; concrete constr. begun and 6,419 c. y. placed; 1 platform completed; waterproofing and embankment begun. **98, 653.**

1899. Both emplacements completed, containing 9,288 c. y. Rosendale and 659 c. y. Portland concrete; general details of constr. given; waterproofing described; latrines constr.; embankment

completed, containing 22,278 c. y. material; emplacements completed and turned over to Artillery Jan. 12, 1899; 2 guns and carriages received and mounting begun; cost of battery given in detail. **99, 797.**

1900. \$1,500 allotted for mounting guns and carriages; defects discovered in carriages repaired; addl. defects found; mounting completed at cost of \$1,208. **00, 861.** Electric plant cared for and repairs made; earthen slopes repaired. **00, 862.**

Part 25, FNH. Emplacements for Two 4.72 R. F. Guns.

1898. \$19,750 allotted from app. for "National defense;" temporary platforms erected on barbette of old fort and guns mounted 12 days after arrival; proj. approv. for permanent emplacements; site and general design described; plant set up and materials ordered. **98, 654.**

1899. Foundations excavated, and 206 piles driven; 1,325 c. y. concrete and 7,000 c. y. sand

and earth placed; settlement took place in embankment and entrances; battery completed and guns mounted; embankment leveled up; buildings moved out of line of fire; expend. shown in detail. **99, 800.**

Part 26, FNH. Emplacements for 15-pounder R. F. Guns, Two on Left Flank and Two on Right Flank of 12-inch Disappearing Gun Battery.

1899. Allotments made for constr. of \$3,800 and \$4,000, respectively; sites cleared and small amount of concrete placed. **99, 790.**

1900. Emplacements form part of 12-inch battery; concrete of all emplacements completed except over small part of platforms; pavements,

wiring, electric fans, and iron stairways put in place; ammunition hoists contracted for. **00, 857.**

1901. Installation of hoists completed (tracing shown); \$400 allotted for mounting guns and carriages; work completed. **01, 776, 777.**

Part 27, FNH. Emplacements for Two 5-inch R. F. Guns, Wire Wound, Located on Left Flank of 10-inch and 12-inch Battery.

1900. \$17,500 allotted for constr.; derricks set up; constr. materials purchased and stored; proposals given in detail. **00**, 845.

1901. Repairs to wharf; concrete constr. work; sand filling, etc.; detailed statement of work and cost given. **01**, 772, 773.

Part 28, FNH. Emplacements for Two 5-inch R. F. Guns, Wire Wound, Located Between River and Mortar Battery.

1900. \$15,900 allotted for constr.; locomotive repaired; small constr. plant erected; 380 c. y. material excavated for foundations; Rosendale and Portland concrete placed, completing masonry of s. emplacement; 4,864 c. y. sand placed under masonry and in front embankment. **00**, 863.

1901. \$900 allotted. Battery completed; doors, stairways, platforms, etc., put in place; no guns or carriages yet received; battery turned over to Artillery. **01**, 780. Detailed table showing cost and amount of work. **01**, 781.

Part 29, FNH. Emplacements for Two 15-pounder R. F. Guns.

1901. \$16,000 allotted. Constr. work begun plant erected, material excavated for foundation, ceilings of magazines and postern constr. **01**, 777, 778.

1902. Battery completed and turned over; no guns or carriages received. **02**, 695.

Part 30, FNH. Magazine for 3-inch R. F. Guns.

1902. \$2,500 allotted for constr. magazines for storage of 500 rounds at entrance to left casemate for 3-inch R. F. guns; designs completed. **02**, 694

Part 31, FNH. Converting Old Magazines Into Casemates.

1901. \$3,500 allotted. Excavation, grading misc. work. **01**, 773.

1902. Work completed; turned over to Artillery. **02**, 694.

Part 32, FNH. Preservation and Repair.

1898. \$325 allotted. Fences repaired; sluice gates ordered. 98, 650.

1899. Allotments of \$945 and \$150. Electric plant cared for by skilled mechanic. 99, 785, 798. \$1,150 allotted. River bank, sluices, roadway, and sea wall repaired. 99, 793.

1900. Under various allotments, tools and supplies purchased, electric plant cared for, river banks and wharf repaired, and other work done. 00, 843, 844. Wharves filled in, cement purchased, walls of old fort repaired. 00, 856. Under various allotments, electric plant of 8 and 12 inch battery cared for and repaired, wharf repaired, ironwork of mortar

battery painted, earthen slopes repaired. 00, 862. \$300 allotted for repair of river banks; banks placed in good condition. 00, 865.

1901. \$600 allotted for repairs to walls at entrance to 4.72-inch battery; work completed. 01, 777. Electric-light and power plant cared for; defective boiler tubes replaced. 01, 779. \$4,150 allotted for necessary repairs to river banks, wharves, sea walls, etc. 01, 783. Old cement shed torn down. 01, 784.

1902. \$930 allotted. Misc. repairs to property. 02, 698.

Part 33, FNH. Range and Position Finders.

1900. Allotment of \$25, tide gauges constr. and station of type B depression range finder near mortar battery changed. 00, 862.

1901. \$11,300 allotted for battery-commander's station; work begun; foundation completed; materials delivered; constr. work in progress. 01, 782.

1902. Work completed and turned over to Artillery; \$295 allotted for fire-control telephone

system; work completed. 02, 696. Constr. of 2 stations for Rafferty range finders begun; brick-work completed; earth embankment not entirely finished. 01, 782. \$8,300 allotted for battery-commander's station for 10-inch battery; work begun; concrete foundations completed. 02, 696. \$161.36 allotted. Work completed. 02, 697.

Part 34, FNH. Sea Walls and Embankments.

Fort Delaware, Del. Embankment around Fort Delaware Isld. repaired. 66, 12; 67, 11; 68, 15. Large repairs needed, as levees seriously damaged by storm. 70, 20. Repairs made. 71, 16. S. dike damaged by severe storm; repaired. 77, 13. Isld. submerged and dike breached by unprecedentedly high storm tide in October, 1878; damage repaired; est. submitted for raising dikes to 13'. 79, 20. Dikes restored to original height of 11'. 80, 35.

Fort Mifflin. R. wall repaired. 68, 14. 1,700' reconstr. 72, 13. Dike breached by storm on October, 1878; damages repaired; height and dimensions reported inadequate; est. submitted for raising and revetting. 79, 19. Dredgings placed on dikes above naval wharf. 80, 34. Extensive repairs made to dikes. 82, 30. Parts of dike thoroughly repaired. 84, 32; 85, 25. Meadow banks damaged by severe storms. 96, 487. Under contract 2,100' of dike on reservation were rebuilt

and repaired, payment of \$3,000 being made from R. and H. app. 97, 639. 280' of dike repaired, and leaks stopped in main bank. 98, 657. 1,080' repaired and 370' raised and revetted. 99, 794.

Fort Mott, N. J. Dike in front of reservation worked on. 73, 14. Extended from wharf s. to boundary line; sea wall of mortar battery completed. 74, 16. 530' built and 120' rebuilt. 75, 17. Sea wall s. of wharf entirely rebuilt on pile foundation. 76, 18. Great damage done by October storm, 1878; dikes partly repaired. 79, 20. Part of sea wall repaired and raised. 83, 28; 84, 33.

Fort Du Pont. Dike along R. front nearly completed. 73, 14. Completed. 74, 17. Top entirely swept away by severe storm, rendering further repairs useless. 78, 17.

Red Bank, N. J. Meadow banks breached by storm. 96, 488. Dike rebuilt under contract at cost of \$2,500. 97, 639.

Part 35, FNH.

Sites.

Measures taken to acquire site at Fort Du Pont (New Fort opposite Fort Delaware) (Fort Mott). 71, 17; 72, 14. Jurisdiction of U. S. to site at Finns Point perfected. 72, 13. Site for defenses at Red Bank, Gloucester County, N. J., acquired, and act

giving consent of State of New Jersey to purchase of land approved. 73, 13. Part of Fort Mifflin reservation assigned to Navy Department and another portion leased to Mrs. M. M. Black. 96, 487. Reservation at Red Bank, N. J., leased. 96, 488.

Part 36, FNH.

Submarine Mines.

1875. Constr. of torpedo casemate begun at Fort Mifflin. 75, 16.

1876. Fort Mifflin casemate completed. 76, 16. Torpedo casemate and cable gallery constr. at Fort Du Pont. 76, 18.

1885. Torpedoes at Fort Delaware painted and stored. 85, 27.

1887. BE. submitted ests. for 2 mining casemates for Philadelphia. 87, 11.

1891. Proj. prepared and approv. for 1 casemate for Philadelphia. 91, 6.

1892. Allotments made for 2 casemates in 1891; work to be completed in 1892. 92, 8.

1893. One casemate completed at cost of \$37,760 and 1 modified at cost of \$27,765. 93, 8.

1895. All casemates required completed. 95, 9.

1897. \$1,600 allotted for constr. of cable tank; work completed; tank has overhead traveling crane. 97, 637. \$7,200 allotted for constr. of fire-proof torpedo storehouse of brick; plans approv. and material ordered. 97, 638.

1898. Storehouse completed at cost of \$5,588; building described. 98, 649. Casemates and loading room fitted up, dynamite and cables pur-

chased, and everything gotten ready to plant mines upon outbreak of war. Order received April 22; 3 grand groups planted by May 13; planting of mines and apparatus used described; telephones installed; tests made and searchlight installed; condition of mines stated; guard tugs employed. 98, 655.

1899. Total allotment, \$22,200. Mines became detached; mines raised and stored; several found to have been injured; 3 blown up; steel mooring ropes broken; condition of mines described; new cable received; reels too large; all parts of torpedo system put in good condition; cost of various operations stated; material cleaned and painted. 99, 802.

1900. Set of cable-testing instruments purchased. 00, 856. \$200 allotted for care and preservation of material; searchlights overhauled and stored; inspection of torpedo material made. 00, 865.

1901. \$1,500 allotted from "Care and preservation" for lining torpedo cable tank with steel sheets; property cared for, painted, etc. 01, 783.

1902. Work on cable tank completed. 02, 697.

Part 37, FNH. Supplies for Seacoast Defenses.

1901. \$3,000 allotted. Materials purchased and turned over. Three thermometer shelters constr.; electric lights installed. 01, 784.

1902. \$1,000 allotted. Extensive repairs to electric-plant boiler; electric-light installation com-

pleted; water and electric supply mains laid. 02, 698.

FSJ. BALTIMORE, MD., FORTIFICATIONS.

[NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.]

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1897-1900 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1902 |
| 4 | BE..... | 1862-1887 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1897-1901 |
| 7 | Fort, etc. (operations, allotments, etc.)..... | |
| 8 | Fort Carroll..... | 1847-1898 |
| 9 | Fort McHenry..... | 1875-1900 |
| 10 | Lazaretto Point, opposite Fort McHenry..... | 1870-1872 |
| 11 | Rock Point, Md..... | 1897-1898 |
| 12 | Site 1—emplacement, 12-inch gun and three 8-inch guns..... | 1897-1901 |
| 13 | Two emplacements, 4.7-inch R. F. guns..... | 1898-1900 |
| 14 | Two emplacements, 15-pounder R. F. guns..... | 1899-1901 |
| 15 | Site 2—two emplacements, 12-inch B. L. rifles, barbette carriages..... | 1898-1900 |
| 16 | Two emplacements, 5-inch R. F. guns, balanced-pillar mounts..... | 1899-1902 |
| 17 | Two emplacements, 15-pounder R. F. guns..... | 1899-1901 |
| 18 | Remodeling old work..... | 1901-1902 |
| 19 | Site 3—emplacements, eight 12-inch mortars..... | 1897-1902 |
| 20 | Two emplacements, 5-inch R. F. guns..... | 1897-1901 |
| 21 | Two emplacements, 12-inch B. L. rifles, disappearing carriages..... | 1898-1901 |
| 22 | Two emplacements, 6-inch B. L. rifles, disappearing carriages..... | 1899-1901 |
| 23 | Two emplacements, 15-pounder R. F. guns..... | 1899-1900 |
| 24 | Two emplacements, 15-pounder R. F. guns..... | 1900-1901 |
| 25 | Site 4—two emplacements, 6-inch B. L. rifles, disappearing carriages..... | 1899-1901 |
| 26 | Miscellaneous (surface drainage; place storage magazine; roadway; civilian electricians)..... | 1901-1902 |
| 27 | Preservation and repairs..... | 1899-1902 |
| 28 | Range and position finders..... | 1899-1902 |
| 29 | Searchlights..... | 1901 |
| 30 | Sea walls and embankments..... | 1894-1902 |
| 31 | Sites..... | 1895-1902 |
| 32 | Submarine mines..... | 1893-1902 |
| 33 | Supplies..... | 1901-1902 |

Part 1, FSJ.**Contracts.**

1897. One 12-inch and three 8-inch gun emplacements, with wharf, \$122,064.46. Mortar battery for eight 12-inch mortars, with wharf, \$91,513.31. **97**, 646, 649.

1898. Electric-lighting plant, mortar battery, \$2,820. **98**, 662. Two 5-inch R. F. gun battery. \$15,798.50. **98**, 663.

1899. Sea walls and embankments at sites 1 and 3, \$24,967. Portland cement, 1,785 barrels, \$2.18 per barrel. Rosendale cement, 7,150 barrels, 95c per barrel. Brick, \$13 to \$45 per M. **99**, 810. Torpedo storehouse, \$3,293. **99**, 817. Wharf, \$5,481.50. **99**, 818.

1900. Electric-lighting plant, \$1,650. **00**, 866.

Part 2, FSJ.**Engineering Features.**

Cement, slag, for concrete. **98**, 665.
Concrete, cost per c. y. **98**, 659, 661; **99**, 819, 820, 821; **00**, 871, 874. Preventing infiltration of water. **02**, 2463.

Dampproofing. Analysis of the problem. **03**, 2400. Air-spacing experiments. **02**, 2462. Asphaltum; unsatisfactory methods of using. **02**, 2464 (pl.). Copper sheeting. **02**, 2464. Fill; care required in forming. **02**, 2462. Magazines and passages. **02**, 2460, 2464 (pl.); **03**, 2404 (pl.). Magnesia lumber; use of. **02**, 2464. Ventilation, experiments with. **02**, 2461.

Emplacements. Sections. **02**, 2464 (pl.).
Excavation, cost per c. y. **98**, 659, 661.
Grading, cost per c. y. **98**, 659.
Granolithic concrete. **98**, 660; **00**, 871, 874.
Plant, description of. **98**, 664, 666.
Sand containing-water under pressure, method of laying concrete on. **97**, 647.
Waterproofing magazines. **98**, 661, 664; **99**, 818, 819; **00**, 866.

Part 3, FSJ.

Engineers.

Chief of Engineers. Rs., 66, 12; 67, 11; 68, 15; 69, 14; 70, 21; 71, 17; 72, 14; 73, 15; 74, 17; 75, 18; 76, 19; 77, 14; 78, 18; 79, 22; 80, 37; 81, 37; 82, 34; 83, 30; 84, 35; 85, 28; 86, 28; 93, 8; 94, 14; 95, 15; 96, 15, 488; 97, 15, 639; 98, 21, 658; 99, 23, 805; 00, 21, 866; 01, 622; 02, 699; 03, 9; 04, 5, 10; 05, 5; 06, 5; 07, 5; 08, 9; 09, 10; 10, 12; 11, 8; 12, 7.

Part 4, FSJ.

Board of Engineers.

Constituted to consider and report upon the condition of fortifications and what number, if any, could be dispensed with. R., 82, 421; 87, 11.

Part 5, FSJ.

Engineers in Charge.

Capt. C. N. Turnbull, 1866.
Col. W. P. Craighill, 1866-93.
Maj. J. G. Parke, 1868.
Col. J. H. Simpson, 1868-70.
Lt. Col. J. D. Kurtz, 1870.
Capt. C. P. Phillips, 1878.

Capt. T. Turtle, 1883.
Col. P. C. Hains, 1896-99.
Lt. C. W. Kutz, 1898-1900.
Lt. Col. O. H. Ernst, 1900-02.
Col. Peter C. Hains, 1902.

Part 6, FSJ.

Assistant.

Lt. C. W. Kutz, 1897-1901.

Part 7, FSJ—

FORTS AND BATTERIES.

Part 8, FSJ.

Fort Carroll.

1847. Work begun. 80, 38.
1866-67. Preservation. 66, 13; 67, 12.
1868. Work is completed on fronts 1, 2, 3, 4, and 5 up to the springing line of casemate arches of second tier., 68, 15.
1869. Temporary wharf repaired. 69, 14.
1870. Preservation and repair. 70, 21.
1871. Observations made to determine the direction and force of the surface and subsurface currents, for use in placing explosives. 71, 17.
1872-73. Preservation. 72, 14; 73, 15.
1874. One wooden center pintle platform for 15-inch gun laid and temporary parapet erected in

front of it. One 15-inch gun mounted on center pintle carriage; minor repairs. 74, 18.
1875-78. Preservation and repair. 75, 18; 76, 19; 77, 15; 78, 18.
1879. Proj. for completion, by BE. Preservation and repair. 79, 23.
1880-82. Preservation and repair. 80, 38; 81, 38; 82, 35.
1883. About 8,000 sq. f. of graveled felt roofing placed on casemate; and minor repairs. 83, 31.
1884-86. Care and preservation. 84, 36; 85, 28; 86, 29.

Part 9, FSJ.**Fort McHenry.**

1775. Fortifications begun. 80, 37.

1794. Present work built. 80, 37.

1866. Reinforcing pintle centers in exterior battery; substitution of low for high traverse circles; constr. of magazines and traverses. The exterior battery platforms ready for 15-inch guns. 66, 12.

1867. Water battery ready for armament; magazines, bombproofs, and traverses nearly completed. Minor work. 67, 11.

1868. New work of parapets of water battery and magazine coverings consolidated; glacis of water battery re-formed; new drains cut for magazines; and minor work. 68, 15.

1869. Repairs to terreplein of water battery and ditch of main work; brick hoods of magazines increased; defective drains in main work relaid; and minor work on slopes. 69, 14.

1870. Minor repairs to slopes. 70, 21.

1871. Wharf rebuilt and minor work; observations made to determine the direction and force of the surface and subsurface currents for use in placing explosives. 71, 17.

1872. \$21,000 app. Preservation and repair. 72, 14.

1873. \$25,000 app. Work begun on new, large exterior battery; minor repairs to slopes of water battery. 73, 15.

1874. Work on parapet and heavy embankment for the terreplein on front of new earthen

battery; concrete work of 3 magazines; and completing drainage. 74, 17.

1875. \$20,000 app. Minor repairs to revet. of parapet of new battery and exterior battery of main work. 75, 18.

1876. Sand parapet extended; sand covering placed on 3 magazines; terreplein partly graded; and minor repairs to slopes. 76, 19.

1877-78. Preservation and repair. 77, 15; 78, 18.

1879. Breaches in sea wall repaired. Preservation and repair. 79, 22.

1880. Preservation and repair. 80, 38.

1881. Repairs to sea walls, slopes, and drains. 81, 37; 82, 34.

1883. Repairs to slopes, etc. 83, 31.

1884. Repairs to scarps, slopes, and drains. 84, 35.

1885-86. Repairs to slopes, drains, gutters, pavements, and retaining wall of ramp; and building wire fences. 85, 29; 86, 28.

1895-96. Work on sea wall completed. 95, 15; 96, 489.

1897. Grounds back of sea wall graded and seeded. 97, 640.

1898. Minor repairs. 98, 658.

1899. \$1,000 allotted for preservation and repair. 99, 806, 818.

1900. Preservation and repair. 00, 866.

Part 10, FSJ. Lazaretto Point, Opposite Fort McHenry.

1870. Site selected. 70, 21.

1871. Observations made to determine the direction and force of the surface and subsurface currents for use in placing explosives. 71, 17.

1872. \$13,000 app. To be transferred to Fort McHenry. 72, 14.

Part 11, FSJ.**Rock Point, Md.**

1897. Site acquired by condemnation proceedings; \$1,400 allotted for wharf 1,080' long; completed. 97, 649.

1898. Marking boundaries with concrete monuments and inclosing the property with wire fence. 98, 666.

Part 12, FSJ. Site 1.—Emplacement for One 12-inch Gun and Three 8-inch Guns.

1897. Land acquired and \$143,800 allotted for fortifying same; work begun by contract; 13,681 c. y. excavated and placed in parapet and 1,682 c. y. concrete laid; work on sea wall. 97, 641.

1898. \$3,200 allotted for mounting guns and carriages; moving from wharf done by contract; battery completed, including ammunition service and electric plant; summary of work; total cost, \$143,800. 98, 659.

1899. Battery turned over to Artillery; repairs to slopes and power plant; exhaust fans installed to prevent dampness. 99, 806, 818.

1900. Seven electrical exhaust fans installed; roadway built and minor repairs. 00, 866.

1901. \$5,608.57 allotted. System of metal ceiling and drainage partially installed to prevent seepage and condensation. 01, 699.

Part 13, FSJ. Site 1.—Two Emplacements for 4.7-inch R. F. Guns.

1898. \$15,000 allotted. Work begun in April, 1898, under oral agreement, by same firm that built 8-inch and 12-inch battery, and practically completed May 10, 1898. Summary and cost of work. **98, 660.**

1899. Two ammunition hoists installed and guns mounted. Battery turned over to the Artillery. **99, 806, 819.**

1900. Repairs to electric plant and slopes. **00, 867.**

Part 14, FSJ. Site 1.—Two Emplacements for 15-pounder R. F. Guns.

1899. \$6,610 allotted. Work begun in April and practically completed; no guns on hand. Waterproofing. Work on sea walls, grading grounds, and range finder erected. **99, 807, 819.**

1900. Minor details of battery finished; no guns or mounts on hand. Total cost, \$6,860. **00, 867.**

1901. Armament received and mounted by troops. **01, 785.**

Part 15, FSJ. Site 2.—Two Emplacements for 12-inch B. L. Rifles on Barbette Carriages.

1898. \$80,000 allotted. Work begun by hired labor; description of battery and plant. Both platforms built and 2,500 c. y. of concrete placed. Character of site necessitated a number of modifications in type plans. **98, 666.**

1899. Battery completed, power house built, carriages mounted, but no guns on hand. **99, 812, 819.**

1900. Guns mounted and fired to test stability of platforms. Battery turned over to the Artillery. Repairs to earth parapet and electric plant. Cost of battery, including mounting guns and carriages, \$82,647.29. **00, 868.**

Part 16, FSJ. Site 2.—Two Emplacements for 5-inch R. F. Guns on Balanced Pillar Mounts.

1899. \$12,300 allotted. Work begun and completed, except mounting guns and carriages. Summary and cost of work. **99, 812, 819.**

1900. Grounds graded and seeded. No complete carriage or guns on hand. **00, 868.**

1901. Work completed; turned over Aug. 1, 1900. **01, 786.**

1902. Top of 1 carriage mounted during year; battery now completed, with exception of guns. **02, 700.**

Part 17, FSJ. Site 2.—Two Emplacements for 15-pounder R. F. Guns.

1899. \$7,600 allotted. Work begun in March and completed, except minor details; no guns or mounts received. **99, 813, 820.**

1900. Stairway and rails erected. Grounds graded and seeded; flag walks placed in rear of

battery. No guns or mounts on hand. Cost of battery without armament, \$8,706.52. **00, 868.**

1901. Guns mounted; emplacements turned over. **01, 786.**

Part 18, FSJ. Site 2.—Remodeling Old Work,

1900. \$12,800 allotted for removing part of old masonry above the crest line of modern batteries to make it conform, both in appearance and utility, to the modern emplacements; work in progress. 00, 869.

1901. \$4,925 allotted. Pavement and runway constr.; casemate piers refaced; work still in progress. 01, 787.

1902. Top of wall finished off with cement mortar; flashings filled, etc., finishing up work. 02, 700.

Part 19, FSJ. Site 3.—Emplacements for Eight 12-inch Mortars.

1897. \$134,637.25 allotted. Site acquired; work begun by contract; wharf completed and 6,591 c. y. excavated and placed in slope and 1,403 c. y. of concrete placed. 97, 647.

1898. Description of battery. All concrete mixed by hand, guns and carriages mounted, and battery completed under contract. Summary and cost of work. Total cost, \$113,000. 98, 660.

1899. Electric plant installed and battery wired by contract; battery turned over to the

Artillery. Preservation and repair. 99, 813, 820.

1900. Repairs to electric light and power plant. 00, 869.

1901. \$13,500 allotted for placing layer of asphalt all about sides and roofs of magazine shot rooms, passages, etc.; work in progress. 01, 788.

1902. Dampproofing work continued. 02, 701.

Part 20, FSJ. Site 3.—Two Emplacements for 5-inch R. F. Guns.

1897. Work to be done by contract. 97, 647.

1898. \$17,400 allotted. Contract price, \$15,798.50. Work begun Aug. 10, 1897; completed June 1, 1898. Description of battery. No carriages on hand. 98, 663.

1900. Carriages received and mounted; roadway built; no guns on hand. Total cost, \$17,400. 00, 870.

1901. Turned over Oct. 27, 1900. 01, 788.

Part 21, FSJ. Site 3.—Two Emplacements for 12-inch B. L. Rifles on Disappearing Carriages.

1898. \$100,000 allotted. Work begun by hired labor. One platform completed. Description of plant, water supply, and constr. 98, 664.

1899. \$18,500 allotted. Guns mounted, elevators installed, battery wired, and completed in all details and turned over to the Artillery; cost

of battery, \$113,500. Handling and mounting 2 guns and carriages, \$4,561.12. 99, 814, 820.

1900. Repairs to electric plant. Defects in carriages corrected at the expense of the Ordnance Department. 00, 870.

1901. Base for range finders set. 01, 788.

Part 22, FSJ. Site 3.—Two Emplacements for 6-inch B. L. Rifles on Disappearing Carriages.

1899. \$47,000 allotted. Excavation begun. 99, 815.

1900. Carriages mounted; grounded graded and seeded. No guns on hand. Battery turned

over to the Artillery. Cost to date, \$37,933.91. Summary and cost of work. 00, 871.

1901. Trolleys and blocks put in and soap-and-alum wash applied to platforms. 01, 788.

Part 23, FSJ. Site 3.—Two Emplacements for 15-pounder R. F. Guns.

1899. \$11,345 allotted. Work completed, except earth parapet and stairway. Summary and cost of work. 99, 815, 820.

1900. Parapet filled in and sodded; stairway and rail erected; grounds graded and seeded. No guns or mounts on hand. Battery turned over to the Artillery. Total cost, \$10,445. 00, 870.

Part 24, FSJ. Site 3.—Two Emplacements for 15-pounder R. F. Guns.

1900. \$10,000 allotted. 00, 872.

1901. \$460 allotted. Emplacements and roadway constr.; turned over to Artillery. 01, 788.

Part 25, FSJ. Site 4.—Two Emplacements for 6-inch B. L. Rifles on Disappearing Carriages.

1899. \$50,000 allotted. Wharf built by contract. Plant installed. 99, 817, 821.

1900. Battery completed, except wiring and furnishing trolleys and blocks; carriages mounted

and the battery turned over to the Artillery. Total cost to date, \$48,255.54. Summary and cost of work. 00, 874.

1901. Trolleys and blocks put in. 01, 790.

Part 26, FSJ.

Miscellaneous.

Surface drainage. \$295.21 allotted for constr. a system of surface drains on reservation 1; work completed. 01, 785.

Peace storage magazine. Plans submitted. 01, 789.

Roadway. \$3,316.50 allotted to constr. road between mortar battery and 12-inch battery; nothing done. 01, 789. Constr. completed. 02, 702.

Civilian electricians. \$1,650 allotted for pay for services. 02, 703.

Part 27, FSJ.

Preservation and Repair.

1899. \$1,000 allotted. 99, 806. General repairs to batteries at site 1. 00, 868.

1900. \$1,000 allotted. General repairs, site 2. 00, 869. \$1,500 allotted for repairs to site 3. 00, 873. \$320 allotted for site 4. 00, 875.

1901. \$1,700 allotted for reservation 1; repairs made. 01, 786. \$1,200 allotted for reservation 2; repairs etc. made. 01, 787. \$2,500 allotted for

reservation 3; misc. repair work 01, 790. \$650 allotted for reservation 4; mainten. work. 01, 791.

1902. Reservation 1; repairs to wharf, power plants, sea wall etc. 02, 700. Reservation 2; repairs. 02, 701. \$500 allotted. Reservation 3; repairs to various works 02, 703. Reservation 4; repairs. 02, 703.

Part 28, FSJ.

Range and Position Finders.

1899. \$50 allotted erecting range finders at sites 1 and 3. 99, 807.

1902. \$6,000 allotted for reservation 2; battery-commander's station; excavation made; foundations built up; ironwork erected; tower nearly completed. 02, 700. \$200 allotted for reservation

3; concrete bases for Rafferty range finders abandoned; structural iron bases substituted. 02, 702. \$14,600 allotted for 2 battery-commander's stations reservation 3; instrument column, shields, and framework erected. 02, 702.

Part 29, FSJ.**Searchlights.**

1901. Proj. submitted; est. cost \$78,821.05.
01, 791.

Part 30, FSJ. Sea Walls and Embankments.

Fort McHenry. Est. cost of repairs to sea wall, \$10,000. 94, 14. Wall in rear of cemetery, 227' long, completed; rear of site of fort, about 808' long, in progress. 95, 15. \$3,591.51 allotted. Sea wall 808' long completed. 96, 489. \$13,750 allotted. Sea wall built by contract; cost, \$14,214.90. 97, 640.

1901. \$3,000' allotted for reinforcing wall on reservation 1 with concrete; 1 200 l. f. done. 01, 786. \$18,000 allotted for filling behind concrete wall; 9,800 c. y. excavated and placed in fill, and 200 l. f. foundation placed for extension of wall. 01, 789. Reservation 4; \$3,000 allotted. 1,266 l. f. wall, 2' wide at top, 4' wide at base, 5' high, constr. 01, 790.

1902. Reservation 1; 400' built during year completed; concrete wall. 02, 700. Reservation

3; riprap foundation for wall placed; fill completed; sod placed to prevent washouts. 02, 702. Reservation 4; fill work finished; swamp sod placed behind wall to prevent washouts. 02, 703.

Hawkins Point. \$7,000 allotted for repairs to sea wall; work in progress. 97, 641. 3,049 c. y. of riprap and 4,476 c. y. of oyster shells and earth filling placed; cost, \$6,645.40. 98, 659. \$35,000 allotted for sea walls at sites 1 and 3 under contract; some work. 99, 807, 821. 1,600 c. y. of riprap placed on face 6. 99, 820. Sea wall at site 1; completed by hired labor (contract expired). 00, 867. Sea wall at site 3 completed by hired labor. 00, 872. \$3,000 allotted for sea wall at site 4. 00, 875.

Part 31, FSJ.**Sites.**

Three sites needed for batteries. 95, 14. \$46,500 allotted for sites at North Point, 28½ acres; Hawkins Point, 12.47 acres; and Rock Point 100 acres. 96, 489. \$4,500 paid for land at Hawkins Point.

97, 641. Site at North Point purchased, \$13,500 paid. 97, 647. \$27,500 paid for 100 acres of land at Rock Point 97, 649. \$155.55 allotted for survey, reservation 1; made. 02, 700.

Part 32, FSJ.**Submarine Mines.**

1893. Mining casemate nearly completed. 93, 8.

1898. Mines planted. 98, 22.

1899. Mining casemate at site 2 waterproofed. \$6,240 allotted for operating mine field and removal and storage of torpedo material. 99, 813. \$6,670 allotted for mining casemate; nearly finished. Summary and cost of work. 99, 816, 821. \$5,000 allotted for torpedo storehouse under contract. 99, 816. \$3,500 allotted for cable tank; completed and crane erected. Summary and cost of work. 99, 817, 821.

1900. Est. of \$9,550 for mining casemate at site 1 approv.; no funds. 00, 868. Casemate at site 3 practically completed and torpedo store-

house built. 00, 872. \$500 allotted for site 4; no expend., as torpedo material was stored and cared for by Engr. force. \$1,000 allotted for supplies for seacoast defenses; no requisition as yet. 00, 875

1901. \$9,000 allotted for constr. mining casemate, reservation 1; excavation made; concrete brought up to height of roof beams. 01, 785. Reservation 3; telephone conduit between casemate and storehouse completed; other misc. work done. 01, 789. Storehouse and cable tank completed; turned over to Artillery. 01, 789. Material cared for. 01, 791.

1902. \$1,202.29 allotted for mining casemate, reservation 1; work completed. 01, 699.

Part 33, FSJ. Supplies for Seacoast Defenses.

1901. \$1,400 allotted for enlarging coal bin in rear of 12-inch emplacement. 01, 785. \$1,000 allotted. Supplies purchased and distributed. 01, 791.

1902. Work of enlarging coal storage completed. 02, 699. \$363.04 allotted. Supplies purchased and furnished. 02, 704.

FSK. WASHINGTON, D. C., FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1896-1902 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1912 |
| 4 | BE..... | 1882-1889 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1892-1899 |
| 7 | Forts, etc. (operations, allotments, etc.)..... | 1816-1902 |
| 8 | Potomac R., Md.—Fort Washington..... | 1816-1886 |
| 9 | Fort Foote..... | 1862-1902 |
| 10 | Left bank—2-gun battery..... | 1892-1900 |
| 11 | Two 10-inch gun emplacements..... | 1896-1900 |
| 12 | R. F. battery—two 4-inch Driggs-Schroeder guns..... | 1898-1900 |
| 13 | Two emplacements, 10-inch guns, disappearing carriages..... | 1898-1900 |
| 14 | Battery B, eight 12-inch mortars, B. L. rifles on carriages, model 1896..... | 1899-1902 |
| 15 | Battery, two 15-pounder R. F. guns..... | 1899-1901 |
| 16 | Battery, two 6-inch R. F. guns..... | 1899-1902 |
| 17 | Right bank—3 emplacements, 8-inch guns, disappearing carriages..... | 1897-1902 |
| 18 | Emplacements, two 5-inch R. F. guns..... | 1899-1902 |
| 19 | Battery, three 15-pounder R. F. guns..... | 1900-1902 |
| 20 | Miscellaneous (electric lighting, etc.; passageways; mounting guns, etc.; obstructions in Potomac R.; telephone booths; experimental parapets, etc.)..... | 1866-1902 |
| 21 | Preservation and repair..... | 1898-1902 |
| 22 | Range and position finders..... | 1898-1902 |
| 23 | Sites..... | 1892-1893 |
| 24 | Submarine mines..... | 1891-1899 |
| 25 | Supplies..... | 1900-1902 |

Part 1, FSK.**Contracts.**

1896. Small st., \$1.88 per c. y.; granolithic st., \$2.08 per c. y.; brick, \$12 per M; Rosendale cement, 99½¢ per barrel; Portland cement, \$2.37 per barrel. **96**, 490.

1897. Rosendale cement, 4,000 barrels, 84½¢ per barrel. **97**, 652. Two emplacements for 8-inch guns, including wharf, \$58,683.96. **97**, 653.

1898. Natural cement, 4,000 barrels, 61¢ per barrel; sand, 1,000 c. y., 40¢ per c. y.; pebbles, 1,000 c. y., 59¢ per c. y.; riprap st., 1,300 c. y., \$1.35 per c. y.; broken st., 1,550 c. y., \$1.50 per c. y. **98**, 672.

Electric light and power plant, \$7,683.92; I beams, 1,423 pounds, 2½¢ per pound. **98**, 674, 678.

1900. Rosendale cement, 5,000 barrels, \$1.12½ per barrel. **00**, 881.

1901. Iron and steel roofs, \$1,185; stairs, railings, and ladders, \$1,460.43; tram rails, trolleys, and hoists, \$1,450; furnishing and erecting lifts and cranes, \$1,730. **01**, 798. Furnishing and delivering stairs, \$180; roof, \$395.

1902. Installing electric plants, \$4,718, \$2,895, and \$3,975. **02**, 707, 710.

Part 2, FSK.**Engineering Features.**

Concrete, settlement of. **00**, 877.

Waterproofing. **98**, 663.

Experimental parapet. **98**, 668; **99**, 126 **00**, 880.

Part 3, FSK.**Engineers.**

Chief of Engineers. R., 66, 13; 67, 12; 68, 15; 69, 14; 70, 21; 71, 17; 72, 14; 73, 15; 74, 18; 75, 19; 76, 20; 77, 16; 78, 19; 79, 23; 80, 39; 81, 38; 82, 35; 83, 31; 84, 36; 85, 29; 86, 29; 91, 5; 92, 7; 93, 8; 94, 10; 95, 9; 96, 16, 490; 97, 15, 650; 98, 22, 667; 99, 24, 822; 00, 22, 876; 01, 23; 02, 23; 03, 9; 04, 5; 9; 05, 5; 06, 5; 07, 5; 08, 9; 09, 10; 10, 12; 11, 8; 12, 7.

Part 4, FSK.**Board of Engineers.**

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. R., 82, 421; 87, 11; 89, 6.

Part 5, FSK.**Engineers in Charge.**

Maj. B. S. Alexander, 1866.
Maj. J. A. Tardy, 1867.
Col. H. Brewerton, 1868.
Maj. N. Michler, 1870.
Lt. Col. J. D. Kurtz, 1870.
Lt. Col. W. P. Craighill, 1870-83.
Capt. C. B. Phillips, 1878.

Capt. T. Turtle, 1883.
Lt. Col. P. C. Hains, 1883-92.
Maj. L. C. Overman, 1892.
Capt. T. Turtle, 1892.
Maj. C. E. L. B. Davis, 1892-96.
Lt. Col. C. J. Allen, 1896-1902.
Maj. W. M. Black, 1902.

Part 6, FSK.**Assistants.**

Lt. G. A. Zinn, 1892-94.
Lt. D. DuB. Gaillard, 1895-96.

Lt. G. P. Howell, 1896-97.
Lt. J. J. Morrow, 1897-99.

Part 7, FSK—**FORTS AND BATTERIES.****Part 8, FSK. Fort Washington, Potomac River, Md.**

1816. Work begun. 80, 39.

1866. The necessary ameliorations to be considered by BE. 66, 13.

1870. Importance of fort. Modification plans being prepared. 70, 22.

1871. Observations made for determining the direction and force of the surface and subsurface currents, for use in placing explosives. 71, 18.

1872. \$21,000 app. Projs. of earthen barbette batteries immediately n. and s. of main work, as well as modification plans of existing water battery, prepared. 72, 15.

1873. \$25,000 app. Work begun in March on removal of old demilune not required by new plans; completion of exterior supporting bank of earth for sand parapet; excavations for traverse magazines made, and some concrete work. 73, 16.

1874. Work on demilune, masonry of traverse magazines, and embankments; 2 platforms be-

tween traverse magazines completed, and work on other platforms. Title to an adjoining 300-acre tract nearly perfected. 74, 19.

1875. Pintles set in 4 new platforms; minor work and repairs; adjoining tract of land purchased. Survey of entire territory completed. 75, 19.

1876. Repairs of wharf, cribwork, and minor repairs. 76, 20.

1877. Repair of br. at sally-port entrance, wharf, fences, and cribwork. 77, 16.

1878. Revised proj. prepared. Repairs of wharf and roofs of 2 principal magazines. 78, 20.

1879. Repair of wharf, etc. 79, 24.

1880-85. Preservation and repair. 80, 39; 81, 39; 82, 37; 83, 32; 84, 37; 85, 30.

1886. Traverse rails and pintle plates for four 15-inch gun platforms laid. Repair of slopes, magazines, and fences. 86, 30.

Part 9, FSK. Washington, D. C.—Fort Foote, Potomac River, Md.

1862. Work begun. 80, 39.
1870. Importance of fort. Survey and minor repairs of ground exterior to the existing works. 70, 21.
1871. Wharf rebuilt. Observations made for determination of the direction and force of the surface and subsurface currents for use in placing explosives. 71, 17.
1872. \$21 000 app. Modification plans approv.; arrangements made for purchase of site. 72, 14.
1873. \$25,000 app. Site acquired and work begun in April on completion of wharf and necessary structures for execution of work; earth embankment for new parapet nearly completed. 73, 15.
1874. Work on earth embankments and slopes, drains, masonry in magazines and wing wall;

wharf extended; foundations of 4 front pintle gun platforms completed. 74, 13.

1875. Completing platforms; work on masonry of magazines. Land acquired to afford the garrison an outlet to the Piscataway Road. 75, 19.
1876. Repairs of cribwork and wharf. 76, 20.
1877. Two new front pintle 15-inch gun platforms provided with traverse circles, and a temporary wooden breast height built in front. 77, 16.
1878-85. Preservation and care. 78, 19; 79, 23; 80, 39; 81, 38; 82, 36; 83, 32; 84, 37; 85, 30.
1886. Traverse rails and pintle plates laid for two 15-inch guns; repair o. quarters, roads, and slopes. 86, 30.
1901. \$50 allotted. Repairs to wharf and roadway. 01, 791.
1902. \$50 allotted. Minor repairs. 02, 704.

Part 10, FSK. Left Bank of Potomac River, Md.—Two-gun Battery.

1892. \$117,150 allotted, 1891. Plans approv.; work begun in September, 1891; wharf built, plant erected, and excavation in progress. 92, 4, 7.
1893. Excavation completed; concrete work begun. 93, 8.
1894. Two emplacements completed, awaiting decision of details of carriages. 94, 10.
1896. \$20,826 allotted, 1895. Emplacements nearly completed. Total cost to date, \$141,403.03. 96, 16, 491.

1897. Guns mounted and battery completed. 97, 651.
1899. Electric-light plant installed and repairs of granolithic covering on superior slope. 99, 822.
1900. Battery turned over to the commanding officer July 6, 1899. 00, 876.

Part 11, FSK. Left Bank of Potomac River, Md.—Two 10-inch Gun Emplacements.

1896. \$50,000 allotted. Work begun on 1 emplacement. 96, 16.
1897. Emplacement practically completed and gun mounted in May, 1897, on a disappearing carriage, L. F. model 1894. \$41,500 allotted for another emplacement, which was begun in June; excavation nearly completed. 97, 652.
1898. Gun mounted on a disappearing carriage, L. F. model, 1896, and battery practically completed; minor work required. 98, 667.

1899. Stairs and railways erected; observation station for type B range finder built; cement floor placed in dynamo room; tile partition built between boiler and dynamo room; and electric plant installed. 99, 822.
1900. Battery turned over to the commanding officer July 6, 1899. 00, 876.

Part 12, FSK. Left Bank of Potomac River, Md.—Rapid-fire Battery—Two 4-inch Driggs-Schroeder Guns.

1898. \$13,150 allotted. Work begun in May: old magazine removed, concrete floors of both magazines and about half that in walls of 1 magazine placed; both guns being mounted. 98, 670.

1899. Mounting of guns completed and battery completed. Summary of work. 99, 824.
1900. Battery turned over to the commanding officer July 6, 1899. 00, 876.

Part 13, FSK. Left Bank of Potomac River, Md.—Two Emplacements for 10-inch Guns on Disappearing Carriages.

1898. \$92,300 allotted. Work begun in March; concrete work two-thirds completed. 98, 670.

1899. \$1,000 allotted. Guns and carriages mounted and battery completed. Summary of work. 99, 823.

1900. Battery turned over to the commanding officer July 6, 1899. 00, 876.

Part 14, FSK. Left Bank of Potomac River, Md.—Battery E, for Eight 12-inch Mortars, B. L. Rifles on Carriages, Model of 1896.

1899. \$113,000 allotted. Work begun in August, 1898; excavation completed. 4,478 c. y. concrete placed and 16 400 c. y. earth placed in embankment. Battery about half completed. 99, 824.

1900. Concrete work on magazines and parapets completed; asphalt covering of magazine placed; no mortars received; base rings to be taken up and leveled. Summary and cost of work. 00, 877.

1901. \$4,000 allotted. About 12% of constr. work remained to be done; completed; electric lights installed and mortar mounting accepted 01, 792 Base rings reset; platforms tested. 01, 793.

1902. Electric-light plant installed 02, 705.

Part 15, FSK. Left Bank of Potomac River, Md.—Battery for Two 15-pounder R. F. Guns.

1899. \$9,500 allotted. Work begun in March on excavation and placing concrete. 99, 825.

1900. Work completed except gun platforms, awaiting arrival of mounts. 00, 879.

1901. Railings set. 01, 794.

Part 16, FSK. Left Bank of Potomac River, Md.—Battery for Two 6-inch R. F. Guns.

1899. \$59,180 allotted. Work begun in June. 99, 826.

1900. Difficulty in obtaining material; 395 c. y. concrete placed, 3,000 c. y. excavation and embankment made; about 25% of work done. 00, 873.

1901. \$5,450 materials received; installation ammunition hoists, concrete constr. completed; base

rings set, embankments built, roadway and gutters constr.; battery 92% completed. 01, 794.

1902. Electric conduit and trolley beams installed; roadway and gutters finished; work completed; carriages mounted, guns received. 02, 705.

Part 17, FSK. Right bank of Potomac River, Va.—Three Emplacements for 8-inch Guns on Disappearing Carriages.

1897. \$106,125 allotted. Work to be done under contract begun in January. 11,623 c. y. excavated, 5,537 c. y. placed in embankment, drainage system put in. 97, 652.

1898. Wharf completed. Excavation and concrete work completed. \$1,850 allotted for mounting guns and carriages; completed. Method of work described. \$120 allotted; 3 telephone booths built. 98, 878.

1899. Completing details of machinery, doors, roadway; covering the embankment with soil. 99, 832

1900. Battery turned over to the commanding officer Jan. 13, 1900. 00, 885.

1901. Minor repairs. 01, 793.

1902. Electric light and power plant installed. 01, 704.

Part 18, FSK. Right Bank of Potomac River, Va.—Emplacements for Two 5-inch R. F. Guns.

1899. \$14,500 allotted. Work begun in November, 1898. Excavation and concrete work in progress. Platforms delayed because of nondelivery of the gun mounts. **99, 832.**

1900. Work suspended; about three-fourths completed; funds exhausted; no mounts received. **00, 884.**

1901. \$2,700 allotted. Gun platforms and parapets finished; cylinders of gun mounts set; batteries practically finished. **01, 798.**

1902. Erection of railing and general care of batteries; guns received, 1 mounted. **02, 708.**

Part 19, FSK. Right Bank of Potomac River, Va.—Battery for Three 15-pounder R. F. Guns.

1900. \$15,100 allotted. No work done. **00, 884.**

1901. Materials purchased; work commenced; about 60% concrete laid; constr. work one-half done. **01, 799.**

1902. Parapets and earth embankments built; drainage system completed. **02, 708.**

Part 20, FSK. Miscellaneous.

Electric, light and power plant—Left bank of Potomac R., Md. **1898.** \$8,250 allotted. Work to be done by contract. **98, 670.**

1899. Plant installed and tested. Description of plant. Total cost of plant in place, \$7,970.50. **99, 827.**

Electric light and power plant—Right bank of Potomac R., Va. **1899.** \$9,032.57 allotted. Work begun on power house and cistern; both completed except floor of power house. **99, 833.**

1900. House completed ready for engine and boiler. Plant not yet installed. **00, 885.**

1901. \$4,800 allotted for plant with a 25-kilowatt generator. **01, 799.**

1902. Cistern and building for housing engine, boiler, and dynamo completed; aerial pole line erected. **02, 708.**

Elevated rear passageways. **1901.** Left bank: \$2,600 allotted for connecting gun platforms and observing station; constr. begun; work 30% completed. **01, 796.** Right bank: \$1,485 allotted. Work 25% completed. **01, 800.**

1902. Left bank: Work completed. **02, 706.** Right bank: Work completed. **02, 709.**

Mounting 10-inch gun on barbette—Left bank of Potomac R., Md. **1898.** \$1,750 allotted for mounting for defense the 10-inch gun and carriage sent for experimental firing; platform was built in May and gun and carriage mounted. **98, 671.**

1899. Gun removed from its temporary position and mounted on its platform in readiness for firing at targets. **99, 824.**

Washington, D. C.—Obstructions of the Potomac R. **1866-69.** Several methods of preparing and estab. suitable obstructions under consideration. **66, 13; 67, 12; 68, 15; 69, 15.**

1870-76. Not found practicable to make the desired experiments upon these obstructions; material stored at Fort Foote. **70, 21; 71, 17; 72, 14; 73, 15; 74, 18; 75, 19; 76, 20.**

1877. Building in which material was stored repaired. **77, 16.**

1879-80. Repair of buildings. **79, 23; 80, 39.**

Washington, D. C.—Telephone booths. **1898.** Batteries B and C, \$160 allotted; work completed and the booths set in place. **98, 670.**

Experimental parapets and platform—Left bank of Potomac R., Md. **1898.** \$20,250 allotted for building experimental parapets, shield, and platform, and parapet for gun. Work begun in December, nearly completed. **98, 668.**

1899. \$1,500 allotted. Gun mounted and work completed. Parapets tested June 29, 1899. **99, 826.**

1900. Removing loose concrete so as to trace the path of the projectile, and minor repairs. **00, 880.**

1901. Gun and carriage shipped away; gun platform filled up and graded. **01, 795.**

Part 21, FSK. Preservation and Repair.

1898. Three buildings repaired for employees. 98, 668. Repairs of mining casemates; strengthening the parapet in front of 15-inch guns; fitting up a field magazine for 15-inch gun. \$175 allotted for dismantling and shipping two 15-inch guns and carriages. Minor repairs of wharf, cisterns, fences, etc. 98, 669. \$500 allotted for purchase of some equipage, painting concrete surface of emplacement, and clearing fronts of guns. 98, 671. Wire fence 5' high built around 8-inch emplacement at cost of \$340. 98, 678.

1899. Left bank of Potomac R., Md.: \$6,678 allotted. Roller paths of two 15-inch S. B. guns taken up and shipped; superior slope injured by firing, repaired; slopes, roadways, drainage, torpedo material, and ammunition lifts, etc., repaired. 99, 830. \$954 allotted for repairs of earth slopes and roadway of Battery G; minor repairs. 99, 834. \$550 allotted for emergency purposes. Right bank

of Potomac R.: Cutting timber to afford a clear field of fire for the three 8-inch guns. Work completed. 99, 834.

1900. \$2,892 allotted for emplacements on left bank of R. Searchlight outfits cared for, quarters repaired, and minor work. 00, 880. \$1,354 allotted for emplacements on right bank of R., repairs of slopes, drains; altering ammunition hoists and minor work. 00, 885.

1901. \$1,225 allotted for misc. repair work; magazines and corridors lined with tile, left bank Potomac R. 01, 797. \$725 allotted. Right bank; repairs to ammunition lift; drains cleaned, rubbish removed, etc. 01, 801.

1902. Left bank: \$310 allotted. Repairs made to ammunition lifts, parapet 10-inch battery, slopes; grass and weeds cut. 02, 706. Right bank: Batteries cared for and cleaned up; misc. repair work done; \$110 allotted. 02, 709.

Part 22, FSK. Range and Position Finders.

1898. Batteries B and C—\$350 allotted for 2 observing stations; work completed. 98, 670.

1899. \$93 allotted for mounting 2 type B range finders each at Batteries B, C, and D. Work completed in October, 1898. 99, 830. \$100 allotted for taking accurate horizontal measurements and making blue prints for location of range finders; work completed. 99, 830. \$3,692 allotted for battery-commander's station at Battery D. \$222 allotted for 2 type B range finders at Battery G. Work begun. 99, 830, 833.

1900. \$20,720 allotted for battery-commander's

station at 10-inch batteries; stations about three-fifths completed. 00, 879. \$4,259 allotted for battery-commander's station near the 8-inch battery; work about 60% finished. 00, 885.

1901. Left bank: Battery-commander's station practically finished. 01, 794. Right bank: Battery-commander's station practically finished. 01, 800.

1902. Left bank: Stations turned over Aug. 29, 1901. 02, 706. Right bank: Work on stations completed; turned over Aug. 26, 1901. 02, 709.

Part 23, FSK. Sites.

Sheridans Point, below Washington, D. C. \$13,576.87 paid for 90.6 acres by appraisalment. 92, 9; 93, 11.

Part 24, FSK. Submarine Mines.

1891. One mining casemate being built. 91, 7.

1893. Mining casemate completed; cost, \$15,784.95. 93, 8.

1898. Cable storage tanks completed. 98, 667. \$4,900 allotted for a brick storehouse for submarine mine material. Walls and roof completed. 98, 668. Waterproofing mining casemate. 98, 669. \$3,500 allotted for purchase of explosives. \$13,725 allotted for planting mines; casemates fitted up and machinery installed; 3 triangulation stations laid out and mines planted. 98, 675. \$925 allotted for observing tower and range-finding station; completed. 98, 678.

1899. Cable-storage tank, small addition made

to foundation at front of shed, and a gravel platform built in front of it; minor work. 99, 827. Storehouse for submarine mine material; floor 1 foot thick built; storeroom for confidential and delicate apparatus built; racks for mine cases put up; sea wall built along R. front and building completed. 99, 827. \$4,500 allotted for extending the mining casemate; work begun and excavation nearly completed. 99, 828. \$9,746 allotted for torpedo defense; all mines and cables removed from R., cleaned, and stored; searchlight operated. Unloading mines described. 99, 828.

1900. Extension to the mining casemate built in 1891 completed. 00, 880.

Part 25, FSK. Supplies for Seacoast Defenses.

1900. \$600 allotted. Nothing done. 00, 881.

1901. Supplies purchased and issued. 01, 796.

1902. \$355 allotted. Boiler electric plant put in order; supplies purchased and issued. 02, 706.

FSL. HAMPTON ROADS, VA., FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1887-1902 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1912 |
| 4 | BE..... | 1862-1885 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1891-1898 |
| 7 | Forts, etc. (allotments, operations, etc.)..... | 1817-1912 |
| 8 | Fort Monroe, Old Point Comfort, Va..... | 1817-1886 |
| 9 | Fort Wool (Fort Calhoun)..... | 1818-1901 |
| 10 | Redoubt A—Emplacements, 10-inch guns..... | 1892-1898 |
| 11 | Emplacement, one 10-inch gun..... | 1893-1898 |
| 12 | Mortar battery, sixteen 12-inch mortars..... | 1895-1902 |
| 13 | Platform, 8-inch rifle on A. R. F. barbette carriage, model 1892..... | 1898 |
| 14 | Redoubt B (left half)—Emplacement, 10-inch gun on spit..... | 1897-1901 |
| 15 | Redoubt B-C—Three 10-inch gun emplacements..... | 1898-1901 |
| 16 | Four 4.72-inch R. F. gun emplacements..... | 1898-1899 |
| 17 | Platforms, four 8-inch rifles on parapet..... | 1898-1899 |
| 18 | Emplacement, 10-inch gun in bastion..... | 1899-1902 |
| 19 | Battery, three 12-inch guns..... | 1899-1902 |
| 20 | Emplacements, four 15-pounder R. F. guns..... | 1900-1902 |
| 21 | Emplacements, two 6-inch R. F. guns..... | 1901-1902 |
| 22 | Emplacements, two 12-inch guns..... | 1901-1902 |
| 23 | South side of chan.—Emplacements, two 6-inch R. F. guns..... | 1902 |
| 24 | Emplacements, four 3-inch R. F. guns..... | 1902 |
| 25 | Miscellaneous (electric plant; ammunition hoist; maneuvering installation; destruction of loaded mine; M. B. electric plant; M. B. azimuth circles; railings; speaking tubes; tide gauges; gallery; walks; bridge, Mill Creek, Va.; reinforcing magazines; sewerage system; wharf)..... | 1899-1902 |
| 26 | Preservation and repairs..... | 1898-1902 |
| 27 | Range and position finders..... | 1897-1902 |
| 28 | Sea walls and embankments..... | 1891-1902 |
| 29 | Sites..... | 1892 |
| 30 | Submarine mines..... | 1891-1900 |
| 31 | Supplies..... | 1901-1902 |
| 32 | Water supply..... | 1868-1893 |

Part 1, FSL.**Contracts.**

1887. Wharf, \$88,305. 88, 806.
 1889. Storehouse, \$7,440. 90, 386.
 1897. Tower and wooden building for range finder, \$1,179. 97, 660.
 1898. Electric-light plant, \$4,420. 98, 685.
 1899. Concrete storage tank, \$1,769.50. 99, 840.
 1900. American cement, 66¢ per barrel; Portland cement, \$2.30 per barrel; broken st., \$1.389 per c. y.; granolithic st., \$1.389 per c. y.; Rosendale cement, \$1.05 per barrel. 00, 888, 891.
 1901. Material for battery-commander's station, \$2,695. 01, 805.

1902. Steel I beams, 2.7¢ per pound; connection plates, bolts, etc., 4¢ per pound; st. (broken), 1 and 2 inch, \$1.58 per c. y.; Portland cement, \$1.40 per barrel. 02, 712. Yellow pine lumber, \$600; broken st., \$1.50 per c. y.; anchor bolts, I beams, etc., prices listed. 02, 713. Steel and iron for fire-commander's and battery-commander's stations, \$14,547. 02, 715. Wharf, \$7,450; yellow pine lumber, \$593.80; anchor bolts, I beams, etc., prices listed; Portland cement, \$1.51 per barrel; broken st., \$1.50 per c. y. 02, 720.

Part 2, FSL.

Engineering Features.

Concrete mixing. 99, 843.
 Condensation, preventing. 05, 3009.
 Dampproofing. 04, 3721. Hollow brick. 05, 3009 (pl.).
 Datum points. 04, 3721 (pl.).
 Flash plates. 99, 835.
 Materials, detailed cost of. 97, 657, 658, 660; 98, 684; 99, 844; 00, 888.

Mines, method of unloading. 99, 842.
 Range-finder tower, description of. 97, 661.
 Sewerage system, report on, with detailed cost 97, 663.
 Ventilating system, description of. 00, 893.
 Waterproofing. 98, 679; 00, 893.

Part 3, FSL.

Engineers.

Chief of Engineers. R., 66, 13; 67, 12; 68, 15; 69, 15; 70, 22; 71, 18; 72, 15; 73, 16; 74, 19; 75, 19; 76, 21; 77, 17; 78, 20; 79, 24; 80, 40; 81, 39; 82, 36; 83, 32; 84, 37; 85, 31; 86, 30; 88, 107; 89, 12; 90, 9, 385; 91, 8, 10, 530; 92, 8, 10, 465; 93,

9, 635; 94, 10, 14; 95, 9, 508; 96, 16, 492; 97, 16, 657; 98, 23, 679; 99, 25, 834; 00, 23, 886; 03, 9; 04, 5, 9, 10; 05, 5; 06, 5; 07, 5; 08, 9; 09, 10; 10, 12, 11, 8, 12, 7.

Part 4, FSL.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. R., 82, 421.

Constituted, 1886, by S. O. No. 268, Nov. 17, 1886, to select and report upon site and plan for wharf. R., 88, 805. (Col. Tidball and Lt. Cols. Chandler and Hains.)

Part 5, FSL.

Engineers in Charge.

Col. H. Brewerton, 1866-70.
 Maj. W. P. Craighill, 1870-75.
 Col. Q. A. Gillmore, 1875-86.
 Capt. J. C. Post, 1883.
 Lt. Col. P. C. Hains, 1887-92. R., 88, 804; 89, 463; 90, 385; 91, 529.

Maj. L. C. Overman, 1892.
 Capt. T. Turtle, 1892.
 Maj. C. E. L. B. Davis, 1892-93.
 Maj. T. L. Casey, 1896.
 Maj. J. B. Quinn, 1900-02.
 Col. Peter C. Hains, 1902.

Part 6, FSL.

Assistants.

Lt. G. A. Zinn, 1891-94.
 Lt. D. DuB. Gaillard, 1895; (Capt.) 1896.
 Lt. C. A. F. Flagler, 1896.

Lt. C. W. Kutz, 1896-97.
 Lt. F. A. Wilcox, 1898-99.
 Lt. E. H. Schultz, 1898.

Part 7, FSL. FORTS AND BATTERIES.

Part 8, FSL. Fort Monroe, Old Point Comfort, Va.

1817. Work begun. 80, 40.

1866. Reinforcement of gun platforms; regrading ramp surfaces; alterations made to adapt water battery to the new 10-inch gun armament; several front pintle platforms for 15-inch guns built in the covered way; and minor work. 66, 13.

1867. Relaying platforms; brs., st. pavements, and slopes, etc., repaired; repairing embrasures, removing traverse circles, and constr. 18 projectile platforms of water battery. 67, 12.

1868. Repairs to floors and embrasures of casemates, terreplein, slopes, and ramp, and grading roadway; repairs to roofs of casemates in water battery and covered way, and minor repairs; 490' of wooden breast-height repaired or rebuilt in the redoubt; a st. wall 80' long built to support foot of glacis, and repairs to slopes. 68, 16.

1869. Center pintle platforms for 15-inch guns built in front 4 and parapet increased in thickness; front pintle platform for 15-inch gun built in covered way; grading 1,000 l. f. of roadway; work on drains, cleaning scarp walls, and repairing terreplein slope and ramps. Water battery—repairs to roofs of casemates, rebuilding part of sustaining wall in rear of 2 platforms, and minor repairs. 69, 15.

1870. Modification plan prepared. General repairs to pavements, cisterns, terrepleins, ramps, roadway, and break'r. 70, 22.

1871. General repairs. Summary of work. 71, 18.

1872. \$42,500 app. Repairing and rebuilding three 15-inch gun platforms; replacing pintle stones injured by experimental firing of 1871; rebuilding 2 front pintle 15-inch gun platforms in covered way and minor work. 72, 15.

1873. \$40,000 app. Six shot furnaces removed. Two casemates floored and plastered for officers' use. Two cisterns built; repairs to break'r, ramps, terreplein, casemate, etc. Work begun on modification plans; 6,000 c. y. sand placed. B.E. est. it would cost \$250,000 for permanent barracks. 73, 16.

1874. \$30,000 app. Masonry of magazine and foundations of 2 gun platforms completed; work on masonry of traverse magazine, and sand placing in the redoubt. Summary of work. Proj. for battery of 10 guns of heaviest caliber, exterior to fronts 2 and 3, and for a battery of 2 guns on fronts 1, 2, 3, and 4 of main work. 74, 19.

1875. \$20,000 app. Platforms Nos. 5 and 6, and 2 service magazines completed; parapet raised and graded; piers of postern br. repaired and entire superstr. of br. rebuilt; repair of wooden break'r. 75, 19.

1876. Platforms and breast-height walls in advanced redoubt nearly completed. Work on terrepleins and slopes and roadways. Three platforms for heavy guns and 15 for lighter ones ready for armament. 76, 21.

1877. Break'r repaired. Preservation and repair. Armament—10-inch Rodman guns dismounted from platforms 87, 88, 89, and 93; 100-pounder Parrott rifles dismounted from platforms 91, 92, and 94, and mounted on platforms 87, 88, and 89. Eight-inch converted rifle guns mounted on platforms 91, 92, 93, and 94. 77, 17.

1878. Repair of brs. and break'r. Timber 13-inch sea-coast mortar platform laid, fronts 4 and 5. 78, 20.

1879. Boathouses and brs. repaired. 79, 24.

1880. Description of fort. Repair of parapet, slopes, etc. 80, 40.

1881-84. General repairs. Summary of work. 81, 40; 82, 37; 83, 32; 84, 39.

1885. Breast-height wall and parapet on fronts 4 and 5 repaired and completed; replacing 5-inch pintles with 6-inch pintles. Permanent platforms for 10-inch Rodman guns Nos. 51 and 52 on bar-bette of main work completed. Minor work. Summary of work. 85, 31.

1886. Platform 96 put in serviceable order; numerous repairs. Summary of work. 86, 30.

Part 9, FSL. Fort Wool, Formerly Fort Calhoun.

1818. Work begun. 80, 41.

1858. Work resumed. 80, 41.

1866. Work on the masonry of the scarp and piers. Summary of work. 66, 14.

1867. Preparations for building the magazine of the first tier at the capital at the e. and w. ends. Summary of work. 67, 12.

1868-69. Work on constr. of magazines of first tier. Summary of work. 68, 16; 69, 16.

1870. Projs. for completion being prepared. Work on magazine of first tier and superstr. of magazine at w. end; stairway and passage finished; minor work. Casemates 2 to 53, inclusive, of first tier ready for guns. 70, 22.

1871-78. Operations suspended August, 1870. Preservation and care. 71, 19; 72, 15; 73, 17; 74, 20; 75, 20; 76, 21; 77, 17; 78, 20.

1879. Repair of wharf and fort-keeper's quarters. B.E. prepared modification plans for heaviest armament. 79, 24.

1880-86. Description and importance of fort. Preservation and repair. 80, 41; 81, 41; 82, 38; 83, 34; 84, 40; 85, 32; 86, 32.

1898. \$425 allotted, 1897. Preservation and care. 98, 698.

1899. \$1,260 allotted. Preservation and care 99, 841.

1901. \$300 allotted for care and preservation. 01, 812.

Part 10, FSL. Redoubt A—Emplacements for 10-inch Guns.

1892. \$158,848 allotted, 1891. Work begun placing concrete. 92, 8.

1893. Concrete for parapet in place and half of earthwork on the front completed. 93, 9.

1894. Emplacements for 2 guns completed; awaiting carriages. 94, 10; 95, 9.

1896. \$3,744 received from other works for completing the emplacements. \$10,292 allotted for constr. 2 platforms; were completed. Summary of work. 96, 492.

1897. \$1,300 allotted. Guns and carriages received; mounted by the garrison. Summary and detailed cost of work. Total cost, \$154,379.99. 97, 656.

1898. \$1,605 allotted. Waterproofing magazines, planting hedge in rear of battery, and installing electric-light plant. 98, 679.

Part 11, FSL. Redoubt A—Emplacement for One 10-inch Gun.

1893. \$64,000 allotted in 1892. Work begun. 93, 9.

1894. Emplacement completed; awaiting carriage. 94, 10.

1896. \$9,774 transferred to other works. \$5,020 allotted for constr. platform; practically completed. Summary of work. 96, 493.

1897. Carriage and gun received, mounted, and turned over to the commanding officer. Work completed. Summary and detailed cost of work. Total cost, \$59,246. 97, 658.

1898. \$552.50 allotted. Waterproofing magazine and installing a small chloride electric storage battery. 98, 680.

Part 12, FSL. Redoubt A—Mortar Battery, Sixteen 12-inch Mortars.

1895. \$100,000 allotted. Work begun on repair of wharf. 95, 9.

1896. Plans modified, repair of wharf completed, and plant constr. 96, 494.

1897. \$100,000 allotted. All concrete in the pits, wing walls, and main work, and 20,200 c. y. sand placed. Summary and detailed cost of work. 97, 659.

1898. Mortars mounted. Work completed; 21,741 c. y. concrete placed. Detailed cost of work. Mortars fired. 98, 683.

1899. Because of dampness in main magazine,

2 small temporary magazines built at cost of \$1,299.60. Description. 99, 839.

1900. \$1,246 allotted. Waterproofing. Ventilating system, description of. Concrete steps placed up the slope of center traverse. 00, 893.

1901. \$1,000 allotted for removing switches, st. bins, cement houses, and other plant; work done. 01, 808.

1902. Taking down 4' cubical concrete mixer; storing machinery; taking up and relaying RR. track. 02, 714. \$3,400 allotted for renewing interior wiring; no work done. 02, 717.

Part 13, FSL. Redoubt A—Platform for 8-inch Rifle on A. R. F. Barbette Carriage, Model 1892.

1898. \$1,800 allotted. Rifle, mounted for some time on a platform at n. end of water battery for target practice, transferred to a platform behind

the cover of the mining casemate. 210 c. y. of concrete placed in platform. Work completed; cost, \$1,608.08. 98, 686.

Part 14, FSL. Redoubt B (Left Half)—Emplacement for 10-inch Gun on Spit.

1897. Plans being made for 10-inch gun mounted on an experimental disappearing carriage, model 1894. 97, 659.

1898. \$50,000 allotted. Work begun and 2,623 c. y. of concrete and 12,038 c. y. sand cover placed. 98, 680.

1899. Battery nearly completed; gun and car-

riage received, but not mounted. Summary of work. 99, 835.

1900. Gun mounted by garrison and tested; electric plant partly installed and minor work. 00, 886.

1901. System of wiring completed; emplacement turned over Jan. 3, 1901. 01, 802.

Part 15, FSL. Redoubt B-C (Right Half)—Three 10-inch Gun Emplacements.

1898. \$125,000 allotted. Work begun. Redoubt C, 3,725 c. y. concrete and 2,186 c. y. sand placed. Right half of redoubt B, 1,067 c. y. concrete and 10,390 c. y. sand placed. 98, 689.

1899. \$5,000 allotted for completion; 3 emplace-

ments practically completed; armament in place. Summary and cost of work. 99, 836, 843.

1900. Slope completed; setting up storage battery. 00, 889.

1901. Electric light installed. 01, 802.

Part 16, FSL. Four 4.72-inch R. F. Gun Emplacements.

1898. \$18,000 allotted. Plans modified. Work begun on platforms on barbette tier. Five old platforms removed; 3 new platforms completed. 98, 690.

1899. All guns mounted and a magazine to serve them built in the interior slope of main work; cost of platform and magazine, \$2,777.01. 99, 845.

Part 17, FSL. Platforms for Four 8-inch Rifles on Parapet.

1898. \$8,000 allotted. Work begun on temporary platform and completed and guns mounted. Five old platforms and material removed. 98, 690.

1899. Two carriages and guns removed from platforms and shipped to other points. 99, 845.

Part 18, FSL. Emplacement for 10-inch Gun in Bastion.

1899. \$38,000 allotted. Work begun dismounting 3 old guns. 3,058 c. y. concrete placed. 99, 836.

1900. Work nearly completed. Gun and carriage received and part of carriage assembled. Detailed cost of work. 00, 888.

1901. Work of minor importance done; railing set, walls and rooms whitewashed, painting, etc.; walk laid. 01, 802.

1902. Iron hoods placed over doors; ammunition hoists cleaned; building 2 platforms. 02, 710.

Part 19, FSL. Battery for Three 12-inch Guns.

1899. \$150,000 allotted. Work begun. 8,500 c. y. sand placed for filling; 8,834 c. y. concrete placed. 99, 837.

1900. Battery, except minor work, completed; awaiting completion of assembling 4 carriages. Summary of work. 00, 889.

1901. Electric wiring finished; cable lines laid; painting and whitewashing; 2 carriages and guns mounted. 01, 803.

1902. System of speaking tubes put in. 02, 711.

Part 20, FSL. Emplacements for Four 15-pounder R. F. Guns.

1900. \$12,500 allotted. Work begun placing 1,349 c. y. of sand for filling. Battery practically completed. 00, 890.

1901. Slopes completed; work delayed awaiting armament. 01, 804.

1902. Minor work of mainten. 02, 714.

Part 21, FSL. Emplacements for Two 6-inch R. F. Guns.

1901. \$30,000 allotted. Plans and ests. under way. 01, 804.

1902. A fill made; wall 2' high built. 02, 713.

Part 22, FSL. Emplacements for Two 12-inch Guns.

1901. \$188,500 allotted. Site graded; laying out battery; 179 l. f. piling driven; 263 c. y. sand removed; track laid; proposals for work and material invited. 01, 803.

1902. Driving of piles; constr. plant installed. misc. excavation work; details given. 02, 713.

Part 23, FSL. South Side of Channel—Emplacements for Two 6-inch R. F. Guns.

1902. \$34,000 allotted for preparation of plans etc. 02, 719.

Part 24, FSL. South Side of Channel—Emplacements for Four 3-inch R. F. Guns.

1902. \$40,000 allotted. Wharf built; assembling of plant, etc. 02, 719.

Part 25, FSL. Miscellaneous.

Electric plant. 1899. \$960 allotted for supplies for operating. Plants in operation 6 months ending Jan. 1, 1899. Description of plant. 99, 842.

1901. \$10,160 allotted for increasing capacity sufficient to furnish current for lighting 1 of the 10-inch batteries, and a building for said plant; foundation of building completed. 01, 807.

1902. Building completed. Generating set to be installed. 02, 716.

Installation of ammunition hoist. 1902. \$2,275 allotted. No work done. 02, 717.

Electric installation for maneuvering 12-inch armament. 1902. \$3,000 allotted. Small building erected; plant completed, except moving and setting up storage battery. 02, 717.

Destruction of mine at Picketts H. 1901. \$25 allotted for destruction of loaded mine case. 01, 810.

Building for mortar battery electric plant. 1901. \$2,900 allotted for changing location of storage battery on account of damp condition of rooms; new building erected, ready for placing doors and windows. 01, 808.

1902. Slopes completed; doors and window frames set; storage battery taken down, etc. 02, 714.

New azimuth circles at mortar battery. 1901. \$400 allotted.—Old circles removed; platforms made ready for new ones. 01, 807.

1902. \$700 allotted. Azimuth circles for 2 carriages placed. 02, 714.

Handrails. 1901. \$100 allotted. Handrails for loading platforms placed. 01, 806.

Speaking tubes. 1901. \$505 allotted for speaking tubes at various batteries. 01, 806.

Tide gauge. 1901. \$30 allotted for erecting tide gauge of float type; shelter for same constr. 01, 806.

Gallery. 1901. \$165 allotted. Emplacement platforms connected; placing of handrails for loading platforms. 01, 805.

Redoubt A, concrete walk. 1900. \$626 allotted for constr. concrete walk; also concrete covering leading to each of the platforms of the battery; no work done. 00, 895.

1901. Walk laid 4' x 376'; cost, \$503.81. 01, 805.

Iron pile br. over Mill Creek, Fort Monroe, Va. 1889. \$20,000 app. for br. between the military reservation of Fort Monroe and Elizabeth City County, Va. Description of proposed br. 89, 12, 408.

1890. Work begun under contract and practically completed in May. Contract price, \$17,500. 90, 387.

Reinforcing water battery magazines. 1898. \$300 allotted. 263 c. y. sand placed in retaining wall and cribs built. 98, 691.

1899. 320 c. y. earth placed as cover for magazines. 99, 845.

Sewerage system, Fort Monroe. 1891. \$25,000 app., 1889. 91, 10, 531.

1892. Sec. of War decided that two systems be constr., one by the U. S. and the other by residents of the reservation. 92, 465.

1893. Discussion as to the best method of drainage. 93, 14, 642.

1895. \$37,500 app., 1894, for one-half of constr., the cost of the other half to be paid by the non-military residents. Work begun; contract, \$34,482.50. 4,391' of 6-inch and 8-inch sewer pipe laid. Fifteen manholes and about 10 c. y. of concrete and brick masonry placed. 95, 9, 511.

1896. Sewerage system completed. Summary of work. 96, 498.

1897. Post quartermaster at Fort Monroe assumed charge of operation and mainten. Total

cost, \$49,527.31. Report of receipt and expend. of constr. and mainten. 97, 663.

Wharf at Fort Monroe. 1889. \$175,000 app. Work begun under contract in August, 1888. Plans modified for steel piles instead of wooden ones; nearly all the piles placed and half the flooring laid. Summary of work. 89, 12, 464.

1890. Wharf completed in September, 1889, and custody transferred to the Quartermaster's Department, Dec. 4, 1889. Cost of materials. Storehouse on wharf nearly completed under contract, \$7,439.67. 90, 386.

1891. Constr. of pile jetty in progress. 91, 530.

Part 26, FSL.

Preservation and Repair.

1898. \$3,500 allotted. Repairs of brs., walks, and quarters. 98, 688.

1899. \$3,266.45 allotted for general repairs. 99, 840.

1900. \$1,936.59 allotted for repair of brs., torpedo material, and minor work. Summary of repairs. 00, 896.

1901. \$1,175 allotted. Repairs, painting, whitewashing; renewing decayed timber. \$1,000 allotted. Cleaning and painting torpedo material. \$1,725 allotted. Base rings of carriages of mortar

batteries releveled. 01, 810. \$100 allotted. Repairs to blocks and hoists of the ammunition service. \$405 allotted for correcting faulty drainage; \$775 allotted for repairing parapet and slopes; \$1,355 allotted to determine cause of leakage of water; \$1,100 allotted for preservation and repair. 01, 811.

1902. \$1,800 allotted for misc. repair work and payment of electrician's salary; drains cleaned; shelves and lockers provided for storage-battery room. 02, 718.

Part 27, FSL. Range and Position Finder Stations.

1897. \$1,800 allotted for tower and shelter. Work begun and completed under contract; turned over to the commanding officer. Description of work. 97, 661.

1898. \$500 allotted for 2 observation stations; both completed and instruments installed. 98, 686.

1900. \$100 allotted to enable data to be furnished the Board on Location of Position Finders as to elevations, etc., of sites selected for the constr. of completed range towers. 00, 894. Plans for battery-commander's station near mortar battery being prepared. 00, 895.

1901. \$6,000 allotted for constr. battery-commander's station; entirely finished, ready for troops. 01, 804, 805.

1902. Transferred to Artillery Oct. 17, 1901. 02, 715.

1901. \$172 allotted for 13 stations for emergency range finders provided for the several modern batteries. 01, 805.

1902. \$6,161.94 allotted for const. fire-commander's station; site graded. 02, 715. \$31,227.13 allotted for 5 battery-commanders' stations; foundation work. 02, 716.

Part 28, FSL. Sea Walls and Embankments—Fort Monroe.

1891. \$27,000 app. for beach protection. Work begun under contract on pile jetties. 91, 10, 530.

1892. Four jetties built and work on sea wall. Summary of work. Work suspended. 92, 466.

1895. \$9,100 allotted for sea wall near old pile break'r; 272 l. f. of sea wall built. Work described. 95, 508.

1896. Break'r completed; cost, \$6,967.43. Summary of work. 96, 495.

1900. \$12,000 to be provided for constr. about 900' of wall. 00, 895.

1901. \$23,000 allotted for concrete sea wall from engineer wharf to first jetty; work started at jetty 1; 175' built; retarded by storms. 01, 809.

1902. 333 l. f. concrete wall constr. during year and 3,450 c. y. sand placed. 02, 717.

Part 29, FSL. Sites—Willoughby Point, Va.

Tract of 47 acres and 2 rights of way purchased for \$23,500. 92, 10.

Part 30, FSL. Submarine Mines.

1891. Concrete work of mining casemate completed; sand cover being placed. 91, 8.

1892. Casemate completed; cost, \$29,452. 92, 8; 93, 9.

1893. \$21,150 allotted, 1897. Second casemate begun in 1897; casemate and gallery completed. Summary of work. 98, 686. Cable storage tank built; cost, \$2,072.79. 98, 687. \$27,000 allotted for torpedo defense; mines planted and cared for. Electrical firing apparatus set up in casemate. 98, 692.

1899. \$116.85 expended for fitting up an unused casemate of the main work for storing torpedo material and providing racks for 200 torpedoes, compound plugs, anchors, etc. 99, 839. \$2,000 allotted for extending cable tank; work completed; cost, \$1,962.45. 99, 840. \$18,000 allotted for removing mines; most of them removed by exploding them on the surface of water. Material cleaned and stored. 99, 841.

1900. \$1,000 allotted for supplies for seacoast defenses. 00, 895.

Part 31, FSL. Supplies for Seacoast Defenses.

1901. \$1,500 allotted. Supplies purchased and issued. 01, 809.

1902. \$1,000 allotted. Supplies purchased and issued. 02, 718.

Part 32, FSL. Water Supply.

1868. Artesian well begun in 1864-65 with a 12-inch pipe. 186' of 5-inch pipe and 120' of 8-inch pipe withdrawn from well of 1845, the 8-inch pipe to be driven inside the 12-inch pipe of the new well. Well 370' deep. 68, 16.

1869. Work continued on sinking the 8-inch pipe till the lowest section separated from the rest, at depth of 517', then tubes $4\frac{1}{2}$ inches diameter, with screw ends, inserted in the 8-inch pipe and driven to depth of 570', where a limited amount of saline water was found. 69, 15.

1870. Work continued on sinking the $4\frac{1}{2}$ -inch tubing. Total depth, 900'. 70, 22.

1871. Well driven to depth of 906 $\frac{1}{2}$ ' below level of parade at Fort Monroe. Work suspended in August, 1870. Plant cared for. 71, 18.

1872. Work resumed October, 1871, by drilling instead of boring. 72, 15.

1873. Little progress made. Work suspended. 73, 16.

1891. \$6,000 app. for new well. Ests. of \$4,000 more required before beginning work. 91, 10, 530.

1892. Description of previous work. 92, 467.

1893. Description of previous work and wells in other localities. 93, 13, 635.

FSM. NORTH CAROLINA FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1897-1901 |
| 2 | Engineering features..... | 1886-1912 |
| 3 | Engineers—Chief of Engineers..... | 1882 |
| 4 | BB..... | 1870-1902 |
| 5 | In charge..... | 1895-1900 |
| 6 | Assistants..... | 1826-1912 |
| 7 | Forts, etc. (allotments, operations, etc.)..... | 1826-1886 |
| 8 | Beaufort, Fort Macon..... | 1898-1902 |
| 9 | Defenses at entrance..... | 1826-1886 |
| 10 | Cape Fear R.—Fort Caswell..... | 1872 |
| 11 | New work at Old Brunswick..... | 1897-1901 |
| 12 | Mouth—Emplacements, four 8-inch guns..... | 1898-1902 |
| 13 | Southport (Fort Johnson)..... | 1899-1902 |
| 14 | Mortar battery—Eight 12-inch steel mortars..... | 1898-1900 |
| 15 | Two emplacements, 12-inch B. L. rifles, nondisappearing carriages..... | 1898-1900 |
| 16 | Two emplacements (one 4.72-inch R. F. gun, one 5-inch R. F. gun)..... | 1898-1902 |
| 17 | Emplacements for two 5-inch R. F. guns..... | 1901-1902 |
| 18 | Emplacements, two 15-pounder R. F. guns and one 5-inch gun..... | 1899-1902 |
| 19 | Miscellaneous (electric plant)..... | 1899-1902 |
| 20 | Preservation and repairs..... | 1901-1902 |
| 21 | Range and position finders..... | 1900-1902 |
| 22 | Sea walls and embankments..... | 1895-1899 |
| 23 | Submarine mines..... | 1902 |
| 24 | Supplies..... | |

Part 1, FSM.**Contracts.**

1897. Emplacements for three 8-inch guns, \$66,631.45 for 2; itemized cost. 97, 671.

1899. Mixing and placing concrete, \$1.20 per c. y. 99, 856.

1900. 6,000 t. broken st., \$1.73 t.; 7,000 t. large st., \$1.53 t. 01, 813. Unloading and transporting

st. from cars, 41¢ and 40¢; 500,000 c. y. material for, filling, 13.7¢ c. y.; erection of steel observation tower, \$3,400. 01, 814.

Part 2, FSM.**Engineering Features.**

Cable tank, description and cost. 99, 858.

Carriages, releveling. 00, 904.

Concrete forms. 99, 851.

Concrete, wet and dry. 00, 906.

Cracks caused by settlement of battery, method of repairing. 99, 859.

Doors. 01, 922.

Drainage system. 00, 910.

Electric plant, description and cost. 99, 849.

Grass; Bermuda grass satisfactory. 02, 2465.

Guns, moving and mounting, and cost. 99, 853.

Leakage, prevention of. 00, 898, 908; stopped by linseed oil. 02, 2465.

Masonry, composition of. 99, 852.

Materials, quantity and cost of. 97, 674; 98, 695; 99, 852, 856; 00, 906.

Percolation, oil treatment. 03, 2408.

Piles, pile driving with derrick. 01, 922.

Plant, description and cost. 97, 673; 99, 851, 852, 856; 00, 908.

Settlement, avoiding unequal settlement. 01, 922.

Shores, protection of. 05, 3010. Jetties. 05, 3010 (pl.).

Storehouse, torpedo, description and cost. 99, 858.

Telephones, boxes for. 01, 922.

Walls, linings. 01, 922.

Walls, sea. Details. 01, 921 (pl.). Repairs. 05, 3010.

Waterproofing. 00, 898.

Part 3, FSM.

Engineers.

Chief of Engineers. R., 66, 14; 69, 16; 70, 16, 670; 98, 24, 692; 99, 25, 845; 00, 23, 897; 01, 22; 71, 19; 72, 15; 73, 17; 74, 20; 75, 20; 76, 21; 6, 24; 02, 7, 24; 03, 9; 04, 5; 05, 5; 06, 5; 07, 5; 77, 17; 78, 21; 79, 25; 80, 41; 81, 41; 82, 38; 83, 08, 9; 09, 10; 10, 12; 11, 8; 12, 7.
35; 84, 40; 85, 33; 86, 33; 95, 10; 96, 17, 501; 97,

Part 4, FSM.

Board of Engineers.

Constituted, 1882, to consider and report upon, the condition of fortifications, and what number, if any, could be dispensed with. **R.,** 82, 422.

Part 5, FSM.

Engineers in Charge.

Col. Q. A. Gillmore, 1870-86.
Capt. J. Mercur, 1883-84.
Capt. J. C. Post, 1883.
Capt. F. A. Hinman, 1884-85.
Capt. W. H. Bixby, 1885-86.

Maj. W. S. Stanton, 1895-96.
Lt. Col. D. P. Heap, 1896-97.
Capt. W. E. Craighill, 1897-99.
Capt. E. W. Van C. Lucas, 1899-1902.

Part 6, FSM.

Assistants.

Lt. E. W. Van C. Lucas, 1895.
Lt. E. Jadwin, 1896-98.

Lt. J. C. Oaks, 1898-99. **R.,** 98, 695.
Lt. E. I. Brown, 1899-1900.

Part 7, FSM—

FORTS AND BATTERIES.

Part 8, FSM.

Fort Macon, Beaufort Harbor.

1826. Work begun. 80, 41.
1866. Question of modifications to be placed before the BE. 66, 14.
1870. Modification plans under consideration. 70, 22.
1871. Timber wharf, and jetty to protect same, built; cost, \$4,779. 71, 19.
1872-73. Work on wharf and break'r under wharf. 72, 16; 73, 17.
1874. Jetty and cribwork built w. of wharf. 74, 20.
1875. Timber cribwork and break'r completed (severe storm destroyed part of these works). 75, 20.

1876-78. Subject of modification still under consideration. 76, 21; 77, 17; 78, 21.
1879. Br. across ditch repaired and new wooden covers placed over the ventilation of all casemates. 79, 25.
1880-82. Board sand-catch built to restore the beach to its former area and height. Results satisfactory. 80, 41; 81, 41; 82, 38.
1883. Parapet and glacis cleared, and fence and jetties repaired. 83, 35.
1884. Work continued on jetties. 84, 40.
1885-86. Care and preservation. Summary of repairs. 85, 34; 86, 33.

Part 9, FSM. Beaufort Harbor—Defense at Entrance.

1898. \$3,000 allotted. Carriages of two 100-pounder Parrott rifles put in good order and 1 of the guns moved to a new and more advantageous position. Two 10-inch S. B. mortars mounted on covered way and a magazine arranged for them. Two platforms for the same mortars were also arranged on the parade. Splinter-proof traverses

built for the protection of guns and mortars. **98**, 692.

1899. Minor work done to complete the placing of the 100-pounder Parrott rifles and two 10-inch S. B. mortars. **99**, 846.

1902. Two 12-pounder guns dismantled and shipped. **02**, 72P.

Part 10, FSM. Fort Caswell, Cape Fear River.

1826. Work begun. **80**, 42.

1866. Question of modification to be placed before BE. **66**, 41.

1870-86. Importance of fort. Modification

plans under consideration. **70**, 22; **71**, 19; **72**, 16; **73**, 17; **74**, 20; **75**, 21; **76**, 22; **77**, 18; **78**, 21; **79**, 25; **80**, 42; **81**, 42; **82**, 39; **83**, 35; **84**, 41; **85**, 34; **86**, 34.

Part 11, FSM. New Work at Old Brunswick, Cape Fear River.

1872. Plans and ests. being prepared. **72**, 16.

Part 12, FSM. Mouth of Cape Fear River—Emplacements for Four 8-inch Guns.

1897. \$127,900 allotted. Work begun under contract for 3 emplacements. 2,966 c. y. concrete and 2,286 c. y. sand for embankment placed. Work given in detail with cost. **97**, 670, 672.

1898. \$43,000 allotted. Three emplacements completed and guns and carriages mounted. Work begun on fourth emplacement March 13 completed, and gun and carriage mounted by May 12. Battery completed, except railings, trolleys, etc. **98**, 608.

1899. \$2,000 allotted for installing storage battery. Battery completed. Repairs of electric

wiring, drainage system, and filling of cracks caused by unequal settlement of battery with asphalt dissolved in naphtha; cistern cleaned and trees planted; traverse circle of gun No. 4 releveled. **99**, 847, 858.

1900. Releveling carriages; new drainage system laid and slopes from terreplein to floors repaired by removing the turving and covering the slopes with a layer of concrete 4 inches thick. **00**, 904.

1901. \$700 allotted for communicating gallery. **01**, 815.

Part 13, FSM. Reservation at Southport (Fort Johnson).

1898. Repair of building on reservation. Proceedings instituted for possession of the reservation by parties claiming to have acquired rights to the property. **98**, 693.

1899. Suits for possession of reservation still pending. **99**, 846; **00**, 897.

1901. Suit still pending. **01**, 813.

1902. Suit settled by payment from app. for imp. Cape Fear R. **02**, 720.

Part 14, FSM. Mortar Battery for Eight 12-inch Steel Mortars.

1899. \$112,000 allotted. Work begun in August, 1898; masonry completed; floors laid; trolleys placed; 29,000 c. y. sand placed in parapet, and 1,801 sq. y. sod placed; 4 mortar pits finished; 7 carriages and 8 mortars received; \$2,120 allotted for mounting; in progress. Itemized cost of work. **99,** 847, 848, 854, 856.

1900. All guns mounted and battery com-

pleted, except installing electric-firing apparatus; constr. work, with cost, in detail; description of wet and dry concrete; foundations for mortars; cracks, methods of filling; plant and materials; drainage system; electric lighting, and damage done by storm of Oct. 30, 1899. **00,** 905-910.

1901. \$1,400 allotted. **01,** 815.

1902. Work of releveling taken up. **02,** 721.

Part 15, FSM. Two Emplacements for 12-inch B. L. Rifles on Non-disappearing Carriages.

1898. \$90,000 allotted. Work begun on platforms May 11 and completed May 27; excavation completed and 4,070 c. y. concrete placed; wharf strengthened for unloading guns. **98,** 693, 696, 697.

1899. \$38,325 allotted. Guns and carriages mounted and battery completed. Description and detailed cost of work. **99,** 846, 848, 852, 854.

1900. Repair of drains. **00,** 905.

Part 16, FSM. Two Emplacements—One for 4.72-inch R. F. Gun and One for 5-inch R. F. Gun.

1898. \$3,000 allotted for mounting guns. The 5-inch emplacement incorporated in the fourth emplacement for 8-inch B. L. rifle and completed when that emplacement was finished. The 4.72-inch R. F. emplacement was built on parapet of the old fort; work completed; no guns received. **98,** 694, 696.

1899. \$3,000 allotted. Guns mounted and all work completed; turned over to the garrison. **99,** 26, 847, 854.

1900. \$600 allotted for installing ammunition lift in 4.72-inch emplacement; lift purchased and installed; description and tracing. **00,** 897, 898, 899, 905.

Part 17, FSM. Emplacements for Two 5-inch R. F. Guns.

1899. \$10,500 allotted. Work begun in 1898 on 1 emplacement. Concrete placed by contract. Wagon road built to connect with mortar battery; masonry and all other work completed; awaiting arrival of carriage. Itemized cost of the emplacements. **99,** 847, 856.

1900. Parapet restored at cost of \$425. No armament as yet. **00,** 897, 911.

1901. One gun provided with a carriage. **01,** 813.

1902. Transferred to garrison. **02,** 721.

Part 18, FSM. Emplacements for Two 15-pounder R. F. and One 5-inch Gun.

1901. \$20,000 allotted. Plans approv.; work in progress on 15-pounder. **01,** 813.

1902. \$1,700 allotted. Emplacements finished. **02,** 721.

Part 19, FSM. Miscellaneous—Electric Plant.

1899. Located in casemate of old fort. Description of plant, with tabulated statement of cost of installation. **99, 849.**

1902. \$3,000 allotted for rewiring batteries. **02, 722.**

Part 20, FSM. Preservation and Repair of Fortifications.

1899. General repair of 8-inch emplacement. **99, 858.**

1900. \$2,225 allotted. Releveling 8-inch gun carriages and repair of drainage of 8-inch and 12-inch emplacements. **00, 904.**

1901. \$2,070 allotted. Carriages at emplacements 1, 2, and 3 of battery for four 8-inch rifles

releveled; safety stops provided for electric ammunition hoists; submarine mining equipment cared for; other misc. repair work. **01, 813.**

1902. Repairs to drainage service, pavements, parapets, ammunition lifts, etc. **02, 721.**

Part 21, FSM. Range and Position Finders.

1901. Work on fire-commander's station started; foundation well advanced; \$8,800 allotted. **01, 813.**

1902. Completed and transferred to garrison. **02, 721.**

Part 22, FSM. Sea Wall and Embankment—Fort Caswell, N. C.

\$150,000 app. May 25, 1900. Violent storm occurred Oct. 30 and 31, 1899. Report submitted by Capt. Lucas, describing the storm and damages caused by it, with plans and ests. of cost and repairs. Proj. submitted. **00, 900.**

1901. Concrete wall 6,612' long built. **01, 813.**

1902. Low places filled to 12' above m. l. w. Work in progress restoring wagon roads and RRs. **02, 721.**

Part 23, FSM.

Submarine Mines.

1895. \$7,000 allotted, 1894, for mining casemate and cable gallery; work begun. **95, 10.**

1896. \$2,000 allotted. Both completed. Total cost, \$3,361.98; detailed cost of work. **96, 17, 501.**

1898. \$10,600 allotted. Torpedo casemate fitted up with operating apparatus; torpedoes planted. Telephone and telegraph connections made with Wilmington, N. C., and minor work. **98, 695, 697.**

1899. \$2,900 allotted for removing mines, caring for same, and altering mining casemate; mines removed, cleaned, and stored. **99, 848.** \$1,250 allotted for cable tank, which was completed; cable stored; description; itemized cost. **99, 848, 857.** \$6,500 allotted for torpedo storehouse; completed, fireproof, and lighted by electricity; description and itemized cost. **99, 849, 858.**

Part 24, FSM. Supplies for Seacoast Defenses.

1902. Supplies issued. **02, 721.**

FSN. SOUTH CAROLINA FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts | 1896-1899 |
| 2 | Engineering features | |
| 3 | Engineers—Chief of Engineers | 1866-1912 |
| 4 | BE | 1882 |
| 5 | In charge | 1870-1902 |
| 6 | Assistants | 1898-1902 |
| 7 | Forts, etc. (allotments, operations, etc.) | 1829-1912 |
| 8 | Charleston, S. C.—Fort Sumter | 1829-1836 |
| 9 | Castle Pinckney, Shutes Folly Island | 1829-1880 |
| 10 | Fort Moultrie, Sullivan Island | 1841-1886 |
| 11 | Fort Johnson, James Island | 1870-1880 |
| 12 | Lift battery, three 12-inch rifles | 1895-1896 |
| 13 | Mortar battery | 1896-1900 |
| 14 | 10-inch battery | 1897-1901 |
| 15 | 12-inch battery | 1898-1902 |
| 16 | 4.7-inch R. F. guns | 1898-1899 |
| 17 | 6-inch R. F. gun, pedestal mount | 1898-1899 |
| 18 | Three emplacements, 15-pounder R. F. guns | 1899-1902 |
| 19 | Emplacement, 6-inch R. F. gun, disappearing carriage | 1899-1900 |
| 20 | Port Royal, S. C.—R. F. guns | 1898-1899 |
| 21 | Siege battery | 1898 |
| 22 | 10-inch battery | 1898-1901 |
| 23 | 8-inch rifle | 1898-1899 |
| 24 | Dynamite guns | 1901-1902 |
| 25 | Georgetown, S. C.—Batteries | 1898-1899 |
| 26 | Preservation and repairs | 1898-1902 |
| 27 | Range and position finders | 1896-1901 |
| 28 | Sites | 1891-1901 |
| 29 | Submarine mines | 1892-1902 |
| 30 | Supplies | 1901-1902 |

Part 1, FSN. Contracts.

1896. Two emplacements for 10-inch guns, \$110,813.56. 97, 698.

1897. One emplacement for 10-inch rifle, \$66,612.80. 98, 700.

1898. Ammunition hoist, \$1,950; trolley system, \$2,355. 98, 702. Electric-light plant, \$5,542. 99, 860.

Part 2, FSN. Engineering Features.

Ammunition, hydraulic lifts. 05, 3015 (pl.).

Borings, description of. 96, 503.

Briquettes, method of making. 96, 507.

Cement, tests. 96, 505.

Closing cracks. 03, 2411.

Concrete, placing with traveling derrick. 99, 866.

Doors; steel doors, telautograph niches. 04, 3722 (pl.).

Linings, magazines. 03, 2410 (pl.); 04, 3722.

Materials, itemized cost. 96, 512.

Percolation, asphaltum as a preventive. 03, 2412.

Planes of weakness, effects of settlement. 96, 693.

Plant, constr.; arrangement of. 96, 694; 98, 705.

Plant, briquette-making. 96, 516.

Plant, constr., itemized cost. 96, 512.

Plant, electric, description. 00, 915.

Plant, stone-crushing (tracing). 96, 516.

Quarry and plant, description and cost. 96, 512.

Settlement of mortar battery. 00, 911.

Waterproofing, unsuccessful. 00, 912. Methods. 03, 2409 (pl.).

Well, artesian; strata passed. 96, 504.

Well-points, description of. 96, 509.

Part 3, FSN.

Engineers.

Chief of Engineers. R., 66, 14; 69, 16; 70, 23; 71, 19; 72, 16; 73, 17; 74, 20; 75, 21; 76, 22; 77, 18; 78, 21; 79, 25; 80, 42; 81, 42; 82, 39; 83, 35; 84, 41; 85, 34; 86, 34; 92, 8; 93, 9; 94, 13; 95, 10; 96, 17; 97, 16, 675; 98, 24, 697; 99, 26, 859, 00, 24, 911; 01, 6, 25; 02, 7, 25; 03, 9; 04, 5; 05, 5; 06, 5; 07, 5; 08, 9; 09, 10; 10, 12; 11, 8; 12, 7.

Part 4, FSN.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. R., 82, 422.

Part 5, FSN.

Engineers in Charge.

Col. Q. A. Gillmore, 1870-86.
Capt. J. C. Post, 1883.
Maj. F. V. Abbott, 1893-1897.

Lt. E. R. Stuart, 1897.
Maj. E. H. Ruffner, 1897-1900.
Capt. J. C. Sanford, 1900-02.

Part 6, FSN.

Assistants.

Lt. E. H. Schulz, 1898-99.
Lt. E. R. Stuart, 1897-98. R., 97, 690.
Lt. H. B. Ferguson, 1897.

Lt. C. Keller, 1898.
Lt. Edw. R. Stewart, 1901-02.

Civilian electrician. 1902. \$1,200 allotted for pay. 02, 725.

Part 7, FSN—

FORTS AND BATTERIES.

Part 8, FSN. Charleston Harbor, S. C.—Fort Sumter.

1829. Work begun. 80, 42.
1866. Fort a mass of ruins. 66, 14.
1870. Modification plans approv. for armament of heavy guns in barbette; est., \$87,000. Work begun removing old wooden bombproofs and galleries; temporary sally port excavated on w. front, and wooden dock built; foundations of new scarp wall on se. face prepared; casemate arches of second tier, w. face, removed, and a large amount of filling placed on parapets of several fronts; minor work. 70, 23.
1871. \$25,000 app. Sand parapets raised about 7' along entire length of n. face. 71, 19.
1872. \$35,000 app. Scarp wall of e. half of gorge and the entire se. face built; broken arches in rear removed and site leveled; surface magazine built on se. face; casemates of ne. face uncovered; those of second tier of this face were removed and scarp wall cut down; middle casemates uncovered

and sites of two 15-inch guns prepared; 2 cisterns of 2,700 and 3,500 gallons capacity, respectively, built. 72, 16.

1873. \$40,000 app. Parapet on e. face and for a length of 57' on the gorge face completed. Ne. face—flagging over casemate arches removed and scarp wall cut down to proper height; 10 casemate arches strengthened and 12 retaining walls built, and minor work. 73, 18.

1874. \$20,000 app. Repairs to 11 of the casemates completed and 11 guns mounted; 1 retaining wall built and earth filling in rear completed; minor work; raising scarp wall of ne. and nw. faces, and casemate arches of ne. face covered with concrete; 2 barbette service magazines built; terreplein of ne. face completed; timber gun platforms for 15-inch guns laid, and minor work. 74, 21.

1875. Old wooden bombproof galleries excavated and removed; arches of 11 casemates strength-

ened and asphalted; 4 retaining walls built in rear of these casemates; masonry of new sally port front and gallery, the barbette service magazine, the foundations for platforms for guns Nos. 1, 2, and 3 on nw. front, and the passageways through paradises in the angles between that front and the adjoining front completed; 2 cisterns, capacity 10,000 gallons each, built; 1 platform ready for gun, and minor work. 75, 21.

1876. Storage magazine, breast-height walls, and permanent platforms for guns Nos. 1, 2, and 3, completed; entire scarp wall of nw. and gorge fronts coped with concrete; minor work. 76, 22.

1877. Timbers of platforms 9 and 10 stored. Slopes repaired; minor work. 77, 18.

1878. Wharf extended 30'. Two 15-inch guns and two 200-pounder Parrott rifles mounted on 15-inch timber platforms. 78, 21.

1879. Preservation and repair—covering of marsh grass placed over the unfinished roof-surface of the principal magazine. 79, 25.

1880. History, and importance of work. 80, 42.

1881. Replacing with a timber revet. the old marsh sod revet. in front of guns 6 and 7 on the ne. face, and guns 9 and 10 on the se. face; beginning the extension of the wharf. 81, 43.

1882. Parapet repaired, storage magazine covered with marsh grass, new wharf built about 350' long; minor work. 82, 40.

1883. Cribbs of new wharf filled with riprap. Sand removed from the casemates of the ne. front, from the galleries, and from the passages leading to magazines; temporary wooden doors made and hung. Slopes and quarters repaired. 83, 36.

1884. Timber breast-height walls for guns Nos. 8 and 9, se. face, repaired; coping placed for all entrances of covered passages of the nw. face; chimneys raised; cisterns, slopes, and quarters repaired. 84, 42.

1885. Buildings repaired, superstr. of wharf, strengthened, and slopes repaired. 85, 35.

1886. Preservation and repair—slopes, wharf, and earthwork repairs. 86, 35.

Part 9, FSN. Charleston Harbor, S. C.—Castle Pinckney, Shutes Folly Island.

1829. Work begun. 80, 43.

1866. Masonry was covered, during the rebellion, with sand and made into a powerful earth-work. 66, 14.

1870. Recom. approv. that the existing condition be temporarily maintained with moderate

repairs, and that guns of medium size be mounted on wooden platforms in the several emplacements already prepared for them. 70, 23.

1880. In its existing condition the work useless for defensive purposes; in charge of the Lighthouse Board for lighthouse purposes. 80, 43.

Part 10, FSN. Charleston Harbor, S. C.—Fort Moultrie, Sullivan Island.

1841. Work begun. 80, 42.

1866. Fort converted by the Confederate forces during the rebellion into a powerful earth-work. Armament inadequate for modern defense. 66, 14.

1870. Modification plans approv. for guns of largest caliber; est., \$75,000. 70, 23.

1871. \$25,000 app. 71, 19.

1872. \$35,000 app. Removal of old platforms, flagging of terreplein, the breast-height parade, tie walls, palmetto crib traverses on the terrepleins, and the heavy wooden bombproofs on the parade and adjacent to the scarp wall; scarp wall uncovered and repaired; 3 service magazines in the s., se., and sw. faces completed, except doors; and the foundation and platform for two 15-inch guns laid. The bricks from Confederate Fort Ripley were transferred to this fort. 72, 16.

1873. \$40,000 app. Brick coping of scarp wall on the 3 chan. fronts built; masonry of principal

and the adjacent service magazine on the e. face finished; earth filling of parapet and traverses on the 3 chan. fronts nearly finished. All brick and concrete work of the 2 small flanking bastions of chan. front removed; minor work. 73, 17.

1874. \$20,000 app. Masonry of ne. bastion magazine completed; wing walls, lintels, and caps added to 3 other service magazines; earth covering placed for the first, second, and third magazines; concrete masonry of the bombproof gallery e. of sally port completed; sally-port gallery raised; terreplein in rear of guns graded; work on paradises; platforms for 4 of the largest seacoast mortars laid in rear of fort, and mortars mounted. Minor work. 74, 21.

1875. \$15,000 app. Work on parapet on sw. and w. fronts and sw. angle; sally port on gorge face completed, and masonry of the sally port and casemates and sally-port gallery nearly completed; sand covering of old storage magazines removed,

drain repaired; 7 platforms ready for guns; minor work. 75, 21.

1876. Old storage magazine remodeled, and a service magazine, permanent platform, and breast-height wall for gun No. 12 completed; postern front completed, and foundation walls of the galleries leading to it were raised; minor work. 76, 22.

1877. Preservation and repair. 77, 18.

1878. Preservation and repair. Two 15-inch guns mounted on timber platforms. 78, 21.

1879. Preservation and repair. 79, 25.

1881. Exposed concrete over the sally port and guard rooms covered to protect it from the weather; general repairs of quarters and fences, etc. 81, 42.

1882-83. Wooden covering placed on principal magazine; repairs of quarters and grounds. 82, 39; 83, 36.

1884. Slopes repaired, graded, and sodded, and fort-keeper's house repaired. 84, 41.

1885. Preservation and repairs—fences and slopes. 85, 34.

1886. Preservation and repair. 86, 34.

Part 11, FSN. Charleston Harbor, S. C.—Fort Johnson, James Island.

1870-74. Modification plans approv.—to be repaired and maintained as an earthwork with such alterations and enlargements as will adapt the emplacements of 15-inch guns. 70, 23. Approv. projs. 74, 22.

1876. Four 13-inch mortar platforms on hand. 76, 23.

1880. Description of this work; a fort only in name, having neither armament nor magazines. 80, 43.

Part 12, FSN. Charleston Harbor, S. C.—Lift Battery for Three 12-Inch Rifles.

1895. \$75,500 allotted. 95, 11.

1896. Work begun, 1895. 1,500 t. large st. procured for \$393. Borings made; wharf built by contract. Artesian well bored under informal

agreement; cost, \$896.64. Work begun on scarp wall, and completed. Total cost, \$3,299.90. Work suspended, and funds transferred to the mortar battery. 96, 502.

Part 13, FSN. Charleston Harbor, S. C.—Mortar Battery.

1896. \$60,000 transferred from 12-inch emplacements, and \$42,222 allotted. Work begun in Mar. Borings made, canal and basin dr.; wharf built, and 5 bins for st. constr. Pile driving begun Apr. 20, 1896; 330 piles driven by the end of the year, completing the piling for 7 mortar platforms. Seven mortars and carriages received. Excavation for mortar pits begun; ground drained of water with well-points. 96, 508.

1897. \$112,000 allotted. Concrete work begun, and 15,562 c. y. placed; 107,816 c. y. sand placed in parapet and covered with 9,000 c. y. mud; 1,388 sq. y. sod placed round the tops and on the steep slopes. One mortar and 5 carriages received, and 8 mortars and 16 carriages mounted. 97, 675.

1898. \$7,000 allotted. Concrete ramps in pits finished and 3 inches of granolithic covering placed; all floors put in; magazine doors built; settlement continued; mortars leveled; remaining 8 mortars received and mounted. 98, 697.

1899. Slopes graded, floors of interior galleries, shell rooms, and recesses raised 6 to 9 inches. Completed battery turned over to the Artillery. 99, 859.

1900. Total settlement of battery to Nov., 1899, 1.49' at n. end, 1.66' at s. end, and 1.47' in middle. Floors of magazine raised about 1'. Wire fence built on 3 sides of reservation. 00, 911.

Part 14, FSN. Charleston, S. C.—10-inch Battery.

1897. \$160,000 allotted. Plans approv. for shifting battery 400' w. of site selected by B.E. Battery to be built under contract. Artesian well begun. Concrete work and sand filling in progress. Shot lifts in position. No armament. **97**, 693.

1898. \$75,000 allotted. Three guns and carriages received and mounted. Artesian well, 1,308' deep, dug, and 3 gun emplacements completed, except electric plant. Work begun under contract on a fourth emplacement completed. **98**, 698.

1899. \$3,100 allotted; electric plant installed and completed and turned over to the garrison. \$1,610 allotted for constr. of 2 cisterns, each to contain 30,000 gallons of water; work begun and completed. **99**, 860, 861.

1901. \$500 allotted. Repairs to ammunition hoists; work completed. **01**, 817. \$1,125 allotted for constr. galleries; work completed. **01**, 818.

Part 15, FSN. Charleston Harbor, S. C.—12-inch Battery.

1898. \$50,000 allotted. Work begun on 1 emplacement for a 12-inch disappearing gun on U. S. carriage, model 1896. Platform ready for base ring by May 14. \$40,000 allotted. Work begun on 1 emplacement for a 12-inch barbette carriage; platform nearly completed. 400 c. y. Portland and 2,500 c. y. natural cement placed. No armament on hand. **98**, 700.

1899. \$7,200 allotted for the emplacement for disappearing carriage. Total of 11,000 c. y. concrete placed in both emplacements; shot lifts and trolleys erected; 2 cisterns built under loading platforms in spaces which would otherwise have been filled with sand; retaining wall built behind both emplacements to the height of the loading

platform. \$1,600 allotted for mounting guns and carriages. Barbette gun and carriage mounted; disappearing gun carriage mounted; gun not yet received. Battery completed, except electric lighting and erection of cranes and hand railing. Minor repairs made. **99**, 863, 864.

1900. 12-inch rifle for disappearing carriage received and mounted. \$5,000 allotted, and electric light plant installed. Battery turned over to the Artillery. **00**, 914.

1902. \$18,800 allotted for completion of work on battery; masonry work completed; front wall cut down and new coping built; filling done; repairs to wall, etc. **02**, 723.

Part 16, FSN. Charleston Harbor, S. C.—4.7-inch R. F. Guns.

1898. \$6,000 allotted Apr. 6 for 2 emplacements. Work begun, and 2 emplacements and 1 magazine, except roof, completed by May 1. **98**, 702.

1899. Completion of gallery and drains; mount-

ing guns; covering parapet with an apron of 6-inch concrete. Completed battery turned over to the Artillery. **99**, 861.

Part 17, FSN. Charleston Harbor, S. C.—6-inch R. F. Gun on Pedestal Mount.

1898. \$3,000 allotted for 1 emplacement. **98**, 703.

1899. \$7,500 allotted. Work begun in Oct.,

1898, and completed. Gun and carriage mounted by Artillery. **99**, 861.

Part 18, FSN. Charleston Harbor, S. C.—Three Emplacements for 15-Pounder R. F. Guns.

1899. \$9,500 allotted. Work begun removing an old 15-inch gun, 750 c. y. sand, and 140 c. y. of old concrete. Battery completed, except setting base castings. **99, 801.**

1900. Guns, carriages, and base casting not yet received. **00, 913.**

1901. Base castings, guns, and mounts received; castings set; guns mounted. **01, 818.**

1902. Turned over to Artillery July 16, 1901. **02, 724.**

Part 19, FSN. Charleston Harbor—Emplacement for 6-inch R. F. Gun on Disappearing Carriage.

1899. \$20,000 allotted. Work begun in April and 635 c. y. concrete placed in walls and 450 c. y. sand placed in parapet. **99, 862.**

1900. 1,100 c. y. concrete placed and 2,400 c. y. sand for parapet. Carriage received and mounted. Battery completed, except mounting gun, and turned over to the Artillery. **00, 913.**

Part 20, FSN. Port Royal, S. C.—R. F. Guns.

1898. \$6,000 allotted April 6 for 2 4.7-inch R. F. guns; work begun; 350 c. y. concrete placed and guns mounted by June 24. **98, 704.**

1899. Grounds graded; parapet protected with oyster shells and battery completed. **98, 868.**

Part 21, FSN. Port Royal, S. C.—Siege Battery.

1898. \$2,000 allotted for temporary battery for one 5-inch B. L. siege gun and one 7-inch B. L. siege howitzer. Work begun and completed, ready for mounting the guns which were on hand. Orders received to ship them to Tampa, Fla. Two light

12-pounders received and mounted on wooden platforms, so as to fire over parapets. One of the magazines is used as a mining casemate and the other for storage purposes. **98, 704.**

Part 22, FSN. Port Royal, S. C.—Ten-inch Battery.

1898. \$89,000 allotted. Work begun on 2 emplacements and 454 c. y. concrete placed in gun blocks, completing same. **98, 705.**

1899. \$50,000 allotted. Work begun on an addl. emplacement; 11,010 c. y. concrete and 14,500 c. y. sand placed; ammunition hoists and trolley systems installed and 2 carriages mounted. **99, 865.**

1900. Remaining carriage and 3 rifles mounted by Artillery; cranes erected; hand railing put up; barbed-wire fence built; electric plant installed and tested. Completed battery turned over to the Artillery. **00, 915.**

1901. Materials used for constr. taken down and stored. **01, 820.**

Part 23, FSN. Port Royal, S. C.—Eight-inch Rifles.

1898. \$12,000 allotted for temporary battery for two 8-inch rifles mounted on 15-inch carriages. Site changed. Work begun on wharf. **98, 706.**

1899. Guns mounted and all work completed. **98, 869.**

Part 24, FSN. Port Royal, S. C.—Dynamite Battery.

1901. \$50,000 allotted for pneumatic dynamite battery. 01, 820.

1902. July 24, 1901, Sec. of War ordered work to be stopped. 02, 727.

Part 25, FSN. Georgetown, S. C.—Batteries.

1898. \$5,000 allotted. Temporary batteries for two 7-inch B. L. howitzers built, requiring the use of 6,000 sandbags and 1,500 c. y. sand to fill in between the walls; emplacement built and howitzer mounted. Two 5-inch B. L. rifles mounted in the old fort prepared for them. Orders received to

ship all ordnance and ordnance stores at Georgetown to Tampa, Fla. These guns were replaced by four 12-pounder guns, which were mounted. 98, 766.

1899. Twelve-pounder guns removed. 99, 870.

Part 26, FSN. Preservation and Repair.

1898. Charleston H.—\$1,800 allotted for mounting 15-inch S. B. guns on emplacements 5, 6, 7, and 8 of old fort; 2 guns mounted. 98, 703.

1899. Charleston H.—\$1,500 allotted for painting I beams and repairing shot lifts and drains of 10-inch battery. 99, 862. \$382.46 expended on minor repairs of 12-inch emplacement. 99, 864.

1900. Charleston H.—\$3,800 allotted for repairs of electric plant, building wire fence, prevention of leakage in magazines (unsuccessful), and minor work on plant. \$500 allotted for caring for torpedo material, building a dust-proof room for torpedo material, and minor work. 00, 912, 913. \$500 allotted for completing guardrail, erecting cranes, and building wooden sheds over passages to keep out the rain. 00, 914.

Port Royal—\$2,500 allotted for repairs of wharf; 126 piles protected by yellow metal driven; work

completed. 00, 915. \$500 allotted for repairs of torpedo material; work completed. 00, 916. \$200 allotted for estab. a bench mark; work completed. 00, 916.

1901. \$2,000 allotted. Charleston H., S. C.—misc. work of alteration and repair. 01, 817. \$800 allotted for painting ironwork, 12-inch battery. 01, 818. Repairs to hoists at 10-inch battery. Port Royal—painting and whitewashing, etc., done. 01, 820.

1902. Charleston H., S. C.—\$150 allotted. Repairs and painting at 10-inch, 12-inch, and mortar batteries. 02, 724. \$300 allotted for imp. lifts, repairs to ammunition hoists and outlet drain. 02, 725. \$1,950 allotted. Work on damaged portion of sloping wall. 02, 725. \$1,300 allotted. Port Royal—cleaning and painting; board walk built; plant removed. 02, 727.

Part 27, FSN. Range and Position Finders—Charleston Harbor, S. C.

1896. Station built in rear of the mortar battery. 96, 517.

1901. \$5,100 allotted for battery-commander's station; no work done. 01, 819.

1902. \$4,961.66 withdrawn and returned to Treas. 02, 726.

1901. \$160 allotted for plotting and observation station; constr. completed. 01, 819.

Part 28, FSN. Sites—Sullivans Island.

Sec. of War requested the cooperation of the governor of South Carolina in obtaining the passage of an act ceding the title to, and jurisdiction over, the sites of these 3 batteries to the U. S. 91, 13. Title granted to the U. S. on condition that the U. S. compensate all persons having any right, title, or interest in any part of the land in question. 95, 14. Twenty-one lots purchased at cost of \$31,332.

Negotiations in progress for remainder of the land. 96, 17. Title to all land acquired for 10-inch and 12-inch batteries, except 4 lots, which were condemned; papers awaiting the opinion of the Attorney General. 97, 17. \$2,175 allotted for purchasing sites. 00, 916.

1901. \$40.95 allotted. Lots Nos. 58 and 59 paid for. 01, 821.

Part 29, FSN.

Submarine Mines.

1892. Charleston H.—1 mining casemate nearly completed. **92, 8.**

1893. Charleston H.—mining casemate completed; cost, \$13,100. **93, 9.**

1898. Charleston H.—cable tank built at mortar battery. Mines planted, kept in order, and mine fields patrolled. **98, 25, 698.**

1899. Charleston H.—\$5,000 allotted. All mines removed by exploding them; material cleaned and stored. 24-inch searchlight outfit transferred to the engineer officer. \$1,900 allotted for a new mining casemate, the existing one found to be unsuitable. accomplished by converting an old magazine in the fort; addl. cover obtained by placing concrete and sand. **99, 865.** Port Royal H.—mines planted

July 28, and removed by exploding them in August; material stored. \$3,000 allotted for cable tank; work begun and completed and a movable hoist installed. **99, 869.**

1900. Charleston H.—200 c. y. sand and 200 c. y. marsh mud placed on slopes. **00, 914.** Port Royal—drums of cable removed from cable tank, tested, insulated, and replaced. **00, 915.**

1901. \$6,500 allotted for constr. torpedo storehouse; contract awarded, but no work done. **01, 819.** Care of torpedo material. **01, 819, 821.**

1902. Constr. of torpedo storehouse completed. **02, 727.** \$1,500 allotted for cable tank, Charleston H.; no work done. **02, 726.**

Part 30, FSN. Supplies for Seacoast Defenses.

1901. \$800 allotted. Requisitions received and filled. **01, 819.**

1902. \$500 allotted. Requisitions received and filled. **02, 726.**

FSO. FORTIFICATIONS OF GEORGIA AND CUMBERLAND SOUND, GA. AND FLA.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1880-1900 |
| 2 | Engineering features..... | 1897-1905 |
| 3 | Engineers—Chief of Engineers..... | 1866-1912 |
| 4 | BE..... | 1879-1895 |
| 5 | In charge..... | 1866-1912 |
| 6 | Assistants..... | 1896-1900 |
| 7 | Forts, etc. (operations, allotments, etc.)..... | 1829-1912 |
| 8 | Savannah—Fort Pulaski..... | 1829-1889 |
| 9 | Fort Jackson (Oglethorpe)..... | 1842-1886 |
| 10 | Tybee Isld..... | 1872-1886 |
| 11 | Four 8-inch rifles, disappearing carriages..... | 1897-1899 |
| 12 | Two 12-inch B. L. rifles, barbette carriages..... | 1898-1899 |
| 13 | R. F. emplacement..... | 1898 |
| 14 | Emplacements, eight 12-inch mortars..... | 1898-1901 |
| 15 | Emplacements, three 4.7-inch R. F. guns..... | 1899-1900 |
| 16 | Site 1—Emplacements, two 15-pounder R. F. guns..... | 1899-1900 |
| 17 | Site 2—Emplacements, two 15-pounder R. F. guns..... | 1899-1900 |
| 18 | Wassaw Sound, R. F. emplacement..... | 1898-1899 |
| 19 | Darien, Ga.—Temporary defenses..... | 1898-1899 |
| 20 | Brunswick, Ga.—Temporary defenses..... | 1898-1899 |
| 21 | Cumberland Sound—Fort Clinch..... | 1897-1898 |
| 22 | Emplacement, 8-inch B. L. rifle..... | 1898-1899 |
| 23 | Temporary batteries..... | 1898-1899 |
| 24 | Fernandina, Fla.—Temporary batteries..... | 1898 |
| 25 | Miscellaneous (overhauling 15-inch guns and platforms; removing materials from temporary batteries; galleries)..... | 1898-1901 |
| 26 | Preservation and repairs..... | 1898-1902 |
| 27 | Range and position finders..... | 1899 |
| 28 | Submarine mines..... | 1894-1901 |
| 29 | Supplies..... | 1901-1902 |

Part 1, FSO. Contracts.

| | |
|--|--|
| 1880. Five spur jetties, Ft. Clinch. 80, 44. | 1897. Wharf, \$15,361.72. Emplacements for four 8-inch guns, \$126,861. 97, 17, 700, 701, 702. |
| 1883. Raising spur jetties, Ft. Screven. 83, 39. | 1900. Portland cement, 5,000 barrels, \$2.47 per barrel. 00, 919. |
| 1885. Work on spur jetties, Ft. Screven. 85, 37. | |
| Repair of gun platforms, Ft. Pulaski. 85, 36. | |

Part 2, FSO. Engineering Features.

| | |
|---|---|
| Battery for 8-inch guns, details of construction, 98, 708. | Plant, arrangement of. 99, 871, 876. |
| Cement testing. 00, 918. | Portland cement specifications. 00, 918. |
| Concrete mixing. 99, 872. | Settlement of emplacements. 99, 870. |
| Cracks, repairs of. 99, 870; 04, 3724. | Teredo, protection of piles against. 97, 700. |
| Guns, moving and mounting. 99, 877. | Triangulation, base-line measurement for. 05, 3018 (pl.). |
| Magazines, dampness in. 99, 884. | Vegetable growth for holding sand. 99, 879; 00, 921. |
| Materials, constr., itemized cost. 98, 709; 99, 873; 00, 917. | Waterproofing. 99, 871; 00, 918, 920; 04, 3723. |
| Mining casemate, temporary. 98, 714. | Wharf, description and cost. 97, 700. |

Part 3, FSO.

Engineers.

Chief of Engineers. R., 66, 14; 67, 12; 68, 16; 69, 16; 70, 23; 71, 20; 72, 17; 73, 18; 74, 22; 75, 22; 76, 23; 77, 19; 78, 22; 79, 26; 80, 44; 81, 44; 82, 41; 83, 37; 84, 43; 85, 36; 86, 36; 93, 4; 94, 6, 10; 95, 5, 6, 11; 96, 17, 517; 97, 17, 700, 98, 25, 707; 99, 27, 870; 00, 25, 917; 01, 26, 821; 02, 26, 727; 03, 9, 13, 681; 04, 5, 9; 05, 5; 06, 5; 07, 5; 08, 9; 09, 10; 10, 12; 11, 8; 12, 7.

Part 4, FSO.

Board of Engineers.

1879. Plans for modification of Ft. Clinch and for new exterior 12-inch battery. 79, 27.

1882. Constituted to consider and report upon the condition of fortifications, and what number,

if any, could be dispensed with. 82, 423.

1895. Proj. adopted for defense of Savannah H. 93, 4; 95, 5.

Part 5, FSO.

Engineers in Charge.

Maj. F. A. Sears, 1866.

Capt. J. W. Barlow, 1866-70.

Col. Q. A. Gillmore, 1869-86.

Capt. W. Ludlow, 1870.

Capt. J. C. Post, 1883.

Capt. O. M. Carter, 1894-98.

Capt. C. E. Gillette, 1898-1903, 1906. R., 99, 884.

Lt. Col. W. H. H. Benyaurd, 1899.

Capt. C. H. McKinstry, 1899-1900.

Lt. Col. S. B. Quinn, 1903-1906. R., 04, 3723
05, 3016.

Col. D. C. Kingman, 1906.

Part 6, FSO.

Assistants.

Lt. H. Burgess, 1896.

Lt. H. S. Morgan, 1898-99.

Lt. C. S. Bromwell, 1898-99.

Lt. Lytle Brown, 1899-1900.

Lt. E. M. Markham, 1900.

Part 7, FSO—

FORTS AND BATTERIES.

Part 8, FSO. Savannah, Ga.—Fort Pulaski, Cockspur Island, Mouth of Savannah River.

1829. Work begun. 80, 44.

1869. Work begun preparing to mount armament—brick and st. masonry work, repair of gun platforms, taking up and resetting traverse sts. and rails to restore the proper radius and level; thorough repair of the water battery and constr. of 6 wooden platforms for 100-pounder rifles. 69, 16.

1870. Est. cost of approv. modifications, \$53,000; necessary repair of gun platforms to enable guns on hand to be mounted; wooden wharf built. 70, 24.

1871. \$26,500 app. 71, 20.

1872. \$25,000 app. Necessary temporary buildings erected; old gun platforms and breast-height wall of the demilune removed; scarp wall of both faces raised; exterior and superior slopes rearranged and sodded; old terreplein excavated for piling and

grillage for the guns and magazines of the n. face and the center pintle gun at the salient; constr. of the grillage for 2 guns in the ne. angle; driving of piling for the adjacent service magazine; replacing the drawbr. over the demilune ditch; and minor work. 72, 17.

1873. \$50,000 app. Completion of sand filling over grillage, retaining wall in rear of gun platforms and the breast-height wall for 2 gun platforms; scarp wall of the gorge face raised; new pile driver built; grillage laid for the adjacent service magazine to guns 8 and 9, n. face; concrete of magazine and passageway and earth filling around them carried to height of magazine floor; piling for foundation of gun platforms 6 and 7 completed; breast height and retaining wall of foundation commenced, and minor work. 73, 18.

1874. \$20,000 app. Completion of breast-height wall and concrete foundations of gun platforms 8 and 9; masonry of service magazine and passageway between guns 7 and 8; work on service magazines bet. guns 3 and 4, and 5 and 6; excavation for foundation of storage magazine; and work on platforms 4, 5, 6, and 7; parapet constructed and 2 guns of approv. caliber mounted on 8 and 9, and minor work. Summary of work. 74, 23.

1875. \$25,000 app. Parapet on n. and s. faces of demilune nearly completed; all gun platforms laid; work on parados. All doors made and hung and minor work. Summary of work. 75, 23.

1876. Entire demilune nearly completed; retaining wall rebuilt; modification work begun. New piers on n. front raised. 76, 23.

1877-79. Preservation and care. 77, 19; 78, 22; 79, 26.

1882. Repairs to buildings and brs. 82, 41.

1883. Wooden fronts of casemates and magazine roof renewed; repairs to wharf. 83, 33.

1884. Concrete masonry covered with sand up to grade and slopes sodded; dikes repaired. 84, 43

1885. Buildings repaired; contract made for repairing 20 permanent platforms for 8-inch and 10-inch Rodman guns on the barbette of the main work. 85, 36.

1886. Twenty platforms repaired; general repair of work. 86, 36.

1898. \$2,800 allotted. Temporary platform for 8-inch B. L. rifle built of concrete in one of the old forts (Pulaski) and gun and carriage mounted. 98, 710.

\$1,950 allotted. Two 15-inch guns and their carriages lifted out of the emplacements, timber platforms replaced by concrete ones, and guns and carriages remounted. 98, 711.

1899. Gun dismounted and carriage shipped away by the ordnance officer. Balance of \$36.37 transferred. 99, 880.

Part 9, FSO. Savannah, Ga.—Fort Oglethorpe,¹ Savannah River.

1842. Work begun. 80, 44.

1870. Est. cost of approv. modifications, \$16,000. 70, 23.

1872. \$15,000 app. 72, 17.

1873. Modification work begun. Casemate arches reinforced, scarp wall raised, and breast-height wall completed; parade wall partly rebuilt and raised; 2 earthen traverses removed from terreplein and the material used to fill in the parapet. 73, 18.

1874. Parapet and breast-height wall finished, parade wall raised, and concrete foundations for guns 1, 2, 4, and 5 built, and gun platforms laid.

Temporary armament of 5 guns mounted; 10-inch S. B. in positions 1, 2, and 3 and 100-pounder Parrott rifles in positions 4 and 5. 74, 22.

1876. Service traverse magazine built between guns 3 and 4 of barbette battery. 76, 23.

1882. Repairs to brs. and doors. 82, 41.

1883. Wharf repaired and grass cut. 83, 37.

1884. Two casemates fitted up as storage rooms for engineer property and grass on slopes cut. 84, 43.

1885-86. Repairs to br. and buildings. 85, 36; 86, 36.

Part 10, FSO. Savannah, Ga.—Fort Screven, Tybee Island, Mouth of Savannah River.

1872-73. Plans in progress. 72, 18; 73, 19.

1874. Surveys made. 74, 23.

1875. Necessary land acquired and its boundary marked with st. monuments. 75, 23.

1876. Plans completed. 76, 24.

1882. Three jetties built, 590', 750', and 650' long. 82, 42.

1883. \$5,000 allotted from app. for preservation

and repair of fortifications and contract let for increasing height of jetties. 83, 38.

1884. Some work done on jetties. 84, 44.

1885. Addl. work on jetties to be done under contract. 85, 37.

1886. Jetty No. 2 extended. 86, 37.

1893. Project adopted. 93, 4.

¹ This work was called Ft. Jackson until 1884.

Part 11, FSO. Savannah, Ga.—Four Emplacements for 8-inch Rifles, Disappearing Carriages.

1897. \$155,000 allotted. Work begun under contract; 2,864 c. y. excavated. Wharf completed under contract; description. **97**, 700.

1898. \$23,950 allotted. 17,400 c. y. concrete placed; all work completed and 4 guns and carriages mounted. Summary of work. **98**, 709.

1899. \$6,000 allotted. Slopes sodded, traverse circles extended, and field of fire of each gun increased about 10°; settlement repaired. **99**, 870.

Part 12, FSO. Savannah, Ga.—Emplacements for Two 12-inch B. L. Rifles, Barbette Carriages.

1898. \$40,000 allotted. Work begun; excavation for platforms completed; some concrete work. Four telephone booths built. **98**, 709.

1899. \$81,100.19 allotted. Emplacements completed. Description of work. \$80 allotted. A 3-inch artesian well sunk to a depth of 90'. **99**, 876.

Part 13, FSO. Savannah, Ga.—Rapid-fire Emplacement.

1898. \$180.71 allotted. Work begun, some materials purchased, and some excavation made. Notice received that guns could not be procured;

work stopped and materials transferred to other works. **98**, 710.

Part 14, FSO. Savannah, Ga.—Emplacements for Eight 12-inch Mortars.

1899. \$108,132 allotted. Work begun in December, 1898; excavation and nearly all of concrete work completed; description and cost of material and labor. **99**, 871.

1900. \$17,310 allotted. Guns mounted and battery, built of Portland cement, completed and

turned over to the Artillery; cost, \$125,442; summary of work. **00**, 917.

1901. \$4,800 allotted for supplying electric-light plant and placing grounds in good condition; pavement rear of battery repaired; drains lowered; grounds cleaned. **01**, 822.

Part 15, FSO. Savannah, Ga.—Emplacements for Three 4.7-inch R. F. Guns.

1898. \$9,000 allotted. Work begun and practically completed; minor work, including mounting of gun and carriage, to be done. **98**, 710.

1899. \$14,800 allotted. Guns were temporarily mounted at defense of Wassaw Sound, then transferred to a new site in process of constr. Nearly all concrete work and fill completed. **99**, 875. \$5,582 allotted. \$225 transferred to other allotments and

32¢ deposited with Treas. U. S. Parapet sodded, gun and carriage mounted, and the completed battery turned over to the Artillery, **99**, 876.

1900. \$1,585 allotted. Guns mounted and battery completed. Summary of work. **00**, 919.

1901. Battery turned over to the Artillery. **01**, 26.

Part 16, FSO. Savannah Ga.—Site 1—Emplacements for Two 15-pounder R. F. Guns.

1899. \$100 allotted. No work. 99, 878. except setting fixed ironwork for guns. Summary
1900. \$9,430 allotted. Work begun Oct. 14, of work. 00, 920.
1899, and battery completed by Mar. 31, 1900, .

Part 17, FSO. Savannah, Ga.—Site 2—Emplacements for Two 15-pounder R. F. Guns.

1899. \$12,800 allotted for protection of mine , 1900. Battery completed except setting of fixed
fields. 1,800 c. y. sand placed in foundations; also iron work for guns. 00, 921.
30,000 old brick. A 3-inch artesian well, 122' deep, 1901. Unexpended balance of \$82.27 deposited.
driven. Minor work. 99, 880. 01, 824.

Part 18, FSO. Savannah, Ga.—Rapid-fire Emplacement at Wassaw Sound.

1898. \$11,000 allotted. Work begun. Two 1899. Guns dismantled and removed to a
emplacements for 4.72-inch guns mounted and permanent site. \$725 transferred to other allot-
battery completed at end of fiscal year. 98, 711. ments, and \$25.84 trans. to Treas. U. S. 99, 879.

Part 19, FSO. Darien, Ga.—Temporary Defenses.

1898. \$10,000 allotted. Battery at s. end of n. end of Blackbeard Isld.; magazine built with
Sapelo Isld.; magazine built and covered with sand; timber and covered with sand. 98, 712.
parapet and magazine covered with grass sod; small 1899. Batteries damaged by storm; repairs
well driven and supplied with pump. Battery at made. \$988.47 trans. and deposited. 99, 882.

Part 20, FSO. Brunswick, Ga.—Temporary Defenses.

1898. \$12,000 allotted. Temporary batteries n. end of Blackbeard Isld.; and 1
built at s. end of St. Simons Isld., and 1 e. of it; at St. Simons Isld. Batteries damaged by storm.
n. end of Jekyll Isld., and 1 at s. end of Jekyll Isld. 99, 882.
98, 712.

Part 21, FSO. Cumberland Sound—Fort Clinch (Amelia Island, Fla.).

1847. Work begun. 80, 44. height wall on 3 fronts laid, terreplein formed,
1866. Curtain galleries connecting the parade graded and seeded; work on exterior wall of para-
with the terreplein of the chemin-de-ronde constr., dos, drainage, quarters, and minor work. 67, 12.
excavation for them filled in, and the ramparts 1868. Main sewer completed; drawbr. gate-
made ready to receive the barbette gun platforms. way nearly finished; completion of masonry of
Work on exterior parapet wall and filling of the those gun platforms which had been begun. Work
glacis. 66, 14. suspended; placed in charge of a keeper. 68, 16.
1867. Four platforms, ne. and nw. curtains, 1869. Preservation and care. 69, 16.
completed; 4 other platforms on the ne. and 6 on 1870. Modification plans; est. cost, \$106,000.
the nw. nearly completed; foundations of breast- 70, 24. 77, 20.

1871-72-77. Preservation and care. 71, 20; 72, 18; 77, 20.

1879. Modification plans necessary for the reception of proposed armament of modern guns, and for a new exterior battery, completed. 79, 27.

1880. Jetties to be built under contract. 80, 45.

1881. Work on jetties and on roofing over the 5-tower bastions; repair of quarters. 81, 45.

1882. Five jetties completed and minor work. 82, 42.

1883. Jetties extended and 2 new spur jetties built. 83, 39.

1884. Break'r or protection of wood to preserve the engineer officers' quarters at Old Fernandina built and repairs made to buildings. 84, 44.

1885. Repairs made to 4 permanent front pintle platforms for 15-inch Rodman guns, and to

18 permanent front pintle platforms for 8-inch or 10-inch Rodman guns, or corresponding rifles; doorways leading to bastions repaired; Roads across parade cleared of brush, etc., and beach protected with compressed brush mattress work loaded with st. 85, 37.

1886. General repair of buildings, etc. Old jetties repaired and two new ones built. 86, 37.

1898. \$1,200 allotted. Temporary parapet of sandbags and sand fill constr. in front of two 15-inch Rodman guns. Platform built back of guns and crane built for shot hoist. Ammunition received; 30 shells shipped away. 98, 713.

1899. \$137.03 returned to appropriation. 99, 886.

1901. \$500 trans. from app. 01, 825.

1902. Balance of \$679.58 deposited. 02, 728.

Part 22, FSO. Cumberland Sound—Emplacement for 8-inch B. L. Rifle.

1898. \$4,500 allotted. Work begun on mounting 8-inch B. L. rifle on a modified 15-inch S. B. carriage; old pintle st. removed and a retaining wall of brick concrete built back of the emplacement; 1,500 c. y. sand placed in parapet. 98, 713.

1899. \$2,825 allotted. Platform and sand fill completed; 15-inch carriage altered; gun mounted; and ammunition crane erected; work completed. \$228.91 trans. from app. 99, 887.

Part 23, FSO. Cumberland Sound—Temporary Batteries.

1898. \$1,600 allotted. Moat of the old work filled in; sand causeway built across moat at the sally port and cisterns baled out and filled with

sand; artesian well sunk 386'; minor work. 98, 713.

1899. \$287.41 returned to app. 99, 886.

Part 24, FSO. Fernandina, Fla.—Temporary Batteries.

1898. \$2,000 allotted. Battery built at the n. end of Little Cumberland Isld. 98, 714.

1899. \$1,376.45 returned to Treas. U. S. 99, 833.

Part 25, FSO.

Miscellaneous.

1899. \$313.12 allotted. 99, 880.

Removing material from temporary batteries.

1899. \$500 allotted for cleaning guns, painting carriages, and removing ammunition and appli-

ances from Brunswick and Darien defenses. Work completed. Balance of \$61.47 transferred. 99, 883

Bracketed galleries to connect gun emplacements. 1901. \$1,600 allotted. Work of installation completed. 01, 822.

Part 26, FSO. Preservation and Repair.

1898. Cumberland Sound—\$500 allotted for placing armament in serviceable order, repairing magazines, and for minor work. 98, 715. Savannah H.—\$500 allotted to imp. the sanitary condition of one of the forts. 98, 716.

1899. Savannah H.—\$1,050 allotted; ditches cleaned and the sand beach in front of batteries seeded. 99, 879. \$751.25 received. Parrott guns and carriages cleaned and inverted in casemates; wharf repaired; minor work. 99, 881. Cumberland Sound—\$1,175 allotted for repairs to buildings, etc. 99, 887.

1900. \$7,545 allotted. 12-inch emplacement—artesian well sunk 155'. Brush placed on sand to hold it down, and minor repairs. 8-inch emplacement—cracks closed; ironwork painted; machinery repaired; minor work. 6-inch battery—steps leveled; ceiling beams painted; minor work. 4.7-

inch battery—ceiling beams painted; sand areas covered with stable manure and seeded; minor work on electrical apparatus. 99, 920. Site 2—\$775 allotted; cleaning ditches and moat; electrical apparatus and torpedo material; minor work. \$200 trans. from app. 00, 922.

1901. \$4,600 allotted. Brush and manure spread over blowing sand areas; drains repaired; mortar battery overhauled and cleaned; 350 c. y. sand removed; minor repairs made. Poor condition of wharf described; cost of repair est. \$16,000. 01, 822. \$400 for decreasing dampness in mining casemate. 01, 824.

1902. \$1,492.77 allotted; covering blowing sand, and minor repairs. 02, 728. Drain holes cut in floors of magazines and storerooms of 3-inch R. F. battery. 02, 728.

Part 27, FSO. Range and Position Finders—Savannah, Ga.

1899. \$50 allotted. \$26.50 returned. One range finder installed. 99, 878.

Part 28, FSO. Submarine Mines.

1894. Savannah, Ga.—Mining casemate begun. 94, 6, 10.

1895. Mining casemate completed. 95, 11.

1898. \$200 allotted—inverted arches below 2 adjacent casemates of the same fort cleaned and converted into tanks. 98, 711. \$2,500 allotted—temporary operating room built in sand dunes and shrubbery. \$4,500 allotted for purchasing explosives and planting mines; mines planted. 98, 714.

1899. Savannah, Ga.—\$650 allotted for cable tank. 99, 881. \$500 allotted for removing mine material, cleaning, and storing same. 99, 881. \$750 allotted: \$320.10 deposited with Treas. U. S.—

temporary mining casemate built; minor work. Two mines lost. 99, 882. Cumberland Sound—\$2,000 allotted for planting and removing mines and caring for the torpedo material. All mines removed by exploding them. \$559.46 restored to appro. 99, 887.

1900. All torpedo material cleaned and stored. 00, 921, 922.

1901. \$9,000 allotted for a mining casemate; work completed. \$83.97 returned to appro. 01, 823. \$4,000 allotted for torpedo storehouse; bids too high; funds returned to Treas. 01, 823. \$500 allotted for fitting up casemate with operating tables, electric wiring, etc.; work completed. 01, 824.

Part 29, FSO. Supplies for Seacoast Defenses.

1901. \$300 allotted. 01, 825.

1902. \$300 allotted. Supplies furnished. 02,

FSP. EASTERN AND SOUTHERN FLORIDA FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1897-1898 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1886-1912 |
| 4 | B.E..... | 1882 |
| 5 | In charge..... | 1886-1902 |
| 6 | Assistants..... | 1891-1901 |
| 7 | Forts, etc. (allotments, operations, etc.)..... | 1756-1912 |
| 8 | St. Johns River—Temporary battery..... | 1898-1899 |
| 9 | Emplacements, two 8-inch B. L. rifles on strengthened 15-inch barbette carriages..... | 1898-1899 |
| 10 | St. Augustine—Fort Marion..... | 1756-1900 |
| 11 | St. Francis Barracks..... | 1897-1898 |
| 12 | Temporary battery..... | 1898-1899 |
| 13 | Miami—Temporary battery..... | 1898-1899 |
| 14 | Key West—Fort Taylor and batteries..... | 1844-1886 |
| 15 | Emplacements, two 12-inch B. L. rifles, barbette carriages..... | 1898-1900 |
| 16 | Emplacements, four 10-inch guns, disappearing carriages (model 1896); two 8-inch guns, disappearing carriages (model 1894); and eight 12-inch rifled mortars..... | 1897-1902 |
| 17 | Emplacements, two 4.7-inch R. F. guns..... | 1898-1900 |
| 18 | Four emplacements, 15-pounder R. F. guns..... | 1899-1901 |
| 19 | Two emplacements, 15-pounder R. F. guns..... | 1900-1901 |
| 20 | Emplacement, right flank, 15-pounder R. F. gun..... | 1901-1902 |
| 21 | Dry Tortugas—Fort Jefferson, Garden Key..... | 1846-1886 |
| 22 | New fort..... | 1866-1869 |
| 23 | Miscellaneous (electric plant; pumping plant; civilian electrician)..... | 1899-1902 |
| 24 | Preservation and repairs..... | 1897-1902 |
| 25 | Range and position finders..... | 1899-1902 |
| 26 | Sites..... | 1897-1902 |
| 27 | Submarine mines..... | 1897-1900 |
| 28 | Supplies..... | 1900-1902 |

(See Nos. 29-47, on p. 1962 of this index.)

Part 1, FSP.

Contracts.¹

1897. Emplacements for four 10-inch guns, two 8-inch guns, and eight 12-inch mortars, \$378,992 97, 17, 713.

1898. Portland cement, \$2.70 per barrel;

Rosendale cement, \$1.35 per barrel; silica sand, \$1.66 per c. y.; coral sand, 70¢ per c. y.; broken brick (including crushing and hauling), \$1.93½ per c. y. 99, 894.

Part 2, FSP.

Engineering Features.

Brick, broken, for concrete. 99, 892, 894.
Cement, tests of Rosendale. 97, 706.
Concrete made with broken brick in place of broken st. 99, 892, 894.

Condensation. No trouble from, in "this" district. 03, 2413. Preventing condensation. 04, 3726.

Cracks in battery, methods of filling. 99, 897.

Crane, description of traveling. 99, 892.

Dampproofing, shell and powder magazines. 03, 2413 (pl.).

Emplacements, itemized cost of four 10-inch, two 8-inch, and eight 12-inch mortars. 97, 713.

Leakage, preventing (and cause). 03, 2413.

Percolation, preventing. 03, 2413; 04, 3725.

Plant, constr., description of. 97, 704.

Waterproofing methods. 99, 897.

¹ See Leach contract, p. 1829 of this index.

Part 3, FSP.

Engineers.

Chief of Engineers. **R.**, 66, 15; 67, 13; 68, 533; 92, 15, 471; 96, 18; 97, 17, 702; 98, 26, 71
17; 69, 16; 70, 24; 71, 20; 72, 18; 73, 19; 74, 23; 99, 27, 888; 00, 25, 923; 01, 26; 02, 26; 03, 9; 0
75, 23; 76, 24; 77, 20; 78, 23; 79, 27; 80, 45; 81, 5, 10; 05, 5; 06, 5; 07, 5, 9; 08, 9, 14; 09, 15; 1
45; 82, 43; 83, 39; 84, 45; 85, 38; 86, 38; 91, 11, 12, 16; 11, 8, 13; 12, 7, 12.

Part 4, FSP.

Boards of Engineers.

1882. Constituted to consider and report upon the condition of fortifications, and what number if any, could be dispensed with. **82**, 423.

Part 5, FSP.

Engineers in Charge.

Maj. W. McFarland, 1866-68.
Col. J. H. Simpson, 1868-69.
Lt. Col. C. E. Blunt, 1869-74.
Lt. J. B. Quinn, 1870.
Col. Q. A. Gillmore, 1871-84.
Maj. J. A. Smith, 1874-77.
Capt. W. H. Heuer, 1877-84.
Capt. J. C. Post, 1883.
Capt. T. Turtle, 1884-85.

Capt. W. T. Rossell, 1885-86.
Capt. W. M. Black, 1886-92.
Maj. J. C. Mallery, 1892.
Maj. T. H. Handbury, 1896.
Lt. Col. W. H. H. Benyaurd, 1896-99.
Capt. C. H. McKinstry, 1898-1901.
Capt. T. H. Rees, 1900-02.
Lt. Edmund M. Rhett, 1902.
Capt. H. Deakyn, 1902.

Part 6, FSP.

Assistants.

Lt. D. D. B. Gaillard, 1891-92.
Lt. J. J. Meyler, 1896-97.
Lt. R. P. Johnson, 1897-99.

Capt. W. W. Harts, 1898-99.
Lt. E. M. Markham, 1899-1901.
Lt. E. M. Rhett, 1901.

Part 7, FSP—

FORTS AND BATTERIES.

Part 8, FSP. St. Johns River, Fla.—Temporary Battery.

1898. \$13,160 allotted. Consent of owners of land obtained; work begun in April on a temporary battery to mount 5-inch B. L. siege rifles and 7-inch B. L. siege howitzers; built of 10 by 10 inch timber in revet., and magazine walls with sand embank-

ment. Two magazines in traverses provided. Gun and howitzers received and mounted in May. **98**, 716.

1899. \$100 allotted. Work completed. **99**, 888.

Part 9, FSP. St. Johns River, Fla.—Emplacements for Two 8-inch B. L. Rifles on Strengthened 15-inch Barbette Carriages.

1898. \$29,000 allotted. Consent obtained from owners of the land. Work begun, excavation completed, and foundations for the platforms prepared. **98, 718.**

1899. \$3,500 allotted. Concrete work begun, platforms completed, carriage altered, and guns mounted. **99, 889.**

Part 10, FSP. East Coast of Florida—Fort Marion.

1756. Fort essentially completed. First named Fort San Augustine; later, Fort St. Mark; built by the Spaniards. Its constr. extended through a period of more than 100 years. **77, 20.**

1873. Repair of hrs. and arch of a large vault. **73, 19.**

1875. Fort repaired and certain Indian prisoners or hostages placed in it. **75, 23.**

1876. Repair of fort continued. **76, 24.**

1877. History of fort; built of coquina—a natural shell-concrete found in the vicinity. **77, 20.**

1878. Modification proj. still under consideration. **78, 23.**

1883. Repairs made so that French officers could occupy the fort for the purpose of observing the transit of Venus. **83, 40.**

1884. \$5,000 app. **84, 45.**

1885. Picket fence built around reservation. **85, 38.**

1886. Repair of sea wall and breast-height wall; bastion towers renewed, interior wall refaced, ramp rebuilt; minor repairs. **86, 38.**

1891. \$15,000 app. 342.5' of sea wall built, terreplein paved and drained, communications restored and renewed, ditch cleaned and graded, glacis planes restored; minor work. **91, 11, 533.**

1892. Entire terreplein coated with paraffin and petroleum, 260' of covered drain laid, pavement leveled, and trees planted. **92, 15.**

1899. \$200 allotted for minor repairs. Fort converted into a military prison in July, 1898. Some repairs made by the Quartermaster's Department. **99, 888.**

1900. Shrubbbery cut down and removed and repair of masonry work of the "City Gates." **00, 923.**

Part 11, FSP. St. Francis Barracks.

1897. \$365 allotted for placing platform of one 8-inch converted rifle, mounted for target practice; work completed. **97, 702.**

1898. Eight-inch rifle dismounted and moved to a temporary battery. **98, 716.**

Part 12, FSP. St. Augustine, Fla.—Temporary Battery.

1898. \$12,460 allotted. Proj. approv. for timberrevet. walls and sand embankment, with 2 magazines in traverses, also built of timber and covered with sand. **98, 717.**

1899. Battery completed and turned over to troops. **99, 888.**

Part 13, FSP. Miami, Fla.—Temporary Battery.

1898. \$12,640 allotted. Consent obtained from owners of the land; work begun April 13, and by May 12 the battery was practically completed. **98, 717.**

1899. \$470 allotted. Armament and all other property removed and the battery abandoned. **99, 890.**

Part 14, FSP. Key West, Fla.—Fort Taylor and Batteries.

1844. Main work begun. 80, 45.

1866. Repair of work damaged by hurricane of Oct. 22, 1865. Wrecks removed, break'rs rebuilt and adjusted, 2 new ones built, sea wall repaired, etc.; flagging laid in most of the casemates of the advanced batteries of towers 1 and 2; minor work. 66, 15.

1867. Work on sea walls, glacis of tower 1; minor work. 67, 13.

1868. S. end of covered face filled in with sand. Work on sea wall, ditch, and embankment. 68, 17.

1870. Modification plans being prepared. Pintles placed on barbette tier. 70, 24.

1871. Modification plans approv.—imp. of main work; completion of the advanced towers; constr. of 2 exterior barbette batteries for heavy guns with magazine traverses. Necessary repair of buildings. 71, 21.

1872. \$42,500 app. Modification work begun, scarp wall of 4 magazines strengthened, barbette tier modified by removal of 18 platforms for 10-inch guns, and placing two 15-inch gun platforms and 3 sand traverses; work on embankments; casemate foundations for platforms and the platforms themselves laid; minor work. 72, 18.

1873. \$50,000 app. S. end of n. battery completed and two 15-inch guns mounted. Work on salient and adjoining faces. Breast-height wall for 4 guns built and minor work. Summary of work. 73, 20.

1874. \$20,000 app. Work on sea walls. Sand embankment and parapet; minor work. 74, 23.

1875. \$15,000 app. 587 c. y. masonry sea wall built and 11,574 c. y. sand embanked in s. battery. Six large masonry shot beds built in rear of casemate. Buildings repaired and minor work. 75, 23.

1876. Sea wall repaired and minor repairs of the works damaged by hurricane of 1875. Summary of work. 76, 24.

1877. General repairs, care, and preservation. 77, 20; 78, 23; 79, 27; 80, 45.

1881. Br. 720' long, connecting the islds. of Key West with the fort, completed, and care and preservation. 81, 45.

1885. Cisterns, drains, and buildings cleaned and repaired; minor work. 85, 38.

1886. Five brick ventilators built, cisterns and buildings repaired, 3 brs. built over road crossings; minor work. 86, 39.

Part 15, FSP. Key West, Fla.—Emplacements for Two 12-inch B. L. Rifles on Barbette Carriages.

1898. \$40,000 allotted. Removing part of old fort. 98, 724.

1899. \$73,000 allotted. 9,166 c. y. of concrete composed of broken brick instead of broken st., and a number of 30-pounder, 100-pounder, and 300-pounder Parrotts, 8-inch columbiads, and 10-inch Rodmans (part of armament of old fort)

embedded in the concrete to serve the same purposes as pieces of random st. Two guns, and carriages received and base rings set. 99, 892.

1900. Trolley beams placed, doors hung, and battery turned over to the care of troops on Feb. 3, 1900. Guns and carriages on hand, to be mounted by the troops. 00, 926.

Part 16, FSP. Key West, Fla.—Emplacements for Four 10-inch Guns on Disappearing Carriages, Model 1896; Two 8-inch Guns on Disappearing Carriages, Model 1894, and Eight 12-inch Rifled Mortars.

1897. \$412,225 allotted. Work begun, under contract, on excavation. Description of plant. 97, 703.

1898. \$6,000 allotted. Concrete work completed, ironwork nearly completed (itemized quantity of work to date). \$9,300 allotted for moving and mounting guns and carriages. Three 10-inch and two 8-inch guns and carriages and 6 mortar carriages mounted. 98, 721, 722.

1899. \$4,000 allotted for work on emplacement and \$900 allotted for moving and mounting guns and carriages. One 10-inch gun and carriage, 2 mortar carriages, and 8 mortars mounted, completing the mounting of armament. Some concrete work, ironwork, and sand filling to be done. Items of work accepted and paid for to Jan. 30, 1899. 99, 891, 896.

1900. Ironwork completed. Some concrete work and sand filling to be done. Electrical firing apparatus installed in mortar battery. \$575 allotted for purchase and installing 12 locking devices for ammunition hoists. Work done by hired labor. \$1,800 allotted for providing communicating galleries between emplacements. Plans prepared. Work delayed because of yellow fever. 00, 925.

1901. New bid for completing work and contract awarded; small amount of sand fill in roadway; necessary plant installed; galleries completed. 01, 826, 827.

1902. Two of the three storehouses completed; work on gun battery practically completed. 02, 730. Repair of leaks. 02, 730. Completion of rear communications of 8-inch and 10-inch batteries. 02, 730.

Part 17, FSP. Key West, Fla.—Emplacements for Two 4.7-inch R. F. Guns.

1898. \$10,000 allotted. Two temporary platforms built and guns mounted. Work begun on permanent emplacements. 98, 724.

1899. \$8,000 allotted. Work on permanent emplacements begun. 1,415 c. y. concrete, com-

posed of broken brick instead of broken st., and 3,478 c. y. sand placed. Emplacement completed. Itemized cost of work. 99, 894.

1900. Emplacements turned over to troops. 00, 926.

Part 18, FSP. Key West, Fla.—Four Emplacements for 15-pounder R. F. Guns.

1899. \$22,000 allotted. Two emplacements completed, awaiting arrival of gun carriages. 850 c. y. concrete, composed of broken brick instead of broken st., and 2,050 c. y. sand placed. On the other 2 emplacements work was delayed somewhat, only 506 c. y. concrete, similar to that above, placed. 99, 894.

1900. \$750 allotted. 627 c. y. of concrete placed. No further work can be done until receipt of the gun mounts. 00, 926.

1901. Guns mounted and emplacements completed; turned over to artillery Apr. 23, 1901. 01, 827.

Part 19, FSP. Key West, Fla.—Two Emplacements for 15-pounder R. F. Guns.

1900. \$13,000 allotted. Plans approv.; no work. 00, 927.

1901. Proj. modified to provide for 1 emplacement only, and \$6,000 withdrawn; emplacement

completed and gun mounted; turned over to Artillery Apr. 23, 1901. 01, 828.

Part 20, FSP. Key West, Fla.—Emplacements for Right Flank 15-pounder R. F. Gun.

1901. \$9,900 allotted. Work begun April, 1901; emplacement nearly completed and ready for base casting of gun mount. 01, 828.

1902. Work completed. 02, 731.

Part 21, FSP. Dry Tortugas, Fla.—Fort Jefferson, Garden Key.

1846. Work begun. 80, 46.

1866. Quarters repaired; walls of large detached magazine raised 13½' and of small magazine 7½'; 80,000 c. f. of sand removed from ditch and embanked; minor work. 66, 15.

1867. Quarters nearly completed; 16 barbette platforms received with the new pattern pintle. 67, 13.

1868. Quarters, except roofing with galvanized iron, completed; ditch on face 3 excavated. 68, 17.

1869. Work on officers' quarters and soldiers' barracks; excavating sand in ditch; minor work. 69, 17.

1870. Modified plans being prepared; work on quarters; twenty 4-inch pintles set on barbette tier and all heavy modern guns on hand, with barbette carriages, mounted. 70, 24.

1871. \$42,500 app. 71, 21.

1872. \$42,500 app. Work on sea wall and ditch; modified plans approv. and work begun; 4 curtain magazines strengthened; 8 barbette magazines

modified; six 15-inch gun platforms begun and completed and 3 center-pintle masonry platforms for 300-pounder Parrott guns built. 72, 19.

1873. \$50,000 app. Sea wall around fort completed, circulation of ditch fully restored; masonry modification of barbette traverses finished, and balconies in their rear made serviceable; six 15-inch guns and three 300-pounder Parrott guns mounted. 73, 20.

1874. Repairs of works damaged by hurricane in October; work on embankment and quarters. 74, 24.

1875. Four-inch pintles placed in 8 platforms; care and preservation. 75, 24.

1876-84. Care and preservation 76, 25; 77, 20; 78, 23; 79, 27; 80, 46; 81, 46; 82, 44; 83, 41; 84, 45.

1885. Repair of sewers and quarters. 85, 39.

1886. Building walks, painting casemates, buildings, etc. 86, 39.

Part 22, FSP. New Fort at Tortugas, Fla.

1866. Plans to be considered by the BE. 66, 15.

1867. Best combination of materials for uncovered scarps not decided. 67, 13; 68, 17.

1869. Commencement to be deferred till a suitable proj. for the position be prepared. 69, 17.

Part 23, FSP. Miscellaneous.

Electric light plant—Key West, Fla.—1899. \$18,500 allotted. Work begun on 2 power stations and 2 separate light plants; stations completed, 1 dynamo installed, and wiring in progress. 99, 895.

1900. \$800 allotted. Work completed and turned over to the care of troops on Mar. 12, 1900. 00, 927.

Pumping plant for mortar battery. 1902. To prevent accumulation of waters in mortar pits, pumping plant installed. 02, 730.

Civilian electricians. 1902. \$1,200 allotted for pay. 02, 732.

Part 24, FSP. Preservation and Repair.

1897. Key West—\$3,701.12 allotted. Repair of quarters and bns. 97, 707.

1898. Key West—\$5,950 allotted. Repair of bns., buildings, and 2 temporary platforms for 15-inch guns built of timber and concrete; and guns mounted. Two unserviceable platforms at north battery torn out and guns, still mounted on carriages, moved to the rear. Three platforms of concrete and granite pintle blocks, for 8-inch converted rifles, built on site of the old platforms, and guns mounted. 98, 724.

1899. Fort Marion, Fla.—\$200 allotted for minor repairs. 99, 888. St. Johns River—\$2,350 allotted for care of torpedo material, R.R. track, and care of property. 99, 889. \$875 allotted for repair of leaks in gun and mortar batteries; methods and results of waterproofing. 99, 896. \$3,000 allotted for a roadway. Work on sand fill. 99, 897. \$700 allotted for repairs to bns. and buildings. \$400 allotted for storage of torpedo material; work completed. 99, 897.

1900. St. Johns River—\$1,700 allotted for cleaning and storing torpedo material and for watchman's services. 00, 923. Roadway—1,000 c. y. of brick crushed and 250 blocks of concrete curbing, each 4' long, made; necessary fill incomplete. 00, 927. \$100 allotted for supplies for care and preservation of electric-light plant; supplies purchased and turned over to the care of troops. 00, 929.

1901. Fort Marion, Fla.—locks for casemate doors. 01, 826. St. Johns R., Fla.—\$1,020 allotted. Torpedo material overhauled, cleaned, and stored away. 01, 826. Key West, Fla.—\$2,305 allotted for misc. repairs. 01, 828.

1902. Fort Marion—plastering walls and ceiling of casemate 4. 02, 729. St. Johns R.—inspection mining material. 02, 729. Key West—repairs, necessary painting, inspections, etc. 02, 732.

Part 25, FSP. Range and Position Finders.

1899. Key West—\$20 allotted. Five-inch cast-iron pipes filled with cement were set up as stations for Lewis depression range finders, emergency (B) type. Base rings for the instruments set in mortar on top of these pipes. 99, 896.

1901. \$9,850 allotted for battery-commander's

station; no work done and contract voided. 01, 828.

1902. Station completed and turned over, 02, 732. \$2,200 allotted for observation stations, mortar battery; work practically completed. 02, 730, 731.

Part 26, FSP.

Sites.

Key West—\$4,600 allotted and 1 site, Livermore estate, bought. \$100 allotted for incidental expenses connected with acquirement of another site for which condemnation proceedings were instituted. 97, 707. \$19,800 allotted, and site, for which proceeding had been instituted, purchased. 98, 723.

East coast of Florida—\$250 allotted for survey of

site needed for fortification purposes. 99, 890. \$1,500 allotted for making a topographical survey; completed. 00, 924.

Proceedings in progress for acquisition of 117.7 acres land. 01, 826.

1902. Deed for 117.7 acres received, June 5, 1902; allotment of \$50 made. 02, 729.

Part 27, FSP.

Submarine Mines.

1897. Key West, Fla.—\$10,000 allotted for mining casemate and cable gallery. Proj. Work begun and the cable gallery completed. Table showing results of Rosendale cement tests. 97, 705.

1898. St. Johns R., Fla.—\$8,000 allotted for planting mines, material purchased, and mines made ready for planting. 98, 720. Key West—\$22,000 allotted for purchasing material and planting mines and operating a 30-inch searchlight. Mines planted and searchlight operated nightly. 98, 725.

1899. St. Johns R., Fla.—mines removed in

September, 1898, by exploding them; cable and other material stored. 1,800 pounds of unused dynamite sold for \$216 to the dealer who furnished it. 99, 889. Key West—\$4,800 allotted for a cable tank, with R.R. track leading to break'r; work about completed. \$200 allotted for fitting up casemates for the storage of torpedo material; not completed. 99, 895. \$682 allotted for operating searchlights: as all mines were removed by explosion, the money was not used. 99, 897.

1900. \$3,105 allotted for general repair of plant, painting ironwork, etc., and caring for torpedo material. 00, 928.

Part 28, FSP. Supplies for Coast Defenses.

1900. \$600 allotted for such supplies as might be called for by requisition of the Artillery; duly approv. by the Chief of Engineers. 00, 929.

1901. Key West—three shelters for hygrome-

ters and thermometers purchased and set up. 01, 829.

1902. Supplies purchased and issued. 02, 733.

FGP. WESTERN FLORIDA FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| | (See Nos. 1-28 on p. 1955 of this Index.) | |
| 29 | Contracts..... | 1899 |
| 30 | Engineering features..... | |
| 31 | Engineers—Chief of Engineers..... | 1898-1912 |
| 32 | In charge..... | 1898-1902 |
| 33 | Assistants..... | 1898-1902 |
| 34 | Fort, etc. (allotments, operations, etc.)..... | 1898-1912 |
| 35 | Tampa, Fla.—Temporary batteries..... | 1898-1899 |
| 36 | Emplacements for two 8-inch B. L. rifles on strengthened 15-inch barbette carriages..... | 1898-1899 |
| 37 | Emplacements, two 6-inch R. F. guns..... | 1898-1899 |
| 38 | Emplacements, eight 12-inch mortars..... | 1899-1901 |
| 39 | Two emplacements, 8-inch guns, disappearing carriages..... | 1899-1900 |
| 40 | Emplacements, three 15-pounder R. F. guns..... | 1901-1902 |
| 41 | Emplacement, one 15-pounder R. F. gun..... | 1901-1902 |
| 42 | Emplacements, two 15-pounder R. F. guns..... | 1901-1902 |
| 43 | Miscellaneous (electrician)..... | 1902 |
| 44 | Preservation and repair..... | 1900-1902 |
| 45 | Sea walls and embankments..... | 1902 |
| 46 | Submarine mines..... | 1898-1900 |
| 47 | Supplies..... | 1901-1902 |

Part 29, FGP.**Contracts.**

1899. Portland cement, \$2.75 per barrel.
Random and crushed st., \$2.66 per c. y. 99, 911.

Part 30, FGP.**Engineering Features.**

Anchor plates, method of supporting. 99, 902; 00, 935. Linings, to make dry magazines 02, 2466.
Plant, electric-light. 00, 931, 932, 934, 937.
Cable tank, description and cost 99, 904. Materials and labor, itemized cost of. 00, 932,
Concrete, cost per c. y. 99, 908, 911; 00, 932, 935. 933, 935.
Description of. 99, 902. Mixing. 99, 906. Materials, quantities. 99, 900; 00, 930.
Guns, repair of anchorage. 02, 2466.

Part 31, FGP.**Engineers.**

Chief of Engineers. R., 98, 718; 99, 29, 899; (See Part 3, FGP.).
00, 26, 929; 01, 27; 02, 28.

Part 32, FGP.**Engineers in Charge.**

Lt. Col. W. H. H. Benyaurd, 1898-99. Lt. E. M. Rhett, 1902.
Capt. H. Jervay, 1899-1900. Capt. H. Deakyne, 1902.
Capt. T. H. Rees, 1900-02.

Part 33, FGP.**Assistants.**

Lt. R. P. Johnston, 1898-99. Lt. F. Boggs, jr., 1899-1900.
Capt. W. W. Harts, 1898-99. Lt. E. M. Rhett, 1901-02.

Part 34, FGP—

FORTS AND BATTERIES.

Part 35, FGP.

Temporary Batteries.

1898. \$14,900 allotted. Work begun April 26; both completed by June 30, constr. of timber and sand; guns and howitzers mounted in position June 1. 98, 718.

1899. One 5-inch gun dismantled and turned over to Gen. Rodgers, U. S. V. In January, 1899, work turned over to the troops. 99, 899.

Part 36, FGP. Emplacements for Two 8-inch B. L. Rifles on Strengthened 15-inch Barbette Carriages.

1898. \$29,500 allotted. Plans approv. and material ordered. 98, 719.

1899. \$4,000 allotted. Work begun in July, 1898, and completed in December, 1898, and guns mounted. Battery turned over to the troops.

Entire cost, \$32,503.04. Description of work done. 99, 899.

1900. Guns dismantled and mounted on disappearing carriages at Battery McIntosh. 00, 933.

Part 37, FGP. Emplacement for Two 6-inch R. F. Guns.

1898. \$29,600 allotted. Plans approv. and material purchased. 98, 719.

1899. \$5,000 allotted. Work begun in July

and completed December, 1898. Guns mounted and battery turned over to the troops. Ammunition service provided. Description of work. 99, 900.

Part 38, FGP. Emplacement for Eight 12-inch Mortars.

1899. \$150,000 allotted. Work begun; dock built; all gun beds completed and anchor bolts set. Two mortar carriages received. Description and cost of work to date. 99, 905.

1900. \$5,651.96 allotted. All emplacements completed; 8 carriages mounted and battery turned

over to the Artillery command. Electric-light plant installed; description of plant. Itemized cost of labor and materials. Summary of work. 00, 930.

1901. \$1,100 allotted for clearing up ground; useless buildings torn down. 01, 830.

Part 39, FGP. Two Emplacements for 8-inch Guns on Disappearing Carriages.

1899. \$97,500 allotted. Work begun; dock built; necessary buildings erected; 1,518 c. y concrete placed; shell used in concrete masonry. Description of work, with tracing showing arrangement of plant. 99, 908.

1900. \$21,449.53 allotted. Battery completed

and turned over to the Artillery command; one 8-inch carriage received and mounted and the other carriage received and turned over to the troops for mounting. Electric-light plant installed. Description. Details of work, with cost. 00, 933.

Part 40, FGP. Emplacements for Three 15-pounder R. F. Guns.

1901. \$15,000 allotted. Emplacements completed with exception of gun platforms; details of work given. 01, 830.

1902. \$440 allotted. Emplacements and platforms completed. 02, 734.

Part 41, FGP. Emplacement for One 15-pounder R. F. Gun.

1901. \$8,400 allotted. Line for railway graded; repairs to plant; preparation for constr. made 01, 830.
1902. \$1,800 allotted. Constr. completed except mounts. 02, 733.

Part 42, FGP. Emplacements for Two 15-pounder R. F. Guns.

1901. \$17,100 allotted. Plant erected; preparations for commencing work made. 01, 831.
1902. Work completed except mounts. 02, 733.

Part 43, FGP. Miscellaneous.

1902. \$750 allotted for pay of electrician. 02, 735.

Part 44, FGP. Preservation and Repair.

1900. \$1,227 allotted for inspecting, cleaning, moving, and protecting submarine mine material and repairing dock. All the work completed. 00, 936.
1901. \$375 allotted. Leaks in ceiling of dynamo room repaired. 01, 831. \$15 allotted for boxes to store electrical instruments; mining material overhauled and cleaned. 01, 832.
1902. Stopping leaks, placing sills in doorways, and erecting pedestal for Rafferty range finder. 02, 734.

Part 45, FGP. Sea Walls and Embankments.

1902. \$2,400 allotted for building concrete wall to prevent erosion in front of 6-inch battery. 02, 734.

Part 46, FGP. Submarine Mines.

1898. \$16,300 allotted for purchase of explosives, laying mines, and patrolling mine fields. No mines planted. 98, 720.
1899. \$4 allotted. Storage shed built and materials stored. Two t. dynamite, purchased when orders for planting mines were first received, burned. 99, 903. \$5,725 allotted for cable tank, which was completed except the traveling crane. Description of tank, with cost. 99, 904.
1900. Cable tank traveling crane installed. 00, 929. All material inspected, cleaned, and stored. 00, 936.

Part 47, FGP. Supplies for Seacoast Defenses.

1901. Shelters for hygrometers and thermometers purchased and turned over to post commander. 01, 831.
1902. Requisitions filled. 02, 735.

FGQ. ALABAMA-FLORIDA FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1898-1899 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1912 |
| 4 | BE..... | 1882 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1895-1901 |
| 7 | Forts, etc. (allotments, operations, etc.)..... | 1828-1912 |
| 8 | Pensacola, Fla.—Fort Pickens..... | 1828-1880 |
| 9 | Fort McRee..... | 1836-1880 |
| 10 | Fort Barrancas and redoubt..... | 1839-1886 |
| 11 | Battery, four 10-inch guns..... | 1895-1902 |
| 12 | Mortar battery, eight 12-inch mortars..... | 1898-1902 |
| 13 | Battery, two 4.7-inch R. F. guns..... | 1898-1899 |
| 14 | Battery, two 12-inch guns, disappearing carriages..... | 1898-1900 |
| 15 | Battery, two 8-inch guns, disappearing carriages..... | 1898-1902 |
| 16 | Battery, four 15-pounder R. F. guns..... | 1899-1901 |
| 17 | Miscellaneous (magazine doors; electric wiring; transporting plant)..... | 1901-1902 |
| 18 | Preservation and repair..... | 1897-1902 |
| 19 | Range and position finders..... | 1899-1902 |
| 20 | Sea walls..... | 1882 |
| 21 | Submarine mines..... | 1894-1900 |
| 22 | Supplies..... | 1901-1902 |

Part 1, FGQ.**Contracts.**

1898. Natural cement, 95¢ per barrel. Electric plant for mortar battery, \$6,474. 98, 7 30. \$1.55 per barrel. Portland cement, \$2.25 and \$2.55 per barrel. Gravel, \$2.20 per c. y. 99, 915, 916.

1899. Gravel, \$1.70 per c. y. Natural cement,

Part 2, FGQ.**Engineering Features.**

Bins, storage; description and cost. 97, 716. Plant, cost. 97, 718.

Concrete, cost per c. y. in place 97, 719; 98, 727; 99, 919. Plant, description of. 98, 726; 99, 920.

Dampproofing, methods. 04, 3726. R.R., 3' gauge; description and itemized cost. 97, 715.

Derrick system, description. 99, 920. Walls, cement, coloring. 04, 3727.

Forms, concrete; cost. 97, 717. Waterproofing, method of. 98, 727; 99, 913, 922;

Labor, distribution and itemized cost. 98, 733; 00, 940, 941, 942; 04, 3726.

99, 919. Water supply, cost. 97, 717.

Materials, description, with quantities and itemized cost. 98, 723, 733; 99, 915, 916, 917, 920. Wharf, description of, and itemized cost. 97, 715.

Mixer, description and cost. 97, 716.

Part 3, FGQ.**Engineers.**

Chief of Engineers. R., 66, 15; 67, 13; 68, 95, 11; 96, 18, 518; 97, 18, 714; 98, 27, 725; 99, 17; 69, 17; 70, 25; 71, 21; 72, 19; 73, 20; 74, 24; 30, 914; 00, 26, 939; 01, 27; 02, 28; 03, 9; 04, 10; 75, 24; 76, 25; 77, 20; 78, 24; 79, 28; 80, 46; 81, 05, 5; 06, 5; 07, 5, 9; 08, 9, 14; 09, 15; 10, 12, 16; 46; 82, 44; 83, 41; 84, 46; 85, 39; 86, 40; 94, 10; 11, 8, 13; 12, 7, 12.

Part 4, FGQ.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. 82, 425.

Part 5, FGQ.

Engineers in Charge.

Capt. J. C. Palfrey, 1866.
Capt. W. E. Merrill, 1866.
Maj. M. C. McAlester, 1866-68.
Maj. F. E. Prime, 1868-69.
Capt. A. N. Damrell, 1869-70.
Maj. C. B. Reese, 1871.
Col. J. H. Simpson, 1871-73.
Lt. Col. W. F. Reynolds, 1873.

Maj. A. N. Damrell, 1873-85.
Capt. R. L. Hoxie, 1885-86.
Capt. P. M. Price, 1894.
Maj. F. A. Mahan, 1894-99.
Capt. C. A. F. Flagler, 1899-1901.
Capt. W. V. Judson, 1901-02.
Lt. R. R. Raymond, 1902.

Part 6, FGQ.

Assistants.

Lt. C. Keller, 1895.
Lt. C. P. Echols, 1895-96.
Lt. J. P. Jervay, 1896-99. R., 97, 714.

Lt. L. H. Rand, 1899-1901.
Lt. G. R. Lukesh, 1901.

Part 7, FGQ—

FORTS AND BATTERIES.

Part 8, FGQ.

Fort Pickens.

1828. Work begun. 80, 46.

1866. One front pintle barbetta gun platform for modern armament and 1 for projectile built; repairs and modifications of the parapet of w. bastion. 66, 15.

1868. Wharf rebuilt; drains, road, and pavement of terreplein repaired; removing sand and traverses in s. bastion and uncovering casemate arches of sw. bastion for foundation of 15-inch gun platform. 68, 17.

1869. Road completed; gun platform in w. bastion prepared and gun mounted; work on platform for a large gun in sw. bastion; wooden platforms for projectiles built; general repairs and minor work. 69, 17.

1870. Modification plans being prepared. 70, 25.

1871. General repairs of wharf, storehouses, etc. 71, 21.

1872. Magazine doors repaired. 72, 19.

1873. Care and preservation. 73, 20.

1874. Repair of cisterns, magazine doors, and buildings; four 4-inch front pintle masonry platforms with low traverse sts. and 2 of the same with high traverse sts. built for ordnance on hand, and 2 more with low traverse sts. nearly completed; minor work. 74, 24.

1875. \$25,000 app. 75, 24.

1876. Necessary buildings repaired and new ones built; R.R. track laid; cars and derricks made; modifications of bastion C nearly completed, and work begun on bastion D. 76, 25.

1877. Bastion D completed; repairs to terreplein, stairs, bermes, etc. 77, 20.

1878. Repair of wharf and buildings. 78, 24; 79, 28.

1880. History of fort; care and preservation. 80, 46; 83, 41; 86, 40.

Part 9, FGQ.

Fort McRee.

1836. Work begun. **80, 47.**
1873. Care and preservation. **73, 20.**
1874. Site undermined by action of sea; scarp fallen, leaving casemates open. Modification plans for barbette batteries for heavy guns and a mortar battery to take the place of the old work. **74, 25.**

1875. Modification plans approv. for 4 batteries for heavy guns, and 1 mortar battery. **75, 24.**
1878. All property of value transferred to Fort Pickens. **78, 24.**
1880. History of fort. **80, 47.**

Part 10, FGQ. Fort Barrancas and Redoubt, Including the Old Spanish Fort.

1839. Work begun. **80, 46.**
1866. Condition of work. **66, 15.**
1868. Breast-height walls of the main work and of the redoubt repaired and parapets regraded and sodded; necessary repairs of foundation of sw. angle of counterscarp wall; s. extremity of glacis and ditch graded and sodded; gates made and hung, and work on fence around reservation begun. **68, 17.**
1869. Fence around work completed; brs. repaired; grating and ventilators placed in magazines; and minor work. **69, 17.**

1870. Modification plans being prepared. **70, 21.**
1873. Magazine doors built. **73, 20.**
1874. Preparations for constr. platforms in progress. **74, 25.**
1875-78. Care and preservation. **75, 24; 76, 25; 77, 21; 78, 24.**
1880. History of fort. **80, 46.**
1881-82. Work on fence around fort and redoubt. **81, 47; 82, 45.**
1883-86. Care and preservation. **83, 41; 84, 47; 85, 40; 86, 40.**

Part 11, FGQ. Battery for Four 10-inch Guns.

1895. \$100,000 allotted. Survey made. **95, 11.**
1896. \$60,000 allotted. Work begun, wharf built, and constr. plant in progress. Description of wharf. **96, 518.**
1897. \$31,500 allotted. Concreting begun Nov. 1, 1896, and completed Mar. 29, 1897. Sand filling completed. Battery practically completed, ready for armament. Summary of work with itemized cost. **97, 714.**
1898. Electric-light plant installed, 4 guns and carriages mounted, and battery turned over to the troops. Itemized cost of work. **98, 726.**
1899. Road built along rear of battery. **99, 914.**

1900. \$2,300 allotted for imp. the cramped condition of the electric-light plant, involving the constr. of 2 addl. rooms, removing the sand covering, and imp. the ventilation. Work begun. **00, 939.**
1901. Work on extension of room completed; 2 new chambers built, 1 for generator and 1 for storage battery, leaving old room for boiler. **01, 832.** \$1,600 allotted for connecting 4 loading platforms by means of concrete-steel gallery. **01, 833.**
1902. Work on gallery completed. **02, 735.**

Part 12, FGQ. Mortar Battery for Eight 12-inch Mortars.

1898. \$121,000 allotted. Work begun in August, 1897. Concrete work begun in February and completed on May 31, 1898. 9,700 c. y. placed. Description of constr. plant, materials, and actual work, with itemized cost. Three carriages in position. **98, 726.**
1899. \$2,250 allotted. Battery completed: mortar carriages mounted. 12,000 c. y. sand filling placed; electric-light plant installed; 2 observation stations, with stairways of concrete and steel, built. Completed battery turned over to the Artillery June 30, 1899. **99, 914.**

1900. The 8 mortars received mounted by the Artillery. **00, 939.**
1901. \$500 allotted for gathering up and storing part of plant used in constr. and for building boat-house for naphtha launch; work nearly completed. **01, 833.** \$600 allotted for remedying dampness in magazine No. 1; floor raised and building interior detached ceiling and walls of lead and brick. **01, 834.**
1902. All work completed. **02, 736.** \$30 allotted for placing guide rails upon loading platforms. **02, 738.**

Part 13, FGQ. Battery for Two 4.7-inch R. F. Guns.

1898. \$6,000 allotted. Work begun; concrete mixed by hand and placed with wheelbarrows. Battery completed and guns mounted. Description of work with itemized cost. **98, 732.**

1899. Some sand filling placed; hanging door and building a chert road in rear. Battery turned over to the Artillery in October, 1898. **99, 918.**

Part 14, FGQ. Battery for Two 12-inch Guns on Disappearing Carriages.

1898. \$50,000 allotted. Concrete in 1 emplacement completed and in second emplacement platform and foundations finished. Summary of work with cost. **98, 732.**

1899. \$23,865 allotted. 13,770 c. y. sand filling placed, completing same, and a total of 9,400 c. y. concrete placed. Electric-light plant installed;

ammunition conveyors, ladders, doors, etc., placed. Guns and carriages received and the work of mounting same begun. Battery turned over to the Artillery June 30, 1899. **99, 916.**

1900. Carriages and guns mounted by the Artillery. **00, 940.**

Part 15, FGQ. Battery for Two 8-inch Guns on Disappearing Carriages.

1898. \$199,750 allotted. Work begun, wharf completed, concrete foundation of magazines and passages completed, and all pre. finished. **98, 735.**

1899. \$23,824 allotted. Battery completed, carriages mounted, electric plant installed; hand ammunition hoists, trolley ammunition conveyors, and cranes placed. Summary of work with itemized cost. Tracing showing derrick system. **99, 918.**

1900. Guns received and mounted and battery turned over to the Artillery Mar. 21, 1900. **00, 941.**

1901. \$1,500 allotted for installation of search light; work completed. **01, 832.** \$700 allotted for connecting 2 loading platforms of this battery by means of concrete-steel gallery. **01, 833.**

1902. Work on gallery completed. **02, 736.**

Part 16, FGQ. Battery for Four 15-pounder R. F. Guns.

1899. \$20,230 allotted. Work begun Mar. 16, 1899. 777 c. y. concrete placed and 3,197 c. y. sand placed for filling. **99, 915.**

1900. \$14.58 allotted. Concrete work completed. 1,243 c. y. placed and 5,696 c. y. of sand

filling placed, completing same. Magazine roof asphalted. No armament received. **00, 940.**

1901. \$360 allotted. Battery completed and turned over to Artillery Apr. 30, 1901. **01, 833.**

Part 17, FGQ. Miscellaneous.

Doors for magazines. **1901.** \$625 allotted for 10-inch and 12-inch batteries; doors hung at magazine No. 1; 12-inch battery and some ironwork for others completed. **01, 834.**

1901 \$275 allotted for 8-inch battery; work not yet begun. **01, 835; 02, 738.**

1902. At 10-inch and 12-inch battery arrangement; made for manufacture of remaining doors. **02, 737.**

Electric wiring. **1901.** \$2,300 allotted for wiring for a system of exterior and interior wiring **01, 834.**

1902. Work completed. **02, 735.** \$2,000 allotted for rewiring 10-inch and 12-inch batteries. No work done. **02, 738.**

Transporting plant. **1902.** \$251.97 allotted for returning to Coosa R. works plant borrowed there from. **02, 737.**

Part 18, FGQ. Preservation and Repair.

1897. \$1,820 allotted. Three concrete platforms with granite pintle blocks for 8-inch converted rifles built to replace 3 timber platforms, which were rotten. Ammunition conveyors repainted. **97, 721.**

1898. \$2,225 allotted for repair of old works; 2 casemates and officers' quarters repaired; loading platforms of 15-inch S. B. guns renewed; 2 shot beds made; the old Spanish fort thoroughly overhauled and restored as far as possible. **98, 736.**

1899. \$10,143 allotted. Magazines of 10-inch battery asphalted; minor repair of old forts and slopes of new works. **99, 922.**

1900. \$4,910 allotted. Repair of wharf, slopes, magazine doors. Waterproofing magazines and dynamo room; mounting guns; repairs of breast-height wall at Fort Barrancas, and minor work. **00, 941.**

1901. \$7,465 allotted for shore protection 15-pounder battery; repairs to slopes; care of torpedo material; care and repairs to plant. **01, 835.**

1902. \$4,670 allotted. Repairs to 12-inch mortars, 10-inch, 8-inch, 4.7-inch, and 3-inch batteries. **02, 738.**

Part 19, FGQ. Range and Position Finders.

1899. Two observation stations built. **99, 914.**

1901. \$140 allotted for shelter for position finder; work completed. **01, 834.** \$150 allotted for fire-commander's station. **01, 834.**

1902. Work on fire-commander's station held in abeyance pending decision as to change of dimensions. **02, 736.** \$18,118.60 allotted. Eight bases for Rafferty range finders placed upon the different batteries; shelters constr. **02, 737.**

Part 20, FGQ. Sea Walls and Embankments—Fort McRee.

Work on jetty in front of fort. **82, 45.**

Part 21, FGQ. Submarine Mines.

1894. One mining casemate completed; cost, \$8,012.39. **94, 10.**

1899. \$9,000 allotted. Mines planted and removed by exploding them; doorway cut through the masonry into the adjoining casemate of a fort and a blower added to imp. ventilation; both casemates ceiled with flooring to prevent dampness. One casemate demolished by explosion June 20; torpedo storehouse built of brick, slate roof, and a traveling crane where nearly all torpedo material was stored, was completely demolished by explosion; a building erected by contractor was bought

for \$200, repaired, and fitted up as a loading room for submarine mines. This building was demolished by the explosion of June 20. **99, 922.** \$1,000 allotted for operating searchlights; materials bought. **99, 923.**

1900. \$8,040 allotted. Mining casemate, torpedo storehouse, and cable tank injured by the explosion of June 20, 1899, repaired. One searchlight plant transferred to the Artillery, and the other plant, injured by the explosion of June 20, 1899, repaired. **00, 943.**

Part 22, FGQ. Supplies for Seacoast Defenses.

1901. \$600 allotted. Supplies furnished on approval. **01, 835.**

1902. \$1,070 allotted. Supplies furnished. **02, 739.** \$700 allotted for constr. of offices and store-rooms; work completed. **02, 740.** \$275 allotted

for connecting boiler rooms of 10-inch and 12-inch batteries with post water supply. **02, 740.** \$175 allotted for building coal sheds; work completed. **02, 740.**

FGR. ALABAMA-MISSISSIPPI FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1897-1902 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1912 |
| 4 | BE..... | 1882 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1895-1901 |
| 7 | Fort, etc. (allotments, operations, etc.)..... | 1819-1912 |
| 8 | Mobile Bay, eastern entrance—Fort Morgan..... | 1819-1886 |
| 9 | Fort Gaines..... | 1848-1886 |
| 10 | Mobile, Ala.—Site 1—Battery, 8-inch guns..... | 1895-1902 |
| 11 | Battery, two 12-inch rifles, disappearing carriages..... | 1898-1902 |
| 12 | Site 2—Battery, two 8-inch rifles, 15-inch Rodman carriages..... | 1898-1899 |
| 13 | Mississippi coast—Ship Island..... | 1862-1886 |
| 14 | Site 1—Emplacement, 4.7-inch R. F. gun..... | 1898-1902 |
| 15 | Mortar battery, eight 12-inch B. L. mortars..... | 1899-1902 |
| 16 | Emplacements, two 15-pounder R. F. guns..... | 1899-1900 |
| 17 | Site 2—Emplacements, two 6-inch R. F. guns, disappearing carriages..... | 1899-1902 |
| 18 | Emplacements, two 15-pounder R. F. guns..... | 1901-1902 |
| 19 | Miscellaneous (magazine)..... | 1902 |
| 20 | Preservation and repair..... | 1897-1902 |
| 21 | Range and position finders..... | 1902 |
| 22 | Sea walls and embankments..... | 1867-1902 |
| 23 | Submarine mines..... | 1895-1902 |
| 24 | Supplies..... | 1900-1902 |

Part 1, FGR.**Contracts.**

1897. Sea wall—fascine mattress in place, \$1.40 per sq. y.; stone in place, \$3.20 per c. y. 97, 723.

1899. Gravel, 10,000 c. y., \$2 per c. y.; Atlas Portland cement, 12,000 barrels, \$2.17 per barrel. 99, 926.

1900. Sea wall—st. in place, \$3.25 per c. y.; fascine mattress in place, 75¢ per sq. y. 00, 949.

1902. Erecting and completing storage magazines, \$6,500 allotted. 02, 745. Roofing storage magazines, \$350 allotted. 02, 745.

Part 2, FGR.**Engineering Features.**

Air spaces. 00, 951.

Concrete ingredients. 00, 944.

Concrete mixing. 98, 741.

Drainage. 04, 3727.

Leakage, preventing. 03, 2414; 04, 3727.

Linings. 02, 2467; 03, 2414 (pl.); 04, 3727.

Materials, itemized cost. 97, 726.

Mines, firing by judgment. 98, 744.

Mixer, concrete. 00, 950.

Plant, concrete. 99, 925.

Electric light. 99, 928; 00, 944.

Itemized cost. 97, 726.

Sea wall, description of. 00, 948.

Waterproofing. 98, 740; 99, 924, 928; 00, 944, 946, 947, 950; 02, 2467 (pl.).

Waterproofing, asphalt. 04, 3728.

Waterproofing, tarred paper for. 02, 2460.

Part 3, FGR.**Engineers.**

Chief of Engineers. R., 66, 16; 67, 13; 68, 18; 69, 17; 70, 25; 71, 21; 72, 19; 73, 21; 74, 25; 75, 24; 76, 25; 77, 21; 78, 24; 79, 28; 80, 47; 81, 48; 82, 46; 83, 42; 84, 48; 85, 41; 86, 41; 95, 11; 96, 18, 519; 97, 18, 722; 98, 28, 737; 99, 30, 924; 00, 27, 943; 01, 28; 02, 29; 03, 9; 04, 5, 9, 10; 05, 5, 10; 06, 5; 07, 5, 9; 08, 9, 14; 09, 10, 15; 10, 12, 16; 11, 8, 13; 12, 7, 12.

Part 4, FGR.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. **82, 425.**

Part 5, FGR.

Engineers in Charge.

Capt. J. C. Palfrey, 1866.
Capt. W. E. Merrill, 1866.
Maj. M. D. McAlester, 1866-68.
Maj. F. E. Prime, 1868-69.
Capt. A. N. Damrell, 1869-70.
Maj. C. B. Reese, 1870-71.

Col. J. H. Simpson, 1871-73.
Lt. Col. W. F. Reynolds, 1873.
Lt. Col. A. N. Damrell, 1873-96.
Lt. E. E. Winslow, 1896.
Maj. W. T. Rossell, 1896-1902. **R., 96, 521.**
Capt. Spencer Cosby, 1902.

Part 6, FGR.

Assistants.

Lt. E. E. Winslow, 1895-96.
Lt. H. Burgess, 1896-97.

Lt. J. B. Cavanaugh, 1897-1900.
Lt. M. L. Walker, 1901.

Part 7, FGR—

FORTS AND BATTERIES.

Part 8, FGR. Eastern Entrance to Mobile Bay—Fort Morgan, Mobile Point, Ala.

1819. Work begun. **80, 47.**
1833. Fort completed. **80, 47.**
1866. Shot holes in counterscarp repaired and those in the scarp made ready for masonry. **66, 16.**
1867. General repairs to parapet, parade walls, and terrepleins of all the front. Work on a break'r. **67, 14.**
1868. Repair of buildings, break'r, drains. **68, 18.**
1869. Repair of wharf, break'r, and slopes. **69, 17.**
1870. Modification plans being prepared. Minor repairs made. **70, 25.**
1871. General repairs. **71, 22.**
1872. Wharf rebuilt, iron screw piles used instead of wooden ones, and the st., brick, and wood pier leading to it renewed. **72, 19.**
1873. Engr. property removed from casemates and stored in buildings outside the fort to make room for ordnance stores and ammunition. Twelve fender piles were coppered and placed around head of wharf; work begun on sea wall. **73, 21.**
1874. Work on sea wall, repair of slopes and ditches; ten 4-inch front pintle masonry platforms, with low traverse sts., and 2 of same with high

traverse sts. built. Est. cost of proposed modifications for exterior batteries, with positions for 37 guns of the largest caliber, and for emplacements for mortars in the old work, \$370,000. **74, 25.**

1875. \$25,000 app. Slight repairs to sea wall and wharf. **75, 24.**

1876. Modification work begun; quarters, buildings, and R.R. track repaired. 2,687' new R.R. track and 4 cars built; parapet, breast-height wall and foundation for the gun platform for gun position No. 1, service magazines for the battery, breast-height wall, foundation for gun platform, and part of parapet for gun position No. 2, completed. **76, 25.**

1877. General repairs to slopes, drains, etc. Work begun on extension to sea wall. **77, 21.**

1878. Sea-wall extension, 750' long, completed. Repairs to buildings; 2 cisterns, each with a capacity of 7,300 gallons, built. **78, 24.**

1879. Repairs to fence, wharf, slopes, and ditches. **79, 28.**

1880. History. Work on sea wall. **80, 48; 81, 48; 82, 46; 83, 42.**

1886. Shutters fitted to embrasures; ditches, drains, gutters, etc., cleaned. **86, 41.**

Part 9, FGR. Entrance to Mobile Bay—Fort Gaines, Dauphin Island.

1848. Work begun. 80, 48.
 1866. Fort in serviceable condition. 66, 16.
 1868. Repairs to wharf, buildings; earth cover of scarp of sw. bastion removed and the material embanked in glacis; 2 wing dams built. 68, 18.
 1869. Repairs to wharf, plank walks, buildings; slopes and ditches graded; 2 jetties and a break'r built. 69, 17.
 1870. Modification plans being prepared. 70, 25.
 1871-72. Care and preservation. 71, 22, 72, 19.

1873. Drains cleaned and repaired and work on jetties. 73, 21.

1874. Work on jetties, 4 front and 4 center pintle platforms removed, and 4 carriages and chassis removed from beach. Est., modifications, \$83,000. 74, 25.

1875. Care and preservation. 75, 24; 76, 26.

1877. Repairs to buildings; a brush apron and jetty built. 77, 21.

1878. Care and preservation. 78, 24; 79, 29.

1880-86. History; care and preservation. 80, 48; 83, 43; 84, 48; 85, 41; 86, 41.

Part 10, FGR. Mobile, Ala.—Site 1—Battery for 8-inch Guns.

1895. \$50,000 allotted. Work begun. 95, 11.
 1896. \$9,000 allotted. 6,800 c. y. concrete placed. Itemized cost of work. \$5,000 allotted for constr. platform; partly finished. Itemized cost. 96, 520.

1897. \$118,500 allotted. Emplacements 1 and 2 ready for carriages, model of 1894; and emplacements 3 and 4 for carriage, model of 1896. First emplacement completed; partial constr. of the 3 others. Summary and itemized cost of each emplacement and platform. 97, 724.

1898. \$16,500 allotted. All concrete placed; trolley systems and ammunition hoists, etc., in-

stalled; all guns and carriages mounted and the battery practically completed and transferred to the Artillery. \$14,700 allotted to complete the battery, install the electric plant, and repair and strengthen wharf; work in progress. 98, 733.

1899. \$500 allotted. 3,517 c. y. sand placed in parapet, 4,690 sq. y. sod placed, electric plant installed, magazines waterproofed, and a carpenter shop built. 99, 924.

1902. \$2,000 allotted. Constr. bracket gallery along rear of battery; work practically completed; misc. repairs of care and preservation. 02, 742.

Part 11, FGR. Mobile, Ala.—Site 1—Battery for Two 12-inch Rifles on Disappearing Carriages.

1898. \$125,000 allotted. Work begun, wharf completed, necessary buildings and plant erected. Platforms completed ready for guns. 98, 741.

1899. \$51,500 allotted. Battery completed except minor details. Two carriages received, mounting them in progress. Summary of work. 99, 927.

1900. Old armament removed from parapet of old fort and parked; electric plant installed. Cor-

rections made by the Ordnance Department of carriages. Minor work completed and battery turned over to the Artillery on June 4, 1900. Summary of work. 00, 945.

1901. Base circles in w. emplacement raised, electric plant cared for, and storage battery charged. 01, 837.

1902. Exudations of asphalt waterproofing effectually stopped. 02, 741.

Part 12, FGR. Mobile, Ala.—Site 2—Battery for Two 8-inch Rifles on 15-inch Rodman Carriages.¹

1898. \$12,000 allotted. Creosoted pile wharf built and constr. materials purchased. 98, 742.

1899. \$8,000 allotted. Concrete work begun and 1,017 c. y. placed, completing same. Carriages

and guns received and mounted. Battery completed except raising the parapet. Summary of work. 99, 931.

¹ This was torn out and replaced by Battery Stanton.

Part 13, FGR. Mississippi Coast—Fort on Ship Island.

1862. Work begun. 80, 48.
1866. Work begun in July with turning the arches supporting the parados; completion of the breast-height wall, culvert arches, and mastic covering. Terreplein graded. 66, 16.
1867. Work completed ready for armament. 67, 14.
1868. Repairs to slopes. 68, 18.
1870. Modification plans being prepared. 70, 25.
1871-73. Care and preservation. 71, 22; 72, 19; 73, 21.
1874. Temporary br. erected across drawbr. well; two 15-inch Rodman guns and two 100-pounder Parrott guns mounted by the Ordnance Department. 74, 25.
1875. Care and preservation. 75, 25.
1876. St. flagging completed; repairs to quarters. 76, 26.
1877. General repair of buildings. 77, 21.
1878. Care and preservation. 78, 25; 79, 29.
1880-81. History; care and preservation. 80, 49; 81, 49.
1882-84. Care and preservation and work on jetties. 82, 47; 83, 43; 84, 48.
1885. Care and preservation. 85, 41.
1886. Fourteen shot beds built, magazine floors cemented over, and shutters repaired. 86, 42.

Part 14, FGR. Site 1—Emplacement for 4.7-inch R. F. Gun.

1898. \$15,000 allotted. Work begun on 2 emplacements, platform built, and guns and carriages mounted. Concrete work of parapet nearly completed. Magazines waterproofed with 4 layers of asphaltic cement and felt. 98, 740.
1899. Battery completed in all its details and transferred to the Artillery. Summary of work. 99, 927.
1902. Damp spots in magazine corrected by waterproofing, painting ironwork, and sodding slopes. 02, 742.

Part 15, FGR. Site 1—Mortar Battery for Eight 12-inch B. L. Mortars.

1899. \$140,000 allotted. Work begun, plant installed, 2,579 c. y. sand placed in parade; 3,278 c. y. concrete, including 591 sq. y. granolithic, placed. Anchor bolts set and platforms completed. Eight carriages received. 99, 926.
1900. 7,831 c. y. concrete placed, completing same; waterproofing battery; electric plant installed; mounting carriages in progress. Summary of work. 00, 943.
1901. \$16,250 allotted (\$2,000 withdrawn). Sand filling completed; observation stations completed; grading and sodding; installation of electric plant completed; ironwork repainted; locks placed on doors, etc. Work of Engineer Department on this battery practically completed. 01, 836.
1902. Battery transferred to Artillery May 20, 1901. Covering of w. flank traverse and central traverse slid into pit, breaking down concrete cornice; repairs made; \$4,500 allotted. Under allotment of \$150 light interior doors installed at entrance of each powder magazine. 02, 740.

Part 16, FGR. Site 1—Emplacements for Two 15-pounder R. F. Guns.

1899. \$9,000 allotted. Work begun. 99, 929.
1900. 549 c. y. concrete placed, 2,188 c. y. sand placed in parapet, and battery completed and turned over to the Artillery on June 4, 1900. Summary of work. 00, 946.

Part 17, FGR. Site 2—Emplacements for Two 6-inch R. F. Guns on Disappearing Carriages.

1899. \$55,000 allotted. Materials being purchased. 99, 932.

1900. \$15,000 allotted. Work begun July 17, 1899. 4,300 c. y. concrete placed, completing same, except steps and walks in rear of battery. Sand filling, steel platforms and stairs in rear, electric-light plant, ammunition service, and minor work remain unfinished. Summary of work. 00, 949.

1901. Stairways constr., pavements finished,

ammunition cranes, trolleys, and trolley beams installed; cables laid, wood and iron work painted, and other misc. work. Emplacements practically completed and turned over May 20, 1901. 01, 838. \$750 allotted for mounting carriages. 01, 838.

1902. Completing drainage system, hoods for doors and windows, sodding, etc.; work on mounting guns in progress. 02, 745.

Part 18, FGR. Emplacements for Two 15-pounder R. F. Guns.

1901. \$10,000 allotted. Work begun early in September, practically completed latter part of February, 01, 838.

1902. Wood and iron work, painting, sodded slope cared for, small amount of waterproofing done. 02, 742.

Part 19, FGR. Miscellaneous.

Peace storage magazine. \$7,350 allotted for constr. peace storage magazine; work nearly completed. 02, 743.

Part 20, FGR. Preservation and Repair—Mobile, Ala.

1897. \$850 allotted for a fence on the e. boundary line of Fort Morgan reservation; barbed-wire fence, 3,350' long, built. 97, 722. \$3,000 allotted for repair of platforms of 8-inch converted rifles and other necessary work. 97, 722.

1898. Main line of fence repaired and connection made with old fence at se. salient of Fort Morgan. 98, 737. The platforms for 8-inch converted rifles completed and rifles and carriages mounted and turned over to the garrison. 98, 737.

1899. \$1,675 allotted and ditch cleaned; parade of old fort leveled; repairs to glacis; and sea wall partly rebuilt. 99, 930. \$1,175 allotted and ditch cleaned; 2 pumps, driven by a heavy 12' windmill, installed to discharge the drainage over the low dam into the B. 99, 932.

1900. \$3,400 allotted. Slopes and fences repaired; old fort cleaned; waterproofing magazines with cork paint, etc. Mine material cared for; sea walls and jetties repaired. 00, 947.

1901. \$2,900 allotted. Permanent bench marks estab.; misc. repairs, painting, etc.; submarine material cleaned. 01, 839.

1902. \$615 allotted. Site 1—survey of e. boundary of reservation; repairs to sea wall, wharves, and office building. (See various work under other batteries.) 02, 743. \$315 allotted. Site 2—repairs to drains at 8-inch rifles; painting iron and wood work at 6-inch guns; repairs to wharf, windmill, pumping plant, etc. 02, 746.

Part 21, FGR. Range and Position Finders.

1902. \$110 allotted for setting bases for Rafferty range finders. 02, 743.

Part 22, FGR. Sea Walls and Embankments.

Fort Morgan, Ala.—extensive temporary break'r built. **67**, 14. Foundation begun for concrete sea wall in combination with the break'r. **68**, 18. Work begun on a sea wall to protect the w. or chan. front of the fort; 53 piles driven and capped for outside of the cofferdam, 790 r. f. of sheet piling completed, and 1,000 c. y. of sand removed. **73**, 21. Sea wall completed. **74**, 25. \$27,000 allotted for extension of sea wall; work begun. **77**, 21. Extension completed, 750' long. **78**, 24. \$3,934.75 allotted and sea wall repaired. **81**, 48. \$5,570 allotted for extension and completion of the brush and st. revet. in front of sea wall; work nearly completed. **82**, 46. \$3,767 allotted for completion of aprons in front of sea wall and 605 r. f. of mattresses placed. **83**, 42. Est. cost of protecting shore, \$14,000. **96**, 523. Work begun on sea wall with funds remaining from allotment for Fort Gaines; 1,988.8 sq. y. fascine mattress and 1,325 c. y. r. placed, completing same. **98**, 737.

1901. Work on n. beach completed; entire length, 3,704 l. f. **01**, 841.

1902. Riprap sea wall 235' long constr. **02**, 746.

Fort Gaines—270 palmetto piles driven in constr. of 5 jetties for the protection of the shore and glais. **73**, 21. Four jetties completed. **74**, 25. Est. cost of protecting shore, \$11,000. **96**, 522. \$25,000 allotted for sea wall to be built under contract; work begun. **97**, 722. 4,629.9 sq. y. fascine mattress and 1,989 c. y. st. placed, completing sea wall. **98**, 737.

Mississippi Sound—\$5,584 allotted for constr. of 3 jetties for protection of the fort. Jetties completed and, in addition, a plank bulkhead 714' long built. **82**, 47. Jetties extended. **83**, 43. Jetty 480' long built. **84**, 48. \$20,000 allotted for extending riprap sea wall; extension completed for 850' and the fascine mattress placed for 850' addl. **99**, 930. Work on sea wall completed; 1,800 l. f. built and an extension of 370 l. f. built. Work in progress. Description of sea wall and summary of work. **00**, 948.

Part 23, FGR. Submarine Mines—Mobile, Ala.

1895. \$7,500 allotted for a mining casemate; work begun. **95**, 11.

1896. \$3,200 allotted. Work on mining casemate and cable gallery completed, except revetting slopes. Itemized cost of work. **96**, 521.

1897. \$4,675 allotted. Casemate and cable gallery completed and work begun on a cable tank. **97**, 723.

1898. Casemate fitted up for operating mines on the Abbott system, and torpedo materials stored. **98**, 742. Concrete cable tank completed and a traveling crane installed. Description of tank. **98**, 742. Three casemates cleaned and repaired, and torpedo material stored. **98**, 743. \$1,000 allotted for planting mines; dynamite and

other supplies purchased; searchlight installed. Mines planted and a base line selected, and stations prepared at each end of it for firing the mines by judgment; description. \$10,000 allotted for planting torpedoes; searchlight plant installed, mine field patrolled, and supplies received ready for future preparations. **98**, 743.

1899. Mines and cable and torpedo instruments received and stored. All mines that had been planted removed by exploding same. Cable, boxes, etc., cleaned and stored. **99**, 933. \$750 allotted for supplies for operating searchlight plants. **99**, 934.

1900. A half mile of multiple cable received and searchlight plant crated and stored. **00**, 949.

Part 24, FGR. Supplies for Seacoast Defenses.

1900. \$600 allotted. No expend. made. **00**, 952.

1901. Boiler repairs and replacing positive groups with new ones in electric plant of 12-inch battery. **01**, 841.

1902. \$300 allotted. Materials purchased and transferred. **02**, 746.

FGS. LOUISIANA-TEXAS FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts | 1897 |
| 2 | Engineering features..... | 1866-1912 |
| 3 | Engineers—Chief of Engineers | 1882 |
| 4 | BE | 1882 |
| 5 | In charge | 1866-1902 |
| 6 | Assistants | 1898-1902 |
| 7 | Forts, etc. (allotments, operations, etc.) | 1819-1912 |
| 8 | Rigolets Pass., La.—Fort Pike | 1819-1885 |
| 9 | Lake Borgne—Chef Menteur Pass, Fort Macomb | 1822-1885 |
| 10 | Battery Bienvenue | 1826-1880 |
| 11 | Tower Dupres | 1830-1880 |
| 12 | Tower at Proctorville | 1856-1880 |
| 13 | Mississippi R.—Fort Jackson | 1822-1869 |
| 14 | Fort St. Philip | 1841-1898 |
| 15 | New Orleans, La.—Emplacements, two 10-inch guns | 1895-1900 |
| 16 | 8-inch battery—emplacements, two 8-inch rifles, disappearing carriages | 1898-1899 |
| 17 | Battery, two 4.7-inch R. F. guns..... | 1898-1899 |
| 18 | 8-inch B. L. rifle on 15-inch S. B. carriage | 1898-1899 |
| 19 | Emplacements, two 8-inch rifles, disappearing carriages..... | 1898-1900 |
| 20 | First battery—emplacements, two 15-pounder R. F. guns | 1899-1901 |
| 21 | Second battery—emplacements, two 15-pounder R. F. guns..... | 1899-1901 |
| 22 | Two 15-pounder R. F. guns, second battery | 1901-1912 |
| 23 | Emplacements, four 6-inch R. F. guns | 1901-1902 |
| 24 | Barataria Bay, La.—Fort Livingstone | 1842-1886 |
| 25 | Sabine Pass, Tex.—Battery, 8-inch rifle on 15-inch S. B. carriage | 1899 |
| 26 | Temporary siege batteries | 1898-1899 |
| 27 | Battery, 8-inch rifles, 15-inch S. B. carriage | 1898-1899 |
| 28 | Miscellaneous (electric-light plant; leveling gun platform) | 1899-1902 |
| 29 | Preservation and repair | 1898-1902 |
| 30 | Range and position finders | 1901-1902 |
| 31 | Sea walls and embankments | 1893-1902 |
| 32 | Sites | 1901-1902 |
| 33 | Submarine mines | 1898-1900 |
| 34 | Supplies | 1901-1902 |

Part 1, FGS.**Contracts.**

1897. Cement, 10,667 barrels, at \$2.37 per sand, 4,180 c. y., \$1.446 per c. y.; hollow tile, 2,000, barrel; gravel and r., 11,056 c. y., \$2.63 per c. y.; 14½¢ each. 97, 734.

Part 2, FGS.**Engineering Features.**

Concrete, cost per c. v. 98, 751. Forms. 97, Percolation, preventing. 03, 2415.
 732. Mixing and placing. 97, 732, 734; 99, 939. Pile driving (tracing). 97, 730; 98, 747, 748;
 Settlement of (tracing). 90, 746; 99, 935, 938, 939, 99, 941.
 942, 944. Plant, constr. 98, 747, 754.
 Condensation, preventing. 03, 2415. Waterproofing methods. 97, 735; 98, 745, 751;
 Lining, magazines. 04, 3728 (pl.). 99, 936, 938, 939; 00, 953.
 Materials, cost of. 97, 734; 98, 751.
 Mines, submarine, planting and removing. 98,
 756; 99, 945. Suggestions for imp. 99, 948.

Part 3, FGS.

Engineers.

Chief of Engineers. R., 66, 17; 67, 14; 68, 18; 69, 18; 70, 25; 71, 22; 72, 20; 73, 21; 74, 26; 75, 25; 76, 26; 77, 21; 78, 25; 79, 29; 80, 49; 81, 49; 82, 47; 83, 44; 84, 49; 85, 42; 86, 42; 95, 11; 96, 19, 523; 97, 18, 727; 98, 28, 744; 99, 32, 934; 00, 28, 952; 01, 30; 02, 30; 03, 9; 04, 5, 9, 10; 05, 5; 06, 6; 07, 5, 9; 08, 9, 14; 09, 15; 10, 12, 16; 11, 8, 13; 12, 7, 12.

Part 4, FGS.

Board of Engineers.

Constituted, 1882, to consider and report upon the condition of fortifications, and what number, if any, could be dispensed with. 82, 425.

Part 5, FGS.

Engineers in Charge.

Capt. J. C. Palfrey, 1866.
Capt. J. M. Wilson, 1866.
Maj. M. D. McAlester, 1866-69.
Capt. W. E. Merrill, 1866.
Maj. F. E. Prime, 1869.
Capt. G. J. Lydecker, 1869.
Maj. C. W. Howell, 1869-82.

Maj. A. Stickney, 1882-85.
Capt. T. Turtle, 1885.
Maj. W. H. Heuer, 1885-86.
Maj. J. B. Quinn, 1895-1900.
Lt. C. S. Riché, 1897.
Maj. H. M. Adams, 1900-02.
Lt. Edw. M. Adams, 1901-02.

Part 6, FGS.

Assistants.

Lt. F. W. Allstaetter, 1898-99.
Capt. H. Jervoy, 1897-99.
Lt. C. S. Smith, 1899-1900.

Lt. H. Burgess, 1899.
Lt. Edw. M. Adams, 1901-02.

Part 7, FGS—

FORTS AND BATTERIES.

Part 8, FGS.

Fort Pike, Rigolets Pass, La.

1819. Work begun. 80, 49.
1870. Est. cost of proposed modifications, necessary repairs, and placing in the curved batterie battery a number of 10-inch rifled guns, with traverses between them, \$24,000 allotted; a break'r built along the Rigolets and a new whar' built. 70, 25.
1871. \$2,000 allotted for care and preservation. 71, 22.
1872. Bns., quarters, and break'r repaired. 72, 20.
1873. Repairs to br. and bric' covering of

terreplein of main work, and shingle revet. of slopes over breast-height wall of covered way replaced with a sodded slope. 73, 21.
1874-79. Necessary repairs. 74, 26; 75, 25; 76, 26; 77, 21; 78, 25; 79, 29.
1880. History of the fort; its importance. 80, 49.
1881. Care and preservation. 81, 49.
1882. Care and preservation. 82, 47.
1884. Minor repairs of bns.; grass, weeds, etc., cut from around the walls and inclosures. 84, 49.
1885. Grass and weeds cut. 85, 42.

Part 9, FGS. Fort Macomb, Chef Menteur Pass, La.

- | | |
|--|---------------------------------------|
| 1822. Work begun. 80, 49. | 26; 75, 25; 76, 26; 77, 22; 79, 29. |
| 1870. Est. cost of proposed modifications, \$24,000. 70, 25. | 1880. History and importance. 80, 49. |
| 1871. \$4,000 allotted for care and preservation. 71, 23. | 1881. Care and preservation. 81, 49. |
| 1873-79. Care and preservation. 73, 22; 74, | 1882. Care and preservation. 82, 48. |
| | 1885. Grass and weeds cut. 85, 42. |

Part 10, FGS. Battery Bienvenue, on Bayou Bienvenue, Near Lake Borgne, La.

- | | |
|---|--|
| 1826. Work begun. 80, 50. | 1873-77. Care and preservation. 73, 22; 7 |
| 1871. \$1,000 allotted for care and preservation. 71, 23. | 26; 75, 26; 76, 26; 77, 22. |
| 1872. Quarters, slopes, and bns. repaired. 72, 20. | 1880. History and importance of batter 80, 50. |

Part 11, FGS. Tower Dupres, Lake Borgne, La.

- | | |
|--|---|
| 1830. Work begun. 80, 50. | 1874. Repairs of tower completed and a keep placed in charge. 74, 26. |
| 1871. \$1,000 allotted for care and preservation. 71, 23. | 1877. Care and preservation. 77, 22. |
| 1873. Some floors relaid, interior of walls of tower repaired, doors hung, and tower cleared of rubbish. 73, 22. | 1880. History. 80, 50. |

Part 12, FGS. Tower at Proctorville, Lake Borgne, La.

- | | |
|---|---|
| 1856. Work begun. 80, 50. | 1875-79. Care and preservation. 75, 26; 7 |
| 1871. \$360 allotted for care and preservation. 71, 23. | 27; 77, 22; 78, 25; 79, 30. |
| | 1880. History and importance. 80, 50. |

Part 13, FGS. Fort Jackson, Mississippi River, La.

- | | |
|--|---|
| 1822. Work begun. 80, 50. | 1872. \$64,000 app. Work begun, necessar buildings erected, plant purchased, levees and draining machine to protect the site of the fo from overflow built, slopes repaired, RR. buil and completion of concrete work for 5 magazir traverses in the lower battery. 72, 21. |
| 1866. Work begun reinforcing barbette platfoms to adapt them to larger calibers. 66, 17. | 1873. \$65,000 app. E. battery, 2 covered-a batteries, and battery in the n. bastion c mai work completed, except gun platforms and mason breast-height walls. 73, 22. |
| 1867. Modification of 22 barbette platforms completed, 16 shot platforms finished, and 2 platfoms for 13-inch mortars begun. 67, 14. | 1874. \$30,000 app. Work on drainage, regra ng new earthwork, providing 20 wooden platfom for 15-inch guns, laying 4 foundations for platfom |
| 1868. Repairs to levees and to main work. 68, 19. | |
| 1869. Lightning rods erected over magazines and slight repairs made. 69, 18. | |
| 1870. Est. cost of proposed modifications, \$191,000. 70, 26. | |
| 1871. \$50,000 app. Levees repaired and property cared for. 71, 23. | |

providing material for 16 foundations, and constr. concrete piers for 3 brs. across moat. 74, 26.

1875. \$25,000 app. Completion of 18 emplacements for 15-inch guns; work on permanent breast-height walls, slopes, brs., casemate storerooms, quarters, and minor work. 75, 26.

1876. Sally port built to connect lower battery with lower covered-way battery; work on 2 platforms and breast-height wall, magazine traverses, and repairs to slopes, etc. 76, 27.

1877-79. Care and preservation. 77, 22; 78, 25; 79, 30.

1880. History; description and importance. 80, 50.

1881. Care and preservation. 81, 51.

1882. Care and preservation. 82, 49.

1883. Work on levees. 83, 45.

1884. Repairs to brs., quarters, and buildings; drains cleaned; 12 shot beds built, and shot and shell piled; a number of guns, carriages, and chassis moved and blocked; levees completed, and a temporaryrevet. placed to protect the new levee. 84, 50.

1885. New wharf built and 2 st. platforms for 15-inch guns completed. 85, 44.

1886. Eight concrete and wooden platforms for 15-inch guns replaced with concrete platforms for same guns and a new levee built. 86, 44.

1898. Repairs of buildings, brs., fences; resurfacing elevated gallery of main work; a number of old guns mounted. 98, 745.

Part 14, FGS. Fort St. Philip, Mississippi River, La.

1841. Work begun. 80, 51.

1866. Reinforcing the barbette platforms to adapt them to heavier guns begun and nearly completed. 66, 17.

1867. The magazine in the lower battery, 15 new gun platforms, 2 mortar platforms, with necessary modification of parapets, breast-height walls, and terrepleins completed, and repairs made to br. across ditch and to 2 gun platforms. 67, 14.

1868. Levees repaired and a new levee built from the lower end of the front levee to the bayou. 68, 19.

1869. Minor repairs. 69, 18.

1870. Est. cost of proposed modifications, \$108,000. Minor repairs to levees. 70, 26.

1871. \$37,500 app. 71, 23.

1872. \$42,500 app. Modification work begun. Necessary buildings erected for employees, levee rebuilt, wharf repaired; completion of concrete work for 2 magazines and work in progress on 3 others; building parapet of new battery. 72, 21.

1873. \$50,000 app. Completion of levee, 6 traverse magazines in the new and lower water battery, and demolition of the old works. Emplacements for 12 guns ready for platforms. 73, 22.

1874. \$30,000 app. Completion of 3 magazine traverses, parapet, and temporary breast-height wall of the lower battery; repairs to slopes; demolition of old magazines and minor work. Summary of work. 74, 27.

1875. \$25,000 app. Completion of 6 magazine traverses; repairs to temporary breast-height walls; completion of 18 platforms for 15-inch guns; minor work and repairs. 75, 26.

1876. Three magazines built and 3 traverses completed up to the crown of the arches; foundation of sally port completed and weighted; 2 wooden platforms placed and excavation made for 7 more; wharf extended and repaired; drains built; reservation resurveyed and the boundaries marked with st. monuments. 76, 27.

1877-79. Care and preservation. 77, 22; 78, 26; 79, 30.

1880. History and description. 80, 51.

1881. Care and preservation. 81, 51.

1882. Care and preservation. 82, 49.

1884. Eight new shot beds built, 3 repaired; guns, carriages, and chassis blocked up; ditches and drains cleaned; brs. repaired; new levee built in front of the old one; a barbed-wire fence built along the river front and on the levee. 84, 51.

1885. New wharf built and a barbed-wire fence built to keep cattle off the levee and grounds. 85, 44.

1886. Replacing 8 concrete and wooden platforms for 15-inch guns with concrete platforms. 86, 44.

1898. Repair of buildings, brs., roof of magazine; minor work; a number of old guns mounted. 98, 745.

Part 15, FGS. New Orleans, La.—Emplacements for Two 10-inch Guns.

1895. \$70,000 allotted. Plans being prepared. 95, 11.

1896. \$55,000 allotted. Work begun; necessary buildings for employees erected. Piles driven in the emplacements of the battery and part of the excavation completed. \$350 allotted for an iron girder br. across moat. Work completed under contract for \$599. 96, 524.

1897. \$38,000 allotted. Plans revised. 11,000 c. y. concrete and 12,000 c. y. earth placed, nearly

completing concrete work and parapet; ironwork placed; because of concrete work of parapet and platforms settling more work required. Summary of work with itemized cost. 97, 727.

1898. \$9,000 allotted. Platforms releveled, guns and carriages mounted, and the completed battery turned over to the Artillery June 7, 1898. Description of releveing with tracing. 98, 746.

1900. \$213 allotted. Handrails placed. 00, 053.

Part 16, FGS. New Orleans, La.—Eight-inch Battery—Emplacements for Two 8-inch Rifles on Disappearing Carriages.

1898. \$90,500 allotted. Work delayed because of yellow fever. Pile driving begun in December, 1897; 1,340 piles driven; concrete work begun on April 6, 1898. Guns and carriages mounted and work nearly completed. Description of pile driving with tracing; waterproofing; itemized cost of battery. **98, 746.**

1899. Battery completed and guns tested, report, with tracing, of the settling of the battery. \$3,300 allotted for earth filling between 8-inch and 10-inch batteries and building a concrete walk in rear. 4,000 c. y. earth placed and a walk 550' x 8' built. **99, 934, 936.**

Part 17, FGS. New Orleans, La.—Battery for Two 4.7-inch R. F. Guns.

1898. \$7,000 allotted. Guns to be mounted temporarily on the face cover, using the existing magazines and parapets. **98, 752.**

1899. Emplacements completed, guns mounted and tested, old magazine repaired, and earthwork completed and sodded. **99, 936.**

Part 18, FGS. New Orleans, La.—Eight-inch B. L. Rifles Mounted on 15-inch S. B. Carriages.

(See emplacements for 8-inch guns on disappearing carriages.)

1898. \$10,000 allotted. No work done; awaiting the arrival of 8-inch rifles. **98, 752.**

1899. Guns received. Work begun on altering

carriages; work completed and guns mounted. Heavy concrete breast wall built in front of the old platforms; some earth filling. Guns dismounted and transferred to other emplacements. **99, 937.**

Part 19, FGS. New Orleans, La.—Emplacements for Two 8-inch Rifles on Disappearing Carriages.

(See emplacements for 8-inch rifles on 15-inch S. B. guns.)

1898. \$125,000 allotted. Work begun; wharf built; pile driving completed; concrete work in progress. Description and cost of plant and summary of work and difficulties attending it. **98, 753.**

1899. \$25,000 allotted. Concrete work completed; 3,800 c. y. placed; carriages received and mounted. Description of waterproofing. Settlement, and general work. **99, 937. \$1,600 allotted.**

Rifles transferred on a deck barge and mounted by June 17, 1899. **99, 940.**

1900. \$34 allotted. Handrail placed on 1 emplacement. **00, 953.** Carriages cleaned and leveled. \$600 allotted for ammunition hoists; erected. \$4,848 allotted for removing old brick parapet, so as to give a clear view of the R. Part of old parapet and an old magazine on the parapet blasted and removed; 4,000 c. y. earth removed from tops of 5 old magazines; 13 obsolete guns and carriages dismounted and stored. **00, 955.**

Part 20, FGS. New Orleans, La.—First Battery—Emplacement for Two 15-pounder R. F. Guns.

1899. \$24,500 allotted. Work begun Dec. 28, 1898. Excavations pile driving, grillage, and concrete work nearly completed; earth slopes finished and battery completed, awaiting the mounts. Summary of work. **99, 940.**

1900. Earth slopes repaired. Wires placed or

electric lights and walk to connect with 8-inch and 10-inch batteries built. No guns or carriage received. **00, 952.**

1901. Base castings placed and platforms completed; guns mounted by troops; transferred to garrison Jan. 17, 1901. **01, 842.**

Part 21, FGS. New Orleans, La.—Second Battery—Emplacements for Two 15-pounder R. F. Guns.

1899. \$24,500 allotted. Work begun Dec. 23, 1898. Excavations, pile driving, earth slopes, and concrete work completed, awaiting arrival of mounts. Summary of work. 99, 941.

1900. Electric wires placed. Earth slopes repaired and parade graded. No guns or carriages received. 00, 955.

1901. Guns mounted by troops. 01, 845.

Part 22, FGS. New Orleans, La.—Two 15-pounder R. F. Guns, Second Battery.

1901. \$10,000 allotted. Work commenced June 25, 1900; emplacements completed September, 1900,

with the exception of gun platforms. 01, 842; 02, 748.

Part 23, FGS. New Orleans, La.—Emplacements for Four 6-inch R. F. Guns.

1901. \$80,340 allotted. Preparation for constr. made; materials ordered; work commenced; site cleared; plant erected. 01, 843.

1902. Foundations for 2 emplacements com-

pleted; concrete work completed; electric lights and switchboards placed in magazines; site for second 2 emplacements acquired; materials for this battery ordered. 02, 748.

Part 24, FGS. Fort Livingstone, Barataria Bay, La.

1842. Work begun. 80, 51.

1870. Est. cost of proposed modifications, \$38,000. 70, 26.

1871. \$202.50 expended on general repairs. \$2,500 allotted for care and preservation. 71, 24.

1873-79. Care and preservation. 73, 23; 74, 27; 75, 26; 76, 27; 77, 22; 79, 31.

1880. History and description. 80, 51.

1884. Repairs to slopes; shot beds built; dismounted guns raised and blocked; minor work. 84, 51.

1885. Quarters repaired. 85, 45.

1886. Survey made, and plans and ests. prepared for jetties to protect shore line of site from further erosion by the sea. 86, 44.

Part 25, FGS. Sabine Pass, Tex.—Battery for 8-inch Rifle on 15-inch S. B. Carriage.

1899. \$6,000 allotted. Work begun June 6; about one-fourth completed. \$3,120 allotted for wharf; wharf 960' long completed. Gun and car-

riage received. Carriage altered and gun mounted. All ordnance and ordnance stores turned over to the ordnance sergeant. 99, 948.

Part 26, FGS. Sabine Pass, Tex.—Temporary Siege Batteries.

1898. \$4,200 allotted for temporary batteries for two 5-inch siege guns and two 7-inch siege howitzers. Work begun in April and completed. Armament received and mounted. All guns, carriages, armament, and ammunition pertaining to these guns were shipped to Tampa, Fla., and 4

light 12-pounder S. B. guns and carriages for same were mounted; work incomplete. 98, 764.

1899. Embrasures cut in breast-height wall to permit the use of smaller guns and parapet raised. Lease of land changed to include sufficient ground for an 8-inch gun emplacement. 99, 949.

Part 27, FGS. Sabine Pass, Tex.—Battery for 8-inch Rifle on 15-inch S. B. Carriage.

1898. \$6,000 allotted. Work begun June 6; about one-fourth completed. \$3,120 allotted for wharf; work begun and nearly completed. 98, 764.

1899. Earthwork and magazine and platform

completed. Gun and carriage received. Carriage altered and gun mounted. All ordnance and ordnance stores turned over to the ordnance sergeant A wharf 960' long completed. 99, 948.

Part 28, FGS.

Miscellaneous.

Electric-light plants. \$1,146.84 allotted and plants installed; description with cost. 99, 942. \$5,250 allotted for a permanent house; house completed, but owing to the unequal settlement of foundations the wall fell in. New site selected and work begun. 99, 943. \$1,900 allotted for operating electric plant; necessary materials purchased. 99, 944.

1900. Permanent house for electric plant completed; dynamos boiler and engine cleaned, repaired, and placed on their foundations and the

completed building transferred to the garrison. 00, 952.

Releveling gun platforms, etc. of new batteries. \$6,545 allotted. 8-inch and 10-inch emplacements—magazines waterproofed and gun platforms releveled. \$400 allotted for raising and leveling base rings of 10-inch battery; work completed. 00, 953.

1902. \$2,885 allotted for releveling base rings of 10-inch platforms; work completed. 02, 749.

Part 29, FGS.

Preservation and Repair.

1898. \$4,000 allotted. Fort St. Philip—repairs to buildings, bns. magazines, and cisterns. Fort Jackson—repairing bns. fences, and gallery of main fort. \$3,500 allotted for mounting old guns at Forts Jackson and St. Philip; work completed. 98, 744.

1899. New Orleans—\$1,000 allotted for repairs to slopes and machinery and care of property. \$250 allotted for moving and storing torpedoes and preparing a casemate for same. \$3.25 allotted for a new tangent wheel for ammunition lift at 10-inch battery. 99, 944. Sabine Pass—\$310 allotted for repair of magazine floors, drains, buildings, erecting a wire fence, and care of property. 99, 950.

1900. New Orleans—\$1,870 allotted. General repair of guns and carriages, slopes, buildings, and machinery. 00, 953. \$4,219.50 allotted; slopes repaired, torpedo material cleaned and stored, plant cleaned and repaired, gun platforms releveled care of property. 00, 955.

1901. \$6,000 allotted for repairing leaks, painting, whitewashing, etc. and repairs to superior slope of 8-inch gun battery. 01, 844. \$115 allotted for changing location of electric-light wires and poles; work completed. 01, 844, 845. \$1,200 allotted for painting ironwork, placing hood and collar on smokestack, and other minor work. 01, 845. \$440 allotted for hire of watchmen. 01, 846. \$1,000 allotted for repairing slope of 8-inch gun battery, painting ironwork whitewashing, caring for plant. 01, 846.

1902. Site 1—\$1,590 allotted for repairs to handrails, 10-inch gun battery; wooden steps 8-inch battery replaced by concrete; quarters and wharf repaired. 02, 751. Site 2—\$360 allotted for care of torpedo property; repairs to buildings; loading platforms; exterior of casemate rendered dry by coating of asphalt. 02, 751.

Part 30, FGS.

Range and Position Finders.

1901. \$8 allotted. Iron rails placed. 01, 843.

1902. \$13,500 allotted for fire-commander's

station; work on foundation completed; work on erecting tower in progress. 02, 748, 749.

Part 31, FGS. Sea Walls and Embankments.

Fort Jackson—\$5 926.21 allotted for constr. and repair of levees; work in progress. 83, 45. Levee completed and a temporaryrevet. built to protect same. 84, 50. New levee built. 86, 44.

Fort St. Philip—new levee built in front of the old one from the upper end of the reservation to where the back levee begins, and from this point to the lower end of the reservation part of the old

front levee was repaired. The back levee rebuilt. 84, 51.

1901. \$2,400 allotted for repairing and raising front of levee of R. side of reservation. 02, 844.

1902. \$2,400 allotted. Land drained and cleared of drift; storm damaged levee; levee rebuilt; work completed. 02, 750.

Part 32, FGS.

Sites.

1901. \$250 allotted for tract of land to be acquired by condemnation. 01, 843.

1902. \$515 allotted for purchasing tract of land for site of 6-inch R. F. guns. 02, 749.

Part 33, FGS.

Submarine Mines.

1898. New Orleans—\$26,500 allotted. Mines planted. Description in detail with cost. 98, 755. Sabine Pass—\$3,600 allotted; mines, dynamite and electrical supplies received and stored awaiting receipt of cables. 98, 764.

1899. New Orleans—\$2,714.93 allotted for installing searchlight and operating casemate; work completed. 99, 942. \$5,366.23 allotted for torpedo

defense of New Orleans; all mines removed. Description of method of removing mines with results and suggestions for imp. 99, 945. Sabine Pass Tex.—10 mines, with necessary supplies, received. No mines planted. All torpedo material transferred to ordnance sergeant. 99, 950.

1900. \$3,675 allotted for a torpedo storehouse; work completed and material stored. 00, 956.

Part 34, FGS. Supplies for Seacoast Defenses.

1901. \$500 allotted for purchase of supplies; hood and collar for smokestack of dynamo house installed. 01, 845.

1902. \$500 allotted. Supplies purchased and issued; reflectors for searchlight purchased. 02, 751.

FGU.

TEXAS FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 1 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|----------|
| 1 | Contracts..... | 1896-190 |
| 2 | Engineering features..... | 1896-190 |
| 3 | Engineers—Chief of Engineers..... | 1879-191 |
| 4 | BE..... | 1882-190 |
| 5 | In charge..... | 1896-190 |
| 6 | Assistants..... | 1896-190 |
| 7 | Forta, etc. (allotments, operations, etc.)..... | 1879-191 |
| 8 | Galveston, Tex.—Batteries at entrance..... | 1879-188 |
| 9 | Emplacement, two 10-inch guns, Battery No. 1..... | 1897-190 |
| 10 | Mortar battery No. 1..... | 1897-190 |
| 11 | Two 4.7-inch R. F. emplacements..... | 1898-190 |
| 12 | Two 10-inch gun emplacements, Battery No. 2..... | 1898-190 |
| 13 | Two 8-inch gun emplacements..... | 1898-190 |
| 14 | Two emplacements, 15-pounder R. F. guns, Battery No. 1..... | 1899-190 |
| 15 | Two emplacements, 15-pounder R. F. guns, Battery No. 2..... | 1899-190 |
| 16 | Three emplacements, 15-pounder R. F. guns..... | 1899-190 |
| 17 | Mortar battery, No. 2..... | 1899-190 |
| 18 | Emplacements, two 6-inch guns..... | 1900 |
| 19 | Site 1..... | 1902 |
| 20 | Reconstr., battery, two 10-inch guns, disappearing carriages..... | 1902 |
| 21 | Reconstr., battery, 12-inch mortars..... | 1902 |
| 22 | Repair, battery, two 4.7-inch R. F. guns..... | 1902 |
| 23 | Repair, battery, two 3-inch R. F. guns..... | 1902 |
| 24 | Site 2—Repair, battery, two 10-inch guns, disappearing carriages..... | 1902 |
| 25 | Repair, battery, eight 12-inch mortars..... | 1902 |
| 26 | Repair, battery, two 3-inch R. F. guns..... | 1902 |
| 27 | Site 3—Repairs, battery, two 8-inch guns, disappearing carriages..... | 1902 |
| 28 | Repair, battery, 3-inch R. F. guns..... | 1902 |
| 29 | Miscellaneous (electric plant; restoration of grounds, etc.; storm)..... | 1899-190 |
| 30 | Preservation and repair..... | 1899-190 |
| 31 | Range and position finders..... | 1901 |
| 32 | Sea walls..... | 1901 |
| 33 | Sites..... | 1897-189 |
| 34 | Submarine mines..... | 1896-190 |

Part 1, FGU.

Contracts.

1896. Battery for eight 12-inch mortars, \$96,-491.80. **97, 742.**

1899. Electric-light plant for 10-inch battery No. 1 and mortar battery No. 1, \$9,248. **99, 958.**

1902. Large and small riprap st., various prices; natural cement, \$1.75 per barrel and \$1.9 per barrel. **02, 758.**

Part 2, FGU.

Engineering Features.

Battery, mortar, reconstr. **04, 3730.**
 Carriages, releveing. **99, 953, 973.**
 Cement, table of tests. **96, 528; 97, 737, 741.**
 Concrete, cost per c. y. **98, 766; 00, 970.**
 Concrete, ingredients of. **96, 525; 97, 737; 99, 959.**
 Strengths; various tests. **05, 3027.**
 Condensation, methods of preventing. **R. 99, 951, 960, 970; 04, 3729; 05, 3029.**
 Construction, methods. **05, 3030 (pl.).**
 Covering, sand, pumping. **05, 3029.**
 Dampproofing, methods. **04, 3730 (pl.).**
 Drainage system, description of. **99, 951**
 Grillage foundations of old R.R. iron. **94, 763; 99, 955.**

Leaks, preventing. **03, 2417.**
 Lining, magazine. **03, 2416 (pl.).**
 Mines, defects noticed in submarine. **98, 770.**
 Mines, description of, method of laying and removing. **98, 769; 99, 964.**
 Percolation, overcoming. **03, 2416 (pl.); 04, 3729; 05, 3029.**
 Seepage through concrete roof, prevention of **R. 99, 952, 970.**
 Ventilation, controlling. **05, 3029.**
 Walls, sea, sheet piling. **05, 3023 (pl.).**
 Concrete, specifications. **05, 3024 (pl.).**

Part 3, FGU.

Engineers.

Chief of Engineers. R., 79, 31; 80, 51; 81, 958; 01, 30; 02, 30; 03, 9, 16; 04, 5; 05, 5, 11, 15; 52; 82, 50; 83, 46; 84, 52; 85, 45; 86, 45; 96, 19, 06, 5, 9; 07, 5, 10, 11, 450; 08, 9; 09, 10, 16; 10, 524; 97, 19, 737; 98, 29, 765; 99, 33, 951; 00, 29, 12; 11, 8, 14; 12, 7, 12.

Part 4, FGU.

Board of Engineers.

1882. Constituted to consider and report upon the constr. of fortifications, and what number, if any, could be dispensed with. R., 82, 427.
1901. Constituted to examine damages made by storm of Sept. 8, 1900. R., 01, 850. (Col. H. M. Robert, Maj. H. M. Adams, Capt. C. S. Riché. 01, 850.)

Part 5, FGU.

Engineers in Charge.

Lt. Col. A. M. Miller, 1896-98. Maj. J. B. Quinn, 1895-99.
Capt. C. S. Riché, 1898-1902.

Part 6, FGU.

Assistants.

Lt. W. V. Judson, 1896-97. Lt. H. Burgess, 1898-99. R., 98, 769.
Capt. C. S. Riché, 1897-98. Lt. M. L. Walker, 1901-02.

Part 7, FGU—

FORTS AND BATTERIES.

Part 8, FGU. Batteries at Entrance to Harbor.

1879-86. Plans made for batteries at Pelican Spit, Galveston Isld., and Bolivar Pt. 79, 31; 80, 51; 81, 52; 82, 50; 83, 46; 84, 52; 85, 45; 86, 45.

Part 9, FGU. Emplacement for Two 10-inch Guns, Battery No. 1.

1897. \$100,000 allotted. Work begun on 1 emplacement designed for all-around fire and 1 for limited fire, and site raised to a level of 8' above m. l. t.; concrete work in progress. Summary of work with itemized cost. 97, 738.

1898. \$17,500 allotted. Concrete work and earthwork completed. To protect the parapet from wave action during storms, sheet piling, protected on the outside by riprap, placed. Gun and carriage mounted in s. emplacement; another gun on hand; settlement; carriage in s. emplacement leveled up. Summary of work with itemized cost. 98, 765.

1899. All-around fire carriage received, mounted with gun, and tested; new drain system completed; waterproofing completed. Itemized cost of emplacement. 99, 951. \$2,500 allotted for concrete splinter-proof power house; work begun and completed. 99, 953.

1900. Electric plant installed, and the completed battery turned over to the Artillery. Total cost, \$117,500. Power house completed; cost, \$2,500. 00, 958.

Part 10, FGU.**Mortar Battery No. 1.**

1897. \$117,700 allotted. Work begun under contract; sheet-piling revet. completed; site of battery raised; mortar platforms completed and made ready for ironwork. Summary of work. 97, 740.

1898. Concrete work and sand fill completed; \$1,600 allotted. Carriages mounted and battery, except installing electric plant, completed. 98, 766.

1899. New drainage system completed; carriages leveled, and all work, except installing electric plant, completed. Itemized cost of work 99, 953.

1900. Electric plant installed; completed battery transferred to the Artillery. 00, 959.

Part 11, FGU. Two 4.7-inch R. F. Emplacements.

1898. \$26,000 allotted. Work begun May 23, 1898. Sheet piling driven around site under contract; 2,000 c. y. sand and 725 t. riprap placed; work in progress. 98, 768.

1899. \$15,000 allotted. Emplacements com-

pleted and guns mounted. Itemized cost of work 99, 961, 966.

1900. Completed emplacements transferred to the Artillery Oct. 25, 1899. 00, 966, 970.

Part 12, FGU. Two 10-inch Gun Emplacements, Battery No. 2.

1898. \$100,000 allotted. Work begun. 954 piles driven for foundation; grillage of old R.R. rails running in both directions and embedded in the concrete, and 5,310 c. y. concrete placed. 98, 769.

1899. \$10,000 allotted. Concrete work com-

pleted; carriages mounted; guns not on hand. Description of waterproofing and ventilating systems. Itemized cost of work. 99, 959, 969.

1900. Guns and carriages received and mounted and battery completed. 00, 965, 972.

Part 13, FGU. Two 8-inch Gun Emplacements.

1898. \$100,000 allotted. R.R. track built to connect site of battery with Gulf & Interstate Ry 776 piles driven for foundation; grillage of 2 layers of old R.R. iron placed. 4,273 c. y. concrete placed. Platforms ready for base rings. 98, 769.

1899. \$10,000 allotted and \$1,000 transferred from 10-inch emplacements; carriage and gun

mounting in progress. Summary and itemized cost of work. 99, 960, 967.

1900. Mounting of guns and carriages completed; waterproofing completed, and the completed battery transferred to the Artillery Oct. 25, 1899. 00, 966, 971.

Part 14, FGU. Two Emplacements for 15-pounder R. F. Guns, Battery No. 1.

1899. \$30,000 allotted for guns on pillar mounts; work begun, trestle built, and pipe laid for filling the site for battery. U. S. dr. boat altered. Itemized cost of work. 99, 955, 967.

1900. \$3,000 transferred from other works.

Site filled in, concrete work completed. 741 c. y. placed; 660 c. y. riprap placed, and battery completed ready for guns. Itemized cost of work. 00, 959, 969.

Part 15, FGU. Two Emplacements for 15-pounder R. F. Guns, Battery No. 2.

1899. \$15,000 allotted. Work begun January 9, foundation piles driven, and a grillage of old R.R. iron laid; concrete work nearly completed, sheet piling revet. completed, emplacement ready for armament. Summary and itemized cost of work. 99, 955, 970.

1900. \$1,500 transferred to other works. Battery, except blast surfaces and part of riprap protection, completed. Sand fill completed; 3,433 c. y. placed. No guns received. 00, 960, 972.

1901. Hurricane damages revet., washing protection away. No work done. 01, 847.

Part 16, FGU. Three Emplacements for 15-pounder R. F. Guns.

1899. \$30,000 allotted. Work begun January 26; all sheet piling driven, foundation piles driven, grillage of old R.R. iron placed, and gun platforms made ready for carriages. Summary of work. 99, 956, 968.

1900. \$1,500 transferred to other works. Con-

crete work completed, 1,109 c. y. placed; sand protection completed, 4,000 c. y. placed. Battery completed and turned over to the Artillery March 31. No guns or carriages received. Itemized cost of work. 00, 961, 971.

Part 17, FGU. Mortar Battery No. 2.

1899. \$125,000 allotted. Work begun Sept. 17, 1898; foundation piles driven, timber grillage laid, concrete work nearly completed; damp course at the 9-foot elevation under all magazines and an asphalt course over all roofs completed. Summary and itemized cost of work. 99, 957, 969.

1900. Sand fill completed; 50,245 c. y. placed;

920 t. riprap protection placed; 8 mortars and carriages received. Itemized list of expend. 00, 963, 972.

1901. Hurricane Sept. 8, 1900, washed down all sand and soil protection; mortars and carriages buried in sand. 01, 847. (See Work of reconstr., 1902.)

Part 18, FGU. Emplacements for Two 6-inch Guns.

1900. \$5,000 allotted. Work begun; 125,000 c. y. sand filling placed on site; sand fences built

to prevent cutting of chan. through the site during high tide. 00, 965, 971.

Part 19, FGU. Site 1.

1902. Work of rebuilding railway trestle and track completed; various machinery and cars rebuilt and repaired. 02, 752.

Part 20, FGU. Site 1—Reconstruction of Battery for Two 10-inch Guns on Disappearing Carriages.

1902. \$175,000 allotted. Work of breaking up old battery under way. 02, 752.

Part 21, FGU. Site 1—Reconstruction of Battery for 12-inch Mortars.

1902. \$290,000 allotted. Removal of carriages and mortars from old battery commenced. 02, 753.

Part 22, FGU. Site 1—Repair of Battery for Two 4.7-inch R. F. Guns.

1902. \$50,000 allotted. Driving of piles, placing of grout, foundation for pavement completed. 02, 753.

Part 23, FGU. Site 1—Repair of Battery for Two 3-inch R. F. Guns.

1902. \$35,000 allotted. Concrete foundation placed around battery; driving of piles. 02, 754.

Part 24, FGU. Site 2—Repair of Battery for Two 10-inch Guns on Disappearing Carriages.

1902. \$85,000 allotted. Sheet piling driven; grouting under battery; riprap filling done. 01, 755.

Part 25, FGU. Site 2—Repair of Battery for Eight 12-inch Mortars.

1902. \$180,000 allotted. Foundation piles for walls driven; new e. and w. wing walls constr.; observation station constr. 02, 756.

Part 26, FGU. Site 2—Repair of Battery for Two 3-inch R. F. Guns.

1902. \$30,000 allotted. Sheet piling driven; pavement in rear of battery completed. 02, 756.

Part 27, FGU. Site 3—Repairs of Battery for Two 8-inch Guns on Disappearing Carriages.

1902. \$85,000 allotted. Sand placed to protect piling. 02, 757.

Part 28, FGU. Site 3—Repair of Battery for 3-inch R. F. Guns.

1902. \$35,000 allotted. Sand placed to protect piling from action of teredo. 02, 757.

Part 29, FGU. Miscellaneous.

Electric-light plant. 1899. \$10,000 allotted for 10-inch battery No. 1 and 12-inch mortar battery No. 1. Work done under contract; wiring completed; dynamos and engine installed; work in progress. 99, 957.

1900. Installation completed and battery transferred to the Artillery. 00, 913, 971.

Restoring railway approaches and fence around reservation. 1901. Site 2—\$6,000 allotted during year. 4,808 l. f. restored, 550 l. f. track repaired, and 692 l. f. railway trestle built. 02, 756. \$3,000 allotted. No work done. 02, 758. Storm of Sept. 8, 1900. (See Sea walls and embankments.)

Part 30, FGU. Preservation and Repair.

1899. \$7,100 allotted. Drainage system and waterproofing completed at 10-inch battery No. 1 and slopes repaired at mortar battery No. 1. 99, 958.

1900. \$2,455 allotted. Repairing ammunition hoists, slopes; planting Bermuda grass seed on slopes; planting trees; releveling gun platforms; repairing magazine doors; minor work. 00, 964.

1901. \$8,500 allotted for preserving and caring

for engineer property damaged by hurricane cleaned, oiled, painted, etc. 01, 848. \$5,000 allotted for preserving batteries on piling from action of teredo. 01, 849. \$18,000 allotted. Preparation of plans; constr. field office and quarters, etc.; erection of plant. 01, 849. \$8,000 allotted. Foundation work; reconstr. minor casemate in traverse of 3-inch battery; driving of piles. 01, 754.

Part 31, FGU. Range and Position Finders.

1901. \$2,000 allotted. Hurricane seriously damages stations; no work done. 01, 847.

Part 32, FGU. Sea Walls and Embankments.

1901. Report by BE., Nov. 23 1900, upon work necessary for repairing damages to fortifications by storm of Sept. 8, 1900. Est. of \$568,000 is

submitted, with addition of \$238,000 if work is delayed. 01, 850, etc.

Part 33, FGU.**Sites.**

\$71,000 allotted for 1 site. 97, 741. \$4.75 allotted for a second site. 98, 767.

Part 34, FGU.**Submarine Mines.**

1896. \$10,000 allotted. Work begun on a mining casemate; 111 c. y. concrete placed. Ingredients of concrete. Testing cement. 96, 19, 524.

1897. \$9,562.40 allotted. Work completed; a total of 1,085 c. y. concrete and 10,795 c. y. of earth placed. Total cost, \$15,009.27. Itemized cost of work. 97, 737.

1898. \$12,000 allotted. Supplies purchased and a temporary line of torpedo defense begun, but discontinued after reception of other material; mines planted and tests made. 98, 769.

1899. \$750 allotted. Searchlight installed on 2 railway flat cars, on the U. S. Jetty track. 99, 963. \$3,000 allotted for cable tank; work begun and nearly completed cable stored. 99, 963.

2,000 allotted for a wooden torpedo storehouse. Work begun and completed except minor work; torpedoes anchors, and other submarine mining material stored. 99, 963. Report on planting and removing mines. 99, 964.

1900. Cable tank completed and cable stored. 00, 967. Torpedo storehouse completed and all torpedo material stored. 00, 968. \$5,000 allotted for system of tracks or submarine-mining service; work completed. Itemized cost. 00, 968, 971.

1902. Site 1—\$2,000 allotted for reconstr. of submarine-mine warehouse; work completed; material stored. 02, 754. \$2,200 allotted. Repair of cable tank; building erected over tank. 02, 754. \$5,800 allotted for reconstr. tracks and wharf; work completed. 02, 755.

FLG.¹ NORTHERN AND NORTHWESTERN LAKES FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

Part 1, FLG.

Engineers.

Chief of Engineers. R., 66, 2; 67, 3; 68, 6; 69, 7; 70, 11; 71, 3; 72, 3; 73, 4; 74, 6; 75, 5; 76, 6; 77, 4; 78, 6; 79, 8; 80, 18; 81, 14; 82, 9; 83, 5; 84, 10; 85, 5; 86, 6; 99, 33, 974; 00, 30, 973; 01, 82; 02, 7, 33; 03, 8, 9; 04, 5; 05, 5.

BE., 1885. R., 86, 509.

In charge:

Col. T. J. Cram, 1866-70.

Maj. W. McFarland, 1870-71.

Maj. G. L. Gillespie, 1871-73.

Maj. F. Harwood, 1873-74.

Lt. Col. C. E. Blunt, 1875-78.

Maj. W. McFarland, 1878-83.

Lt. Col. H. M. Robert, 1883.

Lt. Col. O. M. Poe, 1884-86.

Lt. Col. G. J. Lydecker, 1899-1901.

Maj. W. L. Fisk, 1901-02.

Col. John W. Barlow, 1901.

Col. S. M. Mansfield, 1901.

Col. John W. Barlow, 1901.

Capt. Harry Taylor, 1901-02.

Capt. G. D. Fitch, 1901.

Maj. T. W. Symons, 1901-02.

Capt. L. H. Beach, 1902.

Assistant. Lt. R. R. Raymond, 1901-02.

¹Final G=General.

FLPP. DETROIT, MICH., FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | |
| 2 | Engineers (see FLG above, and Part 5 below)..... | |
| 3 | Forts, etc. (allotments, operations, etc.)..... | 1841-1901 |
| 4 | Fort Wayne, Mich..... | 1841-1901 |
| 5 | Fort Gratiot Military Reservation..... | 1871-1873 |

Part 1, FLPP.**Contracts.**

1882. Pointing the nw. front, and 1 face of casemates, breast-height wall, and parapet. 82, 9. per sq. y.; clearing and pointing casemate walls, \$1.50 per sq. y.; cutting out and replacing damaged

1883. Clearing and pointing scarp walls, \$1.15 brick, \$40 per M. 83, 5.

Part 2, FLPP. (See FGG above, and Part 5 below).**Part 3, FLPP.****FORTS AND BATTERIES.****Part 4, FLPP.****Fort Wayne, Mich.¹**

1841. Work begun. 80, 18.

1862. New work begun. 83, 5.

1866. Work continued on scarp wall, flanking casemates, breast-height wall, and parapet. 66, 2.

1867. Work on breast-height wall; doors of casemates and magazines hung; road from dock to the country road finished; drainage begun; gun platforms completed and sodding and embanking of parapet nearly completed. 67, 3.

1868. Widening of ditch to 25'; glacis graded; lateral batteries laid out; magazines of w. battery completed; doors of w. and e. battery made; ramp leading from roadway up the glacis to the ditch opposite the sally port finished; new main roadway graded and drains rebuilt. 68, 6.

1869. Widening of ditch completed; glacis completed on nw. front and e. face of the n. bastion; open ditch for drainage constr. and sodded at foot of the glacis; parade ground leveled and a fence to inclose the glacis begun. 69, 7.

1870. Glacis on the nw., se., and water fronts completed and seeded; drain and fence along its foot built; ironwork painted and slopes mowed. Batteries not yet completed. 70, 11

1871. Plans for modifying work prepared; care and preservation. 71, 6.

1872. Care and preservation. 72, 3.

1873. Paving and sewerage done in rear of barracks. 73, 4.

1874. Perishable equipment and material sold at auction. 74, 6.

1875. Fences partly rebuilt and boundary lines regraded. 75, 5.

1876. Rebuilding of fences and regrading grounds completed. 76, 6.

1880. Magazine floor rebuilt. 80, 18.

1882. Repairing begun; br. coping at the salient and shoulder angles replaced with cut sts.; sally port repaired; masonry of cesspools relaid; casemate penthouses rebuilt; new roof built over

magazine, and scarp wall repaired and pointed. 82, 9.

1883. \$10,000 allotted for completion of work. Scarp wall repaired. 83, 5.

1884. Repair work completed in 1883. 84, 10.

1885. Renewal of the demilune magazine roof and of the parade revet. on the sw. front. 85, 5.

1886. Gun platforms and demilune magazines repaired. 86, 6. Table showing proposed armament, 1886. 86, 509.

1899-00. \$150 allotted for preservation. 99, 974; 00, 973.

1900-01. \$150 withdrawn. Removal of revet. suggested. 01, 855.

Part 5, FLPP. Fort Gratiot Military Reservation, Mich.

ENGINEERS.

Chief of Engineers. R., 71, 104; 72, 102; 73, 116.

Operations.

1871. By acts of July 20, 1868, and Mar. 18, 1870, this reservation was divided into lots of convenient size and 242 were sold. \$3,000 app. for defraying expenses. Amount received from sale of lots, \$41,524. Another sale contemplated. 71, 104.

1872. Another sale began Aug. 8, 1872, and continued till all lots offered were sold. Amount received was \$58,433.91; a small part unsold. \$2,000 app. for properly laying out the streets and lots, 72, 102.

1873. Act of Mar. 3, 1873, au. the Sec. of War to survey, plat, and sell the cemetery grounds, subject to certain restrictions. No pre. action provided by the statute had been taken by the city of Port Huron. 73, 116.

FLRR. NIAGARA RIVER FORTIFICATIONS.¹

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 1 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|----------|
| 1 | Engineers—Chief of Engineers—Buffalo..... | 1866-186 |
| 2 | Niagara R.—Fort Porter..... | 1866-188 |
| 3 | Fort Niagara..... | 1866-190 |
| 4 | In charge—Buffalo..... | 1866-186 |
| 5 | Niagara R.—Fort Porter..... | 1866-188 |
| 6 | Fort Niagara..... | 1866-190 |
| 7 | Forts, etc. (operations, allotments, etc.)..... | 1839-190 |
| 8 | Buffalo, N. Y..... | 1866-186 |
| 9 | Fort Porter, N. Y..... | 1842-188 |
| 10 | Fort Niagara, N. Y..... | 1839-190 |
| 11 | Preservation and repair..... | 1890-190 |
| 12 | Sea walls and embankments..... | 1890-190 |

Part 1, FLRR. Engineers (Buffalo, N. Y.).

Chief of Engineers. R., 66, 3; 67, 3; 68, 6.

Part 2, FLRR. Engineers (Fort Porter, N. Y.).

Chief of Engineers. R., 66, 3; 67, 3; 68, 6; 77, 4; 78, 6; 79, 8; 80, 18; 81, 15; 82, 10; 83, 6; 70, 11; 71, 6; 72, 3; 73, 4; 74, 6; 75, 5; 76, 6; 84, 11; 85, 6; 86, 6.

Part 3, FLRR. Engineers (Fort Niagara, N. Y.).

Chief of Engineers. R., 66, 3; 67, 3; 68, 6; 83, 6; 84, 11; 85, 6; 86, 6; 87, 4; 90, 5; 91, 8; 69, 7; 70, 11; 71, 6; 72, 4; 73, 5; 74, 6; 75, 5; 92, 12; 93, 11; 96, 527; 97, 20, 743; 98, 29, 773; 76, 7; 77, 4; 78, 6; 79, 8; 80, 18; 81, 15; 82, 10; 99, 33, 974; 00, 30, 973; 01, 32, 255; 02, 32, 759.

Part 4, FLRR. Engineers in Charge (Buffalo, N. Y.).

Maj. J. A. Tardy, 1866-67.

Capt. F. Harwood, 1868.

Col. T. J. Cram, 1868.

¹ See p. 1191.

Part 5, FLRR. Engineers in Charge (Fort Porter, N. Y.).

Capt. and Maj. J. A. Tardy, 1866-67.
Col. T. J. Cram, 1868.
Maj. F. Harwood, 1868-74.
Lt. Col. C. E. Blunt, 1875-78.

Maj. W. McFarland, 1878-83.
Lt. Col. H. M. Robert, 1883-84.
Capt. E. Maguire, 1884-86.

Part 6, FLRR. Engineers in Charge (Fort Niagara, N. Y.).

Capt. J. A. Tardy, 1866-67.
Col. T. J. Cram, 1867-68.
Lt. Col. C. E. Blunt, 1868-69.
Maj. M. D. McAlester, 1869.
Maj. N. Bowen, 1869-71.
Lt. B. D. Greene, 1871.
Maj. J. M. Wilson, 1871-76.
Maj. W. McFarland, 1876-83.
Lt. Col. H. M. Robert, 1883-84.
Capt. E. Maguire, 1884-86.
Maj. M. B. Adams, 1890-91.
Capt. D. C. Kingman, 1890-93. **R.**, 91, 517; 92,
453; 93, 625.

Maj. W. S. Stanton, 1896-98. **R.**, 96, 527.
Lt. Col. A. M. Miller, 1898.
Maj. T. W. Symons, 1899-1900.
Capt. G. D. Fitch, 1899-1901.
Maj. T. W. Symons, 1901-1903.
Maj. T. A. Bingham, 1904.
Lt. P. S. Bond, 1904.
Lt. Col. H. M. Adams, 1905-1907.
Lt. Col. W. L. Fisk, 1908.
Capt. W. L. Guthrie, 1909-10.
Col. G. Y. Warren, 1911-12.

Part 7, FLRR.—

FORTS AND BATTERIES.

Part 8, FLRR. Buffalo, N. Y.

1866. Addl. works for defense to be considered
by board of officers. 66, 3.
1867. Operations awaiting result of experi-

ments and the deliberations of the BE. upon the
application of new material to purposes of defense.
67, 3.

Part 9, FLRR. Fort Porter, Buffalo, N. Y.

1842. Work begun. 80, 18.
1867-68. Two temporary buildings (store-
rooms) repaired. 67, 3; 68, 6.
1871. Projs. for repair prepared. 71, 6.
1873-77. Act of July 11, 1870, au. the Buffalo
park commissioners to beautify the grounds; work
in progress. 73, 4; 74, 6; 75, 5; 76, 6; 77, 4.
1881. Keep nearly destroyed by fire many

years previous, and the entire work in its existing
condition useless for offense or defense. 81, 15.
1885. Park commissioners built a roadway,
by permission of Sec. of War, Apr. 12, 1884, through
the reservation, cutting the rampart of the fort,
necessitating the tearing down of the w. angle,
including the hot-shot furnace and the R. face. A
wooden fence was built along this face. 85, 6.

Part 10, FLRR.**Fort Niagara, N. Y.**

1839. Work begun. The work contains 2 masonry blockhouses, built by the French about 1757, and other buildings begun by the French and finished by the English after its capture by them during the French and Indian War. 80, 18; 81, 15.

1866. Replacing the old wooden scarp of land fronts with masonry. 66, 3.

1867. Constr. casemates and some minor work. 67, 3.

1868. Sally-port arch and land-front arch completed and the dry-st. wall partly finished. 68, 7.

1869. Casemate arches finished; entrance to flank casemate completed; rampart and parapet extended to scarp wall; all dry-st. filling behind walls finished. 69, 7.

1870. Arched passage to the flank gallery backed with concrete, covered with mastic, and parapet formed over it; paved drains behind open scarp wall of the entire land front completed, and minor work. 70, 11.

1871. Terreplein and parapet of the n. and s. bastions raised, graded, and sodded; building wooden platform for 4½-inch rifled gun and minor work. 71, 6.

1872. Repairing and pointing scarp wall; constr. sewer and drains in main ditch and grading and seeding same; paving postern road and casemates; repairing sea wall and minor work. 72, 4.

1873. Cribwork protection at w. angle of fort; jetties on lake front constr.; postern gates made and hung and minor work. 73, 5.

1874-75. Care and preservation. 4, 6; 75, 5.

1876. Main approach damaged by water, being repaired. 76, 7.

1877. New road built to the fort. 77, 4.

1878. Damaged masonry of the salient of a bastion rebuilt. 78, 6.

1882. Jetties repaired. 82, 10.

Part 11, FLRR. Preservation and Repair (Fort Niagara, N. Y.).

1890-91. \$10,000 allotted. Repairs to lake-front revet.; cribwork base for nw. angle of the break'r completed; cofferdam built and nw. angle of fort wall rebuilt. 91, 519.

1898. 1,850' of Niagara R. bank seeded. 98, 774.

1899. Bank repaired and seeded. 99, 974.

1900. Concrete break'r repaired and bank repaired, sodded, and seeded. 00, 973.

Part 12, FLRR. Sea Walls and Embankments (Fort Niagara, N. Y.).

1890. \$20,000 allotted, 1888, for preservation. Work delayed until Aug. 10, 1889, by stage of water in the lake; 1,811 l. f. shore revet. built; breach in work being closed. 90, 5.

1891. \$10,000 allotted. Proj. for protection of site of Fort Niagara. Wall at nw. angle repaired and some dike built. 91, 518.

1892. Sea wall completed and 941 l. f. of bank graded. 92, 454.

1893. Retaining wall repaired and tile laid for draining slope. 93, 626.

1896. Est. cost of protecting 650' of bank in front of the officers' quarters \$7,000. 96, 527.

1897. Lake wall repointed, sts. relaid, and 80' of its foundation protected with riprap. R. bank surveyed. 97, 743.

1898. 1,850' of Niagara R. bank sloped, graded, and protected with brush fascines and st. ballast. Proj. of 1888 completed. 98, 774.

1901. Repairs made to injured R. bank. 01, 8.

1902-1912. No operations.

FLRR. OSWEGO, N. Y., FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 13 | Engineers—Chief of Engineers..... | 1866-1886 |
| 14 | In charge..... | 1866-1886 |
| 15 | Forts, etc. (operations, allotments, etc.)..... | 1839-1902 |

Part 13, FLRR. Engineers.

Chief of Engineers. R., 66, 3; 67, 3; 68, 7; 69, 7; 70, 12; 71, 6; 72, 4; 73, 1; 74, 6; 75, 5; 76, 7; 77, 5; 78, 6; 79, 8; 80, 18; 81, 16; 82, 11; 83, 6; 84, 12; 85, 86, 7. See p. 1991.

Part 14, FLRR. Engineers in Charge.

Lt. Col. C. E. Blunt, 1866-69.
Maj. M. D. McAlester, 1869.
Maj. N. Bowen 1869-71.
Lt. B. D. Greene 1871.
Ma. J. M. Wilson, 1871-76.
Maj. W. McFarland, 1876-83.
Lt. Col. H. M. Robert '83-85.
Capt. E. Maguire, 1885-86.
Capt. C. F. Palfrey, 1887-89.
Maj. M. B. Adams, 1890.

Capt. D. C. Kingman, 1891-95.
Maj. W. S. Stanton, 1896-98.
Maj. T. W. Symons, 1899, 1901-1903.
Capt. G. D. Fitch, 1899-1900.
Maj. T. A. Bingham, 1904.
Lt. P. S. Bond, 1904.
Lt. Col. H. M. Adams, 1905-1907.
Lt. Col. W. L. Fisk, 1908.
Capt. W. L. Guthrie, 1909-10.
Col. J. G. Warren, 1911-12.

Part 15, FLRR. Fort Ontario, N. Y.

1839. Work begun. 80, 19.
1863-66. Replacing the timber revets. with masonry; scarp wall raised 3'; constr. flank casemates. 66, 3.
1867. Raising scarp wal. in progress; masonry of gateway postern arch, and casemates of left flank completed. 67, 3.
1868. Raising scarp wall; masonry of 2 guard-houses completed; roof surfaces on front 4 finished and covered with mastic, and parapet on the curtain and flanks embanked. 68, 7.
1869. Work on scarp wall. 69, 7.
1870. Masonry of left flank commenced and completed; masonry of right flank in progress; copin aid and backed with concrete on the adjoining face; scarp of both faces raised and minor work done. 70, 12.
1871. Gallery in right flank of bastion E nearly completed; scarp wall of bastion E completed; building dry walls in the galleries and under the back of stairways; parapets of right and left faces so ded; terreplein graded and minor work. 71, 7.
1872. Gallery in right flank of bastion E

completed; gallery in left flank of bastion A continued; connection of gallery to proposed magazine and parapet on fronts 5 and 6 formed and added. 72, 4.
1873-78. Care and preservation. 73, 5; 74, 6; 75, 6; 76, 7; 77, 5; 78, 7.
1879. Minor repairs. Est cost of completion, \$119,97. 79, 9.
1880. Four penthouses built over the entrances to the flank casemates and scarp galleries of bastions D and E and entrance to unfinished gallery panked up. 80, 19.
1881. Work in an unfinished stat. 81, 16.
1882. Work turned over to the Engineer Department for repairs. No work to be done at once. 82, 11.
1883. New York, Ontario & Western R.R. au. to lay 3 tracks across the reservation. 83, 7.
1884. Timber revet. repaired; some minor repairs made. 84, 12.
1885. Revet. repaired. 85, 6.
1886. Revet. and drain ditches repaired. 86, 7.
1902. Repairs to revets. 01, 855; 02, 759.

FLE. LAKE CHAMPLAIN FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|------------------------------------|-----------|
| 1 | Engineering features | 1897-1898 |
| 2 | Engineers—Chief of Engineers | 1866-1902 |
| 3 | In charge | 1866-1900 |
| 4 | Forts, etc.—Fort Montgomery | 1841-1902 |

Part 1, FLE. Engineering Features.

Prevention of percolation of water with patent granite laid in hot mastic. 97, 744. Not satisfactory. 98, 744.

Part 2, FLE. Engineers.

Chief of Engineers. R., 66, 3; 67, 4; 68, 7; 69, 7; 70, 12; 71, 7; 72, 4; 73, 5; 74, 6; 75, 6; 76, 7; 77, 5; 78, 7; 79, 9; 80, 19; 81, 16; 82, 11; 83, 7; 84, 13; 85, 7; 86, 7; 97, 20, 743; 98, 29, 773; 99, 33, 974; 00, 30, 973.

Part 3, FLE. Engineers in Charge.

Capt. C. B. Reese, 1866-67.
Lt. Col. C. E. Blunt, 1866-68.
Capt. J. W. Barlow, 1868-70.
Lt. Col. J. Newton, 1870-77.
Capt. J. Mercur, 1877-78.
Col. H. W. Benham, 1878-82.

Maj. W. McFarland, 1883.
Lt. Col. H. M. Robert, 1883-85.
Maj. M. B. Adams, 1885-86.
Maj. W. S. Stanton, 1897-98.
Lt. Col. A. M. Miller, 1898-99.
Col. J. W. Barlow, 1899-1900.

Part 4, FLE. Forts and Batteries—Operations—Fort Montgomery, N. Y.

1841. Work begun. 80, 19.

1866. St. and earthen parapet and breast-height wall of the land front completed; setting parade-wall coping and turning floor arches; embanking terreplein and cover-face; constr. masonry barbette platforms (20) and excavating the moat. 66, 3.

1867. Seventeen barbette gun platforms com-

pleted; scarp wall of the fort completed and minor work; the fort is ready for part of its armament. 67, 4.

1868. Flagging for first and second stories of bastions C and D completed; raising s. end of parade wall; constr. revet. wall of cover-face and minor work. 68, 7.

1869. Staircase and s. end of parade wall

raised; quarters and drainage under constr.; the st. facing of w. salient of cover-face completed and minor work. **69, 8.**

1870. Completion of staircase bastion C, parade walls, asphaltic covering, and terrepleins of curtains 2 and 3; turning 4 arches of second-story floors of curtain 3 and completing earthen parapet of right flank bastion B. **70, 12.**

1871. Projs. for modification for modern guns, prepared by B.E., approv. **71, 7.**

1872. Slight repairs made to magazines, retaining walls; general care of work. **72, 4.**

1873. Minor work. **73, 5.**

1875. Six shot and shell beds built on parade, and repairs made to earthen parapet, footbr. over marsh, and cavities in causeway and revet. **75, 6.**

1876. Parade graded, br. built in main poste', causeway repaired, and parapet sodding begun **76, 7.**

1877. Earthen parapet part resodded, asphalt covering repaired, and tie rods for strengthening n. face of bastion D placed. **77, 5.**

1878. Tie rods placed on curtain 3. **78, 7.**

1879. Care and preservation. **79, 9.**

1880. Br. and wharf roadway repaired; causeway and parade raised and graded. **80, 19.**

1881. Asphalt covering of curtains 1, 2, 4, and 5, and of bastions B, C, D, and E around the staircase, and wooden stair roofings, repaired; casemate doors painted and terreplein graded. **81, 17.**

1882. Repair of asphalt covering of curtains 1, 2, 3, 4, and 5; brick arches of embrasures of second tier repaired and repointed and minor repairs made. **82, 12.**

1884. Tie-rods placed in curtains 1, 3, 4, and 5, for fastening the scarp wall to the casemates to prevent leakage into magazines. **84, 13.**

1885. Wooden shutters fitted to embrasures and loophole openings, water-front sally-port gateway repaired, and interior gates placed at the land-front sally-port entrance. **85, 7.**

1886. Five center pintle and 6 front pintle platforms repaired; woodwork of br. over moat renewed. **86, 7.**

1897. 103' of parade wall covered with patent granite roofing laid in hot mastic to prevent the percolation of water. **97, 744.**

1898-00. Care and preservation. **98, 774; 99, 975; 00, 973.**

1901. Mainten. work. **01, 855; 02, 759.**

FPSS. SOUTHERN CALIFORNIA FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1896-1899 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1872-1902 |
| 4 | BE..... | 1882 |
| 5 | In charge..... | 1873-1902 |
| 6 | Assistants..... | 1897-1898 |
| 7 | Forts, etc. (allotments, operations, etc.)..... | 1872-1912 |
| 8 | San Diego, Cal..... | 1872-1874 |
| 9 | 10-inch battery..... | 1897-1902 |
| 10 | 15-pounder R. F. battery..... | 1899-1902 |
| 11 | 5-inch R. F. battery..... | 1900-1901 |
| 12 | 15-pounder R. F. battery, east side of bay..... | 1901-1902 |
| 13 | Miscellaneous (electric plant)..... | 1902 |
| 14 | Preservation and repair..... | 1898-1902 |
| 15 | Range and position finders..... | 1900-1902 |
| 16 | Sites..... | 1897-1902 |
| 17 | Submarine mines..... | 1897-1900 |
| 18 | Supplies..... | 1901-1902 |

Part 1, FPSS.**Contracts.**

1896. Two 10-inch gun emplacements and a torpedo casemate, \$109,417.39. 97, 748.

1898. One 10-inch gun emplacement, \$37,-788.68. 98, 778.

1899. Imported Portland cement, \$2.83 per barrel. Crushed st., \$1.75 per c. y. Random st., \$1.90 per t. 99, 975, 976.

Part 2, FPSS.**Engineering Features.**

Air spaces for dampproofing not necessary in San Diego climate. 01, 923.

Base ring, method of leveling. 00, 977.

Cement, testing of. 00, 979; 02, 2471, 2472. Briquettes, repairing with sulphur. 01, 922.

Concretes, comparison of. 00, 978. Ingredients. 00, 979. Mixing of. 97, 747; 99, 976; 02, 2470.

Improvised plant for. 02, 2470. Placing of. 00, 979. Blasting through cement galleries. 02, 2471.

Cracks in; sulphur used to fill. 01, 922 (see Cracks, below). Material or standards. 02, 2471.

Surfaces; preventing checking. 01, 923. Wet and dry spots in; material or composition behind. 01, 923. Sand for, character of. 02, 2470.

Cracks, in emplacements. Asphalt used to fill. 01, 923. (See Concrete.)

Dampness, circulation in San Diego climate to be guarded against. 01, 923.

Floors, slopes reversed by settlement. 01, 923. Leaks, stopping. 01, 922. Local treatment satisfactory. 02, 2472.

Platforms, built as a monolith. 98, 776. Sand, bearing power of. 97, 746.

Ventilating, method of. 00, 978.

Waterproofing, method of. 00, 978. Not necessary. 02, 2470.

Part 3, FPSS.**Engineers.**

Chief of Engineers. R., 72, 24; 73, 24; 74, 19, 528; 97, 20, 744; 98, 30, 775; 99, 34, 975; 00, 31, 28; 75, 28; 76, 29; 77, 24; 78, 27; 79, 32; 80, 51; 974; 01, 33; 02, 34; 03, 9; 04, 5; 05, 5; 06, 5; 81, 52; 82, 50; 83, 46; 84, 52; 85, 45; 86, 45; 96, 07, 5; 08, 9; 09, 10; 10, 12 11 8; 12, 7.

Part 4, FPSS.**Board of Engineers.**

Constituted, 1882, to consider and report upon the constr. of fortifications, and what number, if any, could be dispensed with. **R.**, 82, 427.

Part 5, FPSS.**Engineers in Charge.**

Col. C. S. Stewart, 1873-86.
Maj. C. E. L. B. Davis, 1897-99.
Capt. J. J. Meyler, 1899-1900.
Capt. Jas. J. Meyler, 1901-02.

Lt. Col. C. E. L. B. Davis, 1902.
Lt. Col. T. H. Handbury, 1902.
Capt. Edgar Jadwin, 1902.

Part 6, FPSS.**Assistants.**

Lt. C. L. Potter, 1897.
Lt. H. Deakynne, 1897-98.

Capt. J. J. Meyler, 1898.

Part 7, FPSS—**FORTS AND BATTERIES.****Part 8, FPSS.****Fort at San Diego, Cal.**

1872. Plans prepared. **72**, 24.
1873. \$50,000 app. Work begun; necessary buildings erected. **73**, 24.
1874. Site cleared; 27,626 c. y. earth placed in

the embankment; concrete drains built; foundation of 1 magazine laid and its walls carried up to the spring of the main arch. **74**, 28.

Part 9, FPSS.**Ten-inch Battery.**

1897. \$115,000 allotted. Work begun under contract for 2 emplacements; wharf built. Concrete work begun; excavation work nearly completed; concrete work in progress. Methods of work. **97**, 746.

1898. \$48,000 allotted for a third emplacement under contract. All work completed; guns and carriages mounted; description of work. **98**, 775.

1899. \$60,000 allotted for a fourth emplacement by hired labor. Work begun. 16,000 c. y. excavated for foundations; concrete finished, water-

proofing completed, and emplacement completed except some minor work. **99**, 975.

1900. \$1,100 allotted; concrete work completed; gun and carriage mounted; waterproofing magazines in progress; work nearly completed **00**, 974, 977.

1901. Plant removed. **01**, 856.

1902. \$1,400 allotted for cutting galleries through traverses of battery; plan and est. submitted for substitution of chain ammunition hoists for platform type now in use. **02**, 760.

Part 10, FPSS. Fifteen-pounder R. F. Battery.

1899. \$3,865 allotted. Work begun on 2 emplacements. Excavation completed and concrete work begun and nearly completed. 99, 978.

1900. Battery completed except 2 gun platforms awaiting the arrival of the well linings for the gun mounts. 00, 975, 978.

1901. Blast surface constr.; platforms put in place. 01, 856.

1902. Work delayed pending arrival of well linings. 02, 760.

Part 11, FPSS. Five-inch R. F. Battery.

1900. \$18,270 allotted. Work begun for 2 emplacements; excavation and back filling done by contract. Concrete work completed; drainage system completed. Battery completed except platform awaiting mounts. 00, 976, 978.

1901. Gun carriages mounted; battery transferred Nov. 17, 1900. 01, 856.

Part 12, FPSS. Fifteen-pounder R. F. Battery on East Side of Bay.

1901. \$10,000 allotted. Work will begin after title to land is approv. 01, 857.

1902. Work completed and turned over. 02, 760.

Part 13, FPSS. Miscellaneous.

1902. Plans and est. submitted for installing electric light and power plant searchlight; pro-

posed plan for general constr. of plant approv. 02, 761.

Part 14, FPSS. Preservation and Repair.

1898. \$720 allotted for care and general repairs. 98, 778.

1899. \$1,080 allotted. General repair of buildings, fences, and grounds, etc. 99, 979.

1900. \$1,440 allotted. Electrical instruments cared for; care of property. 00, 977.

1901. \$976 allotted. Care of torpedo material and other property, repairs, painting; new ratchet

wheels on elevator windlass 10-inch battery; prevention o. dampness; "P. & B." paint used; survey of various grounds made. 01, 858.

1902. \$299.03 allotted for misc. repair work. 02, 762.

Part 15, FPSS. Range and Position Finders.

1900. \$2,500 allotted for battery-commander's station. Work begun; concrete work and station completed except minor work. 00, 976, 980.

1901. Battery-commander's station completed and turned over Nov. 17, 1900. \$450 allotted for

constr. of 3 datum marks completed and ready for transfer. 01, 856, 857.

1902. Adjusted; table of corrections prepared; transferred to battery. 02, 760.

Part 16, FPSS.

Sites.

1897. \$2,500 allotted for purchase of site for mortar battery; \$2,031.50 paid for 40.63 acres. 97, 748.

1901. \$20,500 allotted. Purchase of land. 01, 857.

1902. Negotiations completed. 02, 760.

Part 17, FPSS.

Submarine Mines.

1897. \$8,030 allotted; mining casemate being built under contract. 97, 20, 747.

1898. Casemate completed. 98, 776. \$1,700 allotted for a cable tank; work begun in May and completed in June. 98, 777. \$7,800 allotted for mining defense; mines planted and chan. guarded by 2 Napoleon guns. 98, 777.

1899. \$2,200 allotted for additions and changes, mining casemate; work completed. 99, 977.

\$4,840 allotted for a torpedo storehouse. Work begun in August and completed in April, and torpedo materials stored. 99, 978. All mines removed from H. 99, 979.

1900. Torpedo casemate completed and storage battery installed. 00, 974. Wharf and tramway built near torpedo storehouse. 00, 975 980.

Part 18, FPSS. Supplies for Seacoast Defenses.

1901. Purchase of supplies. 01, 857.

1902. Requisitions filled. 02, 760.

FPTT¹ UPPER CALIFORNIA FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1901-1902 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1902 |
| 4 | BE..... | 1882-1889 |
| 5 | In charge..... | 1866-1902 |
| 6 | Assistants..... | 1891-1904 |
| 7 | Forts, etc. (allotments, operations, etc.)..... | 1853-1912 |
| 8 | Fort Winfield Scott..... | 1853-1886 |
| 9 | Fort Point..... | 1853-1882 |
| 10 | Fort Mason..... | 1883 |
| 11 | Battery at Point Jose..... | 1866-1880 |
| 12 | Angel Isld..... | 1870-1880 |
| 13 | Alcatraz Isld..... | 1866-1885 |
| 14 | Lime Point..... | 1866-1882 |
| 15 | Point Lobos..... | 1866 |
| 16 | South side of B.—Emplacements 9, 10, 11, 12, 13, for 10-inch rifles, disappearing carriages..... | 1891-1900 |
| 17 | Emplacements 14, 15, 16, 18, and 19, for 12-inch rifles on barbette carriages..... | 1892-1900 |
| 18 | Mortar battery No. 2..... | 1893-1902 |
| 19 | Pneumatic dynamite gun battery..... | 1896-1901 |
| 20 | Emplacement 8, for 12-inch nondisappearing carriages..... | 1897-1899 |
| 21 | Mortar battery No. 2..... | 1897-1900 |
| 22 | Two emplacements, 5-inch R. F. guns, balanced pillar mounts..... | 1898-1902 |
| 23 | Three emplacements, 8-inch rifles, disappearing carriages..... | 1899-1900 |
| 24 | Emplacement for 8-inch gun, disappearing carriage..... | 1899-1901 |
| 25 | Emplacement for 12-inch gun, nondisappearing carriage..... | 1901-1902 |
| 26 | Emplacements, three 15-pounder R. F. guns..... | 1901-1902 |
| 27 | Emplacement for 5-inch R. F. gun, balanced pillar mount..... | 1899-1902 |
| 28 | Emplacements, two 6-inch guns, disappearing carriages..... | 1899-1901 |
| 29 | Emplacements 6 and 7, for 12-inch rifles, disappearing carriages..... | 1899-1900 |
| 30 | Emplacements, two 5-inch R. F. wire-wound guns..... | 1900-1901 |
| 31 | Emplacements, two 15-pounder R. F. guns..... | 1900-1902 |
| 32 | Emplacements, two 12-inch guns, disappearing carriages..... | 1900-1902 |
| 33 | Emplacements, sixteen 12-inch mortars..... | 1900-1902 |
| 34 | North side of B.—Emplacements, three 12-inch rifles, disappearing carriages..... | 1894-1900 |
| 35 | 6-inch R. F. guns..... | 1902 |
| 36 | Two emplacements, 3-inch R. F. guns..... | 1902 |
| 37 | Emplacements, two 12-inch guns, disappearing carriages, and eight 12-inch mortars..... | 1901-1902 |
| 38 | Two emplacements, 8-inch B. L. rifles, nondisappearing carriages..... | 1898-1900 |
| 39 | Emplacements, two 12-inch guns, disappearing carriages..... | 1899-1901 |
| 40 | Emplacements, two 5-inch R. F. guns, balanced pillar mounts..... | 1899-1901 |
| 41 | Platforms, four 8-inch rifles..... | 1897-1898 |
| 42 | Ten platforms, 8-inch converted rifles and service magazine..... | 1898-1900 |
| 43 | Two 6-inch guns, Ordnance Department mounts..... | 1901 |
| 44 | Island in H. (San Francisco)—Emplacement, one 8-inch B. L. rifle, nondisappearing carriage..... | 1898-1900 |
| 45 | Emplacement, one 8-inch gun, disappearing carriage..... | 1899-1901 |
| 46 | Emplacements, two 5-inch R. F. wire-wound guns..... | 1900-1901 |
| 47 | Miscellaneous (Electric plant; Firing of ordnance; Engineer buildings; Searchlight; Magazine; Projector; Lockers; Steam vessel; Racks)..... | 1899-1902 |
| 48 | Preservation and repair..... | 1897-1902 |
| 49 | Range and position finders..... | 1898-1902 |
| 50 | Sea walls..... | 1868-1870 |
| 51 | Sites..... | 1892-1902 |
| 52 | Mines..... | 1891-1902 |
| 53 | Supplies..... | 1900-1901 |
| 54 | Surveys..... | 1866-1868 |

¹Usually in charge of Second San Francisco, Cal., U. S. Engineer Office.

Part 1, FPTT.**Contracts.**

1901. Constr. steam vessel, \$20,000; supplementing work, \$150. 01, 894.
1902. Electric-lighting plant, \$2,190; moving six 12-inch mortar carriages and base rings, \$3,375; moving two 12-inch gun carriages and base rings, \$2,500. 02, 781.

Part 2, FPTT.**Engineering Features.**

- Air space, description of. **99**, 982.
 Asphalt, composition of. **96**, 534, 535; **99**, 982; **00**, 982, 1013.
 Aprons, concrete; description of. **96**, 534, 535.
 Bolt, anchor; setting. **96**, 536.
 Concrete, cost per c. y. **93**, 621; **94**, 465; **96**, 528, 530; **97**, 754; **98**, 788, 793; **00**, 987, 994. Ingredients of. **93**, 620; **99**, 987; **00**, 982, 988. Mixing. **93**, 620; **99**, 987; **00**, 982, 990, 1009; **02**, 2473.
 Placing. **00**, 1003. Plant. **03**, 2418. Settlement of. **99**, 985.
 Cracks in retaining walls. **99**, 982, 985; **00**, 990, 1012, 1013.
 Dampproofing. **99**, 957, 969; **00**, 982; **02**, 2473, 2474.
 Drainage. **02**, 2474.
 Entrance, of battery. **04**, 3738 (pl.).
 Foundations. **03**, 2417.
 Ironwork, cleaning and painting. **03**, 2419.
 Materials, cost of. **93**, 620; **94**, 465; **96**, 529, 537; **97**, 987; **00**, 987, 994.
 Mixer, gravity, description of. **00**, 1009.
 Mortars, firing. **97**, 753.
 Ordnance, transporting. **03**, 2422 (pl.).
 Parapet and traverse, method of building. **00**, 980.
 Plant, electric light and power; description of. **00**, 991, 1007. Description of. **93**, 620; **00**, 989, 993; **02**, 2472.
 Railroad and cars. **04**, 3738 (pl.).
 Reservoirs. **04**, 3738 (pl.).
 Roads; details. **04**, 3733 (pl.), 3738.
 Roofs; details. **03**, 2419, 2420.
 Sand blast. **03**, 2420.
 Surfaces, concrete, finishing. **96**, 536.
 Tile, placing. **00**, 982.
 Ventilation. **04**, 3738 (pl.).
 Walls, coating. **03**, 2420. Construction. **03**, 2419.
 Waterproofing, various methods. **03**, 2420, 2421; **04**, 3737, 3738 (pl.).
 Water supply, cisterns, etc. **04**, 3738.
 Water-supply system. **00**, 993.
 Whitewash for walls and ceilings of rooms and passages, composition of. **99**, 987.

Part 3, FPTT.**Engineers.**

- Chief of Engineers. **R.**, 66, 17; **67**, 14; **68**, 19; **69**, 19; **70**, 26; **71**, 24; **72**, 22; **73**, 23; **74**, 27; **75**, 26; **76**, 28; **77**, 23; **78**, 26; **79**, 31; **80**, 52; **81**, 52; **82**, 51; **83**, 47; **84**, 52; **85**, 45; **86**, 45; **90**, 4; **91**, 6, 8; **92**, 8; **93**, 9; **94**, 10; **95**, 11, 515; **96**, 19, 528, 530; **97**, 20, 744, 748; **98**, 8, 30, 79; **99**, 35, 980; **00**, 32, 980; **01**, 33; **02**, 34; **03**, 9; **04**, 5; **05**, 5; **06**, 5; **07**, 5; **08**, 9; **09**, 10; **10**, 12; **11**, 8; **12**, 7.

Part 4, FPTT.**Board of Engineers.**

- Constituted, 1882, to consider and report upon the constr. of fortifications, and what number, if any, could be dispensed with. **R.**, 82, 427.
 Ests. 1881 **87**, 11.
 Ests., 1889. **89**, 6.

Part 5, FPTT.**Engineers in Charge.**

- Col. R. E. de Russey, 1866.
 Maj. G. H. Elliot, 1866-70.
 Lt. Col. G. H. Mendell, 1867-86.
 Col. C. S. Stewart, 1870-86.
 Col. G. H. Mendell, 1891-96. **R.**, 93, 619; **94**, 465.
 Lt. Col. W. H. H. Beñyaurd, 1893-96. **R.**, 93, 423.
 Lt. C. L. Potter, 1896.
 Maj. C. E. L. B. Davis, 1896-1900.
 Capt. J. E. Kuhn, 1896.
 Maj. W. H. Heuer, 1898-1900.
 Col. S. M. Mansfield, 1899.
 Lt. Col. C. E. L. B. Davis, 1901-02.
 Lt. Col. Thos. H. Handbury, 1902.

Part 6, FPTT.

Assistants.

Lt. H. C. Newcomer, 1891-92.
Lt. C. L. Potter, 1891-97.
Lt. C. A. F. Flagler, 1893-95.
Capt. J. E. Kuhn, 1895-98.
Capt. H. Deakayne, 1896-1900.

Lt. H. C. Wolf, 1898-99. **R.**, 98, 787, 794.
Lt. L. M. L. Walker, 1898.
Capt. F. R. Shunk, 1898-99.
Lt. W. Kelly, 1899-1900.
Lt. Geo. B. Pillsbury, 1901.

Part 7, FPTT—

FORTS AND BATTERIES.

Part 8, FPTT.

Fort Winfield Scott.

1853. Work begun. 83, 47.

1870. Exterior earthen batteries begun. 83, 47.

1883-86. General repairs for preservation.

83, 47; 84, 53; 85, 45; 86, 45.

Part 9, FPTT.

Fort at Fort Point.

1853. Work begun. 53, 52.

1866. Ironwork cleaned and painted; drainage repaired; some work on sea wall. 66, 17.

1867. Work on painting ironwork, drainage, sea wall; excavation for w. casemated battery; excavation for sea wall begun; heavy cofferdam built for a distance of 350' along the shore; buildings removed from site of new battery; wharf extended and repaired. 67, 14.

1868. R.R. completed; coping of old wall extended 126'; cofferdam for protection of site of new sea wall completed. 68, 19.

1869. Repair of quarters; minor work on sea walls, etc. 69, 19.

1870. Importance of fort. General repair of quarters. Modification plans prepared. 70, 26.

1871. \$50,000 app. Work begun on batteries to the s. of fort; 29,586 c. y. embankment placed; 7,180 sq. y. slope sodded. Work on breast-height wall and traverse magazines; 1,928 c. y. masonry placed. Repair of wharf, buildings, etc. 71, 24.

1872. \$85,000 app. Work on breast-height wall; 8 front-pintle st. platforms placed, and the masonry of 12 others completed; 2 traverse magazines built, 10 others finished; 1,324 l. f. of earth-work of barbette batteries completed; magazine doors made and hung and minor work. 72, 22.

1873. \$65,000 app. 830 l. f. of parapet of barbette and mortar batteries nearly completed; 6

magazines built and work on 3 others and on embankments; 11 pintles and sets of traverse rails placed for heavy guns; 8 platforms for heavy mortars placed and minor work. 73, 23.

1874. \$30,000 app. Four service magazines built; work on concrete foundation for 8 platforms for heavy guns; pintles and rails placed on 2 platforms for 15-inch guns and 4 platforms for heavy mortars built. Work on embankment; asphalt floors placed in 11 traverse magazines; wharf rebuilt; minor work. 74, 27.

1875. \$25,000 app. Work on 1 service magazine; breast-height walls for 8 heavy gun completed; 8 pintle blocks placed as well as concrete foundations for 12 platforms for heavy guns; 9,443 c. y. earth embanked in parapets and traverses, and 6,743 sq. y. sodding placed on slopes; minor work. 75, 28.

1876. Breast-height wall for 6 heavy guns completed and concrete foundations for 2 heavy gun platforms placed. 8,365 c. y. earth embanked in parapets and traverses and 3,777 sq. y. sodding placed on slopes; doors completed and hung in 7 traverse magazines; minor work. 76, 28.

1877-79. Care and preservation. 77, 23; 78, 26; 79, 31.

1880. History and importance of fort. 80, 52.

1881. Repair of quarters, slopes, etc. 81, 52.

1882. Condition of works. 82, 51.

Part 10, FPTT.**Fort Mason.**

1883. Two temporary earthen batteries built during the Civil War. 83, 49.

Part 11, FPTT.**Battery at Point José.**

1866-70. Modification plan submitted. 66, 18; 70, 27.

1870. Three 5-inch Rodman guns brought to the rear of battery. 70, 23.

1880. History of battery. Timber magazine in earthen battery rebuilt and 3 timber platforms replaced for purposes of drill and practice firing 80, 53.

Part 12, FPTT.**Batteries on Angel Island.**

1870. Modification plans prepared. 70, 23.

1880. History and importance of batteries. 80, 53.

Part 13, FPTT.**Fort on Alcatraz Island.**

1866. Work on new bombproof barrack; new ramp built from guardhouse to summit of isld.; new wharf built; old platforms removed; minor work. 66, 18.

1867. Work on new barrack; r. excavation made for extension of Battery Rosecranz. Resurvey of isld. in progress. 67, 15.

1868. Wharf extended; a number of permanent center pintle platforms adopted for 8-inch and 10-inch guns; work on new barrack. 68, 20.

1869. 4,000 c. y. r. excavated and thrown over the scarp walls; repair of buildings, etc. 69, 19.

1870. Importance of fort. Modification plans prepared. 18,000 c. y. r. excavated for foundations and work begun converting gun rooms into a magazine traverse. 70, 27.

1871. \$75,000 app. Gun platforms in batteries 1 and 4 removed; 3 service magazines in battery 2 completed; 1 service magazine built in battery 3, and breast-height wall for 4 guns begun; excavation for foundation of battery 5. 70, 25.

1872. \$42,500 app. Battery 4—breast-height wall for 2 guns built, parapets made and sodded, magazine completed; 3 magazines in battery 2 covered and sodded; work on large magazine. Battery 5—2 granite platforms for 15-inch guns with circular breast-height walls built and sodded; service magazine nearly completed; minor work. 72, 23.

1873. \$50,000 app. N. caponiere completed,

covered, and sodded; 6 magazines and 3 shell rooms built; work on retaining walls and parapets for guns; excavations for batteries 5 and 6 completed. Filling in mortar battery begun; minor work. 73, 24.

1874. \$20,000 app. S. caponiere partly remodeled, 2 magazines with bombproofs built, breast-height walls for 2 guns built, and 2 st. platforms laid; parapets for 4 guns made; 6,300 sq. y. sodding laid on parapets, magazines, and slopes; wood revet. in rear of wharf replaced with a substantial st. wall laid in mortar work on retaining wall. 74, 28.

1875. \$25,000 app. 469 c. y. masonry placed in magazine; 2,250 sq. y. sod placed on slopes; 36,930 c. y. excavation made; minor work. 75, 27.

1876. Two magazines and 2 bombproofs built; 3 adjacent wings of the breast-height wall built; 2 drains extended and wharf repaired. 76, 28.

1877. 5,368 c. y. excavated for parade ground by the prisoners. Magazine P covered with earth, its floor asphalted, and gutters in passageway concreted. 77, 23.

1878. Care and preservation. 78, 27.

1879. Wharf painted; general repairs of buildings. 79, 31.

1880. History and importance of fort. 80, 53

1882-83. General repairs. 82, 53; 83, 49.

1885. Two st. platforms completed. 85, 47.

Part 14, FPTT.

Fort at Lime Point.

1866. Title approv. and land bought. 66, 18.

1867. Work begun; excavation for foundation in progress. 67, 15.

1868. Necessary buildings erected; water supply for fire purposes installed; fence and wharf built; SS. built for service on the work; 60,000 c. y. r. excavated and a tunnel 60' long excavated for a large blast. 68, 20.

1869. 90,000 t. of r. removed by 2 blasts; work of excavating for foundations completed; fence completed. 69, 19.

1870. Importance of fort. Proj. 70, 27.

1871. \$100,000 app. Wagon road built; 4 magazines in Gravelly Beach battery completed; excavation for batteries on the cliffs; minor work. 71, 24.

1872. \$75,000 app. Gravelly Beach battery—2 magazines completed, 6 covered with earth and sodded, a breast-high timber revet. placed and concrete foundations for guns put in. Lime Point Ridge—breast-high walls for 4 front and 5 center-pintle guns built of masonry; 4 magazines built, covered with earth, and sodded; 4 st. platforms for front-pintle 15-inch carriages completed; parapets for 9 guns and 6 mortars finished and 3 mortar platforms made and placed. Point Cavallo battery—work on roadway and excavation. 72, 22.

1873. \$160,000 app. Gravelly Beach battery—12 wooden platforms placed and battery nearly completed; three 13-inch mortar platforms placed in the Ridge battery. Point Cavallo battery—5 magazines built and work on 6 others; parapets and terreplein. 73, 23.

1874. \$30,000 app. Point Cavallo work nearly completed. Gravelly Beach parapets and traverses repaired; new road, 4,200 l. f., completed near Point Diablo. 74, 27.

1875. \$20,000 app. 5,950 l. f. of road built to site of batteries near Point Diablo; gun battery in advance at Point Cavallo completed except gun platforms; 8 breast-high walls laid in Point Cavallo battery; minor work. 75, 27.

1876. Hoods placed on traverses at Point Cavallo battery; 4,000 c. y earth and 2,535 sq. y. sodding placed. Repairs at the Ridge and Gravelly Beach batteries. 76, 28.

1877. Property in charge of fort keepers. 77, 23.

1880. History and importance of the fort. 80, 52.

1882. Condition of works. 82, 52.

Part 15, FPTT.

Point Lobos.

1866. Topographical survey made. 66, 18.

Part 16, FPTT. South Side of Bay—Emplacements 9, 10, 11, 12, and 13, for 10-inch Rifles on Disappearing Carriages.

1891. Work begun on excavation. 91, 8.

1892. Excavation completed and concrete work in progress. 92, 8.

1893. Concrete work completed; awaiting details of carriages to be used. Work described. 93, 619.

1894. Top surfaces of magazines plastered and painted with waterproof paint. Roadway being built. 94, 10.

1895. Details of carriages received and concrete work in progress on platforms. 95, 516.

1896. Parapets and magazines completed and 3 inches asphalt covering placed; 3 platforms completed 1.319 c. y. concrete placed ammunition service installed, 2 guns and carriages received;

mounting was begun but stopped to alter carriages. Itemized cost of work. 96, 535.

1897. Two guns mounted in emplacements 11 and 12. Work in progress; mounting gun in emplacement 13. \$57,000 allotted for emplacements 9 and 10. Work begun in June, excavation completed and some concrete work done; itemized cost of work. 97, 749, 755.

1898. Concrete work of emplacements 9 and 10 completed; machinery installed and guns and carriages mounted; guard and relocater room built; itemized cost of work. 98, 779, 788.

1900. Steps at emplacements 11 and 12 repaired. 00, 983.

Part 17, FPTT. South Side of Bay—Emplacements 14, 15, 16, 18, and 19, for 12-inch Rifles on Barbette Carriages.

1892. Work begun on emplacements 14, 15, and 16; excavation completed and concrete work in progress. 92, 8.

1893. Concrete work completed; awaiting details of carriages to be used. Work described. 93, 619.

1894. Top surfaces of magazines plastered and painted with a waterproof paint. Roadway being built. 94, 10.

1895. Details of carriages received. One emplacement completed, R.R. iron and cable placed in concrete, gun mounted, and work in progress on another. 95, 11, 515.

1896. Parapets, aprons, and magazines of 3 emplacements completed and covered with a 3-inch layer of asphalt. Gun fired 17 times to test asphalt covering. Two other platforms built, R.R. iron and cable placed in concrete and 1 gun

mounted. Ammunition service installed and all engineering work of the 12-inch emplacement completed, except setting base ring in 1 emplacement; carriage not yet received; itemized cost of work. 96, 533, 564.

1897. Work begun on emplacements 18 and 19 in November, 1896; concrete work completed; 4,576 c. y. placed; all machinery installed; 1 gun mounted in emplacement 18. Itemized cost of work. 97, 749, 754.

1898. Guard and relocater room emplacement 14 completed; itemized cost. Minor work completed. Gun mounted in emplacement 19 and the completed battery turned over to the troops. Itemized cost of work for emplacements 18 and 19. 98, 780, 791.

1900. Latrine built; description and itemized cost. 00, 988.

Part 18, FPTT. South Side of Bay—Mortar Battery No. 1.

1893. Work begun Apr. 5, 1893; 10,781 c. y. excavated for foundation, completing same; 528 c. y. concrete placed; drainage in progress; conduit for electric-firing wires laid in floor. 93, 622.

1894. 32,324 c. y. earth excavated; 7,097 c. y. concrete and 44,124 c. y. filling placed. Two platforms laid in granite; electric-light system installed; minor work. 94, 11, 465.

1895. All concrete work completed; slopes sodded and seeded; 16 mortars mounted; firing cable installed; picket fence built around the battery; battery completed except ammunition conveyors. 95, 11, 516.

1897. Ammunition conveyors, etc., being installed; a new firing room built and a new firing circuit installed. 97, 748, 753.

1898. Relocater room built; speaking tubes installed; cost of work. 98, 788.

1901. \$5,233 allotted. Changing azimuth circles and completing battery; steam drill purchased. 01, 875.

1902. Work continued; circles placed by Ordnance Department; excavation concrete used to repair roads in vicinity of battery; itemized statement of cost given. Constr. of latrine; details given. 02, 770, 771.

Part 19, FPTT. South Side of Bay—Pneumatic Dynamite Gun Battery.

1896. Three 15-inch guns mounted; compressor plant in place. No form of protection undertaken. 96, 533.

1899. \$150,000 app. High earthen traverse built nearly around power house, kept in place by a high concrete retaining wall; wall badly cracked; 120,000 c. y. back filling placed; work in progress. 99, 981.

1900. Magazines and traverses completed,

built of 90,000 c. y. of sand; seven 1½-inch iron rods, each 120' long, were driven through the sand to the rear walls of the gun pits, thus tying the retaining wall to the rear walls of the gun pits. Completed battery turned over to the Artillery. Description of placing sand and of making slopes. 00, 989.

1901. Alterations made to switchboard, electric plant. 01, 875.

Part 20, FPTT. South Side of Bay—Emplacement 8, for 12-inch Non-disappearing Carriages.

1897. Work begun in October, 1896; concrete work completed; 4,257 c. y. placed. Machinery installed and emplacement nearly completed. Itemized cost of work. 97, 749, 754.

1898. Machinery installed and minor work done; cost; carriage not yet received. 98, 780, 789.

1899. Gun and carriage mounted and emplacement turned over to the Artillery June 15, 1899. 99, 981.

Part 21, FPTT. South Side of Bay—Mortar Battery No. 2.

1897. \$108,000 allotted. Work begun in June; site cleared. 97, 750, 755.

1898. 43,500 c. y. excavated; 45,850 c. y. back fill and 9,920 c. y. concrete placed; carriages mounted. Battery completed except installing

electric plant and mounting mortars; itemized cost of work. 98, 779, 793.

1899. Mounting mortars completed. 99, 981.

1900. Electric-light plant to be installed. 00, 981.

Part 22, FPTT. South Side of Bay—Two Emplacements for 5-inch R. F. Guns on Balanced Pillar Mounts.

1898. Work begun March 16; excavation completed and concrete work in progress; work delayed; cylinders to pivot the guns not on hand; concrete work on relocater and entrance to old magazine completed; itemized cost of work. 98, 780, 781, 791.

1901. \$7,700 allotted. Cylinders arrived; forms erected; concreting completed; battery allowed to dry; rooms whitewashed; electric wiring put in. 01, 875.

1902. Battery transferred; carriages mounted; guns not received. 02, 770.

Part 23, FPTT. South Side of Bay—Three Emplacements for 8-inch Rifles on Disappearing Carriages.

1899. \$67,000 allotted. Work begun and completed except the magazine doors, electric lights, and minor work. Air space formed in 1 emplacement by placing hollow partition tile around the magazine. Dampproof course laid over the magazine. 99, 982.

1900. \$8,000 allotted. Magazine doors placed; trolleys installed, electric-light plant installed, guns mounted, and battery turned over to the Artillery. All concrete surfaces exposed to view from the H. were painted with paraffin paint to conceal them. 00, 987.

Part 24, FPTT. South Side of Bay—Emplacement for 8-inch Gun on Disappearing Carriage.

1899. \$28,700 allotted. Work begun in February and completed except electric plant, ammunition hoist, and minor work. 99, 983.

1900. \$4,000 allotted. Fence built around battery; trolleys installed; electric-light plant installed by contract; speaking-tube connections made with emplacements for 8-inch converted rifles and the

relocater room. Ammunition hoists and base ring still to be set in place. Description of excavation work, concrete mixing, tile placing, and cement finishing, with itemized cost of all work. 00, 981.

1901. Ammunition hoist set; Artillery mounted gun; other misc. work; battery transferred August 1900. 01, 873.

Part 25, FPTT. South Side of Bay—Emplacement for One 12-inch Gun on Non-disappearing Carriage.

1901. \$60,000 allotted. Plans and est. approv. No work done. 01, 876.

1902. Excavation and concrete work in progress. 02, 771. Drainage, ventilation, ammunition service, electric-light plant, minor accessories, etc.,

done; detailed statement of work and cost given. 02, 773. Battery is entirely completed except setting base rings of carriage, which have not yet been received. 02, 774.

Part 26, FPTT. South Side of Bay—Emplacements for Three 15-pounder R. F. Guns.

1901. \$15,200 allotted. Nothing done. 01, 888.

1902. Excavation and concrete work in prog-

ress; details given. Minor accessories supplied; refill made; slopes covered with loam; macadamized road made; itemized cost given. 02, 769.

Part 27, FPTT. South Side of Bay—One Emplacement for a 5-inch R. F. Gun on Balanced Pillar Mount.

1899. \$6,000 allotted. Materials purchased. 99, 981.

1900. Work begun, excavation completed, road prepared, and the loam placed on slopes for a top dressing. Work suspended, awaiting the arrival of ironwork of the balanced pillar mount. 00, 988.

1901. Cylinder arrived; work carried on same as 2 other 5-inch emplacements. 01, 875.

1902. Battery transferred; carriages mounted; guns not received. 02, 770.

Part 28, FPTT. South Side of Bay—Emplacements for Two 6-inch Guns on Disappearing Carriages (Part of the Heavy R. F. Armament).

1899. \$56,000 allotted. Work begun on excavation. 99, 981.

1900. \$3,050 transferred from other works. Excavation completed; new water-supply system installed; concrete work in October; battery entirely

completed by June; no guns on hand; description of mixing concrete. 00, 990.

1901. Transferred to Artillery; carriages mounted; guns not received. 01, 875.

Part 29, FPTT. South Side of Bay—Emplacements 6 and 7, for 12-inch Rifles on Disappearing Carriages.

1899. \$75,500 allotted. Work begun in September, 1898, and practically completed in the spring of 1899. Guns and carriages not received. 99, 981.

1900. Floor of dynamo room laid, aprons built,

base rings set; battery entirely completed in November and turned over to the Artillery, who mounted the guns. 00, 988.

Part 30, FPTT. South Side of Bay—Emplacements for Two 5-inch R. F. Wire-Wound Guns.

1900. \$17,473 allotted and \$3,600 transferred from other allotments. Work begun in January; platform built separate from magazines. Battery completed except setting base rings, not received. whitewashing the rooms. 00, 987.

1901. Whitewashing rooms; name plates for speaking tubes put in place; battery transferred August, 1900. 01, 873.

Part 31, FPTT. South Side of Bay—Emplacements for Two 15-pounder R. F. Guns.

1900. Site selected and plans and ests. prepared for 2 emplacement. on balanced pillar mounts 00, 988.

1901. \$12,000 allotted. Plant erected; work begun and practically completed. 01, 874.

1902. Work in progress. 02, 769.

Part 32, FPTT. South Side of Bay—Emplacements for Two 12-inch Guns on Disappearing Carriages.

1900. \$114,000 allotted. Work begun in September, 1899. Necessary buildings erected; excavation and roadway completed; water-supply system installed; about 35 acres of the barren sand dunes planted with bunch grass (*Arundinaria*); 4,000 young eucalyptus trees bought and planted. Concrete work begun in February and completed in March; electric-light plant installed; ammunition hoists and trolleys erected and all work completed except setting base rings; base rings to arrive.

Description of excavation work, erection of plant, mixing concrete, water-supply system, placing sod and planting trees on the sand dunes, placing tiling, with complete itemized cost of all work. **00, 992.**

1901. Ammunition hoists installed; battery painted; work to prevent leaking. Base rings to be set. **01, 875.**

1902. Ironwork painted; carriage No. 26 received; base ring set. **02, 771.**

Part 33, FPTT. South Side of Bay—Emplacements for Sixteen 12-inch Mortars.

1900. \$175,000 allotted. Work begun Nov. 27 1899. Excavation completed; 68,300 c. y. removed; concrete work begun and 8 platforms finished. Sewers and drains laid. Description of excavation work and of placing concrete. **00, 1002.**

1901. Floors and foundations completed; concrete work in progress and practically completed; installation of plumbing, electric light, trolleys, etc.; a windmill and tank erected; 6

mortar carriages received and mounting carried on by Artillery; engineering work completed except setting 10 base rings and grates for fireplaces. Detailed statement of work and cost given. **01, 876, 878.**

1902. Grates for fireplaces installed; 11 base rings set; 1 mortar received and mounted by the Artillery. **02, 774.**

Part 34, FPTT. North Side of Bay—Emplacements for Three 12-inch Rifles on Non-disappearing Carriages.

1894. \$72,000 allotted, 1892. Work begun in February for 2 emplacements; concrete work completed as far as contemplated and 4 inches of asphaltum placed on top of the emplacements; magazine doors made and hung; minor work. **94, 11.**

1895. \$36,761.29 allotted. 4,870 c. y. loose r. excavated for another emplacement; concrete work in progress. **95, 12.**

1896. \$8,400 allotted for 3 gun platforms; 1 completed and work on the other 2 in progress. Itemized cost of work. **96, 528.**

1897. Ammunition service installed; 2 guns

and carriages mounted; work on the other gun and carriage. Mounting of guns and carriages done by the Artillery. **97, 744.**

1898. Battery completed; 3 guns and carriages mounted; battery and covered way leading back to the main road surrounded with barbed-wire entanglements and a stockade built across the end of the covered way. **98, 780.**

1900. Slight alteration of trucks of ammunition service. Waterproofing magazines in progress; previous work unsuccessful. **00, 1011.**

Part 35, FPTT. North Side of Bay—Four Emplacements for 6-inch R. F. Guns.

1902. \$54,409 allotted. Road built excavation about 25% done. **02, 765.**

Part 36, FPTT. North Side of Bay—Two Emplacements for 3-inch R. F. Guns.

1902. \$16,787.70 allotted. Work begun; excavation 60% done. **02, 765.**

Part 37, FPTT. North Side of Bay—Emplacements for Two 12-inch Guns of Disappearing Carriages and for Eight 12-inch Mortars.

1901. Sites selected; tramway and wharf built; details of work and physical conditions at this battery given; \$122,210 allotted for disappearing guns; \$106,867 allotted for mortars; \$14,466 allotted for wharf and tramway. 01, 863.

1902. \$9,490 allotted for two 12-inch disappearing guns; excavation completed; concrete

work in progress; gun carriages with base rings received; detailed statement of work given. 02, 763. Eight 12-inch mortars; excavation work in progress. 02, 763. Road built connecting batteries. 02, 764. Transportation of mortar carriages completed. 02, 764.

Part 38, FPTT. North Side of Bay—Two Emplacements for 8-inch B. L. Rifles, Non-disappearing Carriages.

1898. \$55,000 allotted. Work begun April 9, and the work nearly completed; awaiting arrival of carriages. 98, 781.

1899. \$3,000 allotted. Total of 17,885 c. y. excavation and 2,700 c. y. concrete placed; electric-light plant and ammunition service installed; walls and ceiling whitewashed; reservoir, capacity

of 10,000 gallons, built; minor work; no carriages received. Itemized cost of work. 99, 986.

1900. \$1,505 allotted. Guns and carriages received and moved from wharf to site of battery under contract; base rings set and battery turned over to the Artillery May 5, 1900. 00, 1011.

Part 39, FPTT. North Side of Bay—Emplacements for Two 12-inch Guns on Disappearing Carriages.

1899. \$67,000 allotted. Work begun. Owing to the peculiarly sheltered position of this battery provision had only to be made against direct penetration and all concrete surfaces were so shaped as to deflect any impinging shot. Work delayed, awaiting settlement of concrete. Old flat traverse irons distributed through the concrete to resist the effect of unequal settlement. 99, 985.

1900. \$8,000 allotted and \$3,913 transferred

from other works. All cracks in concrete repaired and asphalt laid on upper surfaces of the concrete covering of the rooms; electric plant installed and tested. Carriages moved from landing to site of battery under contract; base rings set in June. Summary and itemized cost of battery. 00, 1013.

1901. Guns mounted; turned over to Artillery. 01, 862.

Part 40, FPTT. North Side of Bay—Emplacements for Two 5-inch R. F. Guns on Balanced Pillar Mounts.

1899. \$25,000 allotted. Work begun on excavation, making roadway, storing the necessary gravel and sand obtained from the beach. 99, 986.

1900. Excavation completed, foundations and drains laid, road to site of battery built, and materials for concrete work stored. Work suspended,

awaiting arrival of ironwork of the balanced pillar mounts. 00, 1012.

1901. Engineer work on battery completed; au. given by Chief of Engineers to mount carriages: Artillery troops to do same. Itemized statement of work given. 01, 860.

Part 41, FPTT. Platforms for Four 8-inch Rifles.

1897. \$1,400 allotted. Four platforms for converted rifles nearly finished. 97, 750.

1898. Four platforms for 8-inch converted rifles completed and armed. 98, 786.

Part 42, FPTT. Ten Platforms for 8-inch Converted Rifles and One Service Magazine.

1898. \$3,700 allotted. Three built on n. side of B. and 3 on an isld. in the B. Old timber magazine on the isld. repaired. 98, 786.

1899. Two guns and carriages mounted, in good condition; 2 mounted on practice platforms;

6 guns and carriages received but not mounted. 99, 990.

1900. Three emplacements on an isld. in the B. All armament removed to make way for permanent R. F. gun emplacement. 00, 1008.

Part 43, FPTT. Two 6-inch Guns on Ordnance Department Mounts.

1901. \$30,000 allotted (withdrawn). Preparation of plans in progress. 01, 893.

Part 44, FPTT. Island in Harbor—Emplacement for One 8-inch B. L. Rifle on Non-disappearing Carriage.

1898. \$31,000 allotted. Work begun April 1; necessary buildings erected; excavation completed; 2,300 c. y. concrete placed; on June 20 the entire work was completed, awaiting arrival of carriage. Itemized cost of work. 98, 781, 794.

1899. \$2,000 allotted. Electric-light plant installed; no base ring received. 99, 989.

1900. \$500 allotted. Carriage received; minor repairs of concrete of lookout, latrine, and wooden steps; gun mounted; emplacement transferred to the Artillery on May 1, 1900. 00, 1006.

Part 45, FPTT. Island in Harbor—Emplacement for One 8-inch Gun on Disappearing Carriage.

1899. \$36,000 allotted. 99, 988.

1900. \$2,100 allotted and \$3,492.70 transferred from other allotments. Work begun in July, 1899. As the site of the battery was occupied by a reservoir of 150,000 gallons capacity, a new reservoir had to be built; tank completed. All st. was received from a quarry on Angel Isld. and crushed for use.

Concrete work completed; about 2,000 c. y. placed; electric-light system and ammunition service installed and battery completed, except placing the base ring, not received. Description of work, with itemized cost. 00, 1006.

1901. Base ring set; work completed; transferred to Artillery August, 1900. 01, 871.

Part 46, FPTT. Island in Harbor—Emplacements for Two 5-inch R. F. Wire-Wound Guns.

1900. \$20,093 allotted. Battery site occupied by 3 emplacements for 8-inch converted rifles; rifles and carriages on hand but not mounted also 10 old cannon. These were removed by the Artillery. Work begun January 27 on excavation. 5,310 c. y. removed; 1,296 c. y. concrete placed. No large st. was placed in roofs of magazines. Concrete retaining wall built to the left and slightly

in front of gun No. 2, to prevent further disintegration of the original bank. All machinery installed and work completed, except whitewashing the interior walls. Emplacements ready for guns. Description of work with itemized cost. 00, 1008.

1901. Walls whitewashed; batteries transferred. 01, 871.

Part 47, FPTT.**Miscellaneous.**

Electric plant. 1899. \$13,300 allotted and \$2,719.74 transferred from other works. Plans prepared. 99, 982.

1900. Emplacements 6 to 19, inclusive, to be divided into 3 groups, with a dynamo room and switchboard complete for each group. All work completed under contract for \$8,814. Description of dynamos. 00, 991.

1901. \$1,108.78 allotted. Additional instruments on boards and switchboard at mortar battery No. 1: repairs to wiring. 01, 885.

1902. \$375 allotted. Electric connections made at emplacements 6 and 7; itemized statement of cost given. 02, 775.

Electric-light and power plant. 1901. \$23,595 allotted. Remarks relative to constr. of this plant. 01, 868.

Firing of ordnance. 1901. List of shots fired from batteries on n. side of H. 01, 869. List of shots fired by Ordnance Department on s. side of H. 01, 887.

Engineer buildings. 1901. \$6,451 allotted. New buildings for quarters for workmen and teams under way. 01, 868.

1902. \$181.95 allotted. Buildings completed. 02, 764.

Installation of searchlight. 1901. \$2,515 allotted for constr. br. power house for oil engine and corrugated iron shelter for a 30-inch searchlight work completed. 01, 884. Proj: prepared for installation of 25 lights; est., \$127,205.61. 01, 893.

Peace storage magazine. 1901. Ests. for constr. of peace storage magazine in this district, respectively, \$7,665.58, \$6,511.16, \$10,316.97, \$7,554.43. 01, 893.

Power house and shelter for projector. 1901. Building erected; work completed; itemized statement given. 01, 862.

Shelf lockers for dynamo rooms. 1901. Constr. of 8 shelf lockers for tools and cleaning material; work completed. 01, 885.

Steam vessel. 1901. \$12,000 allotted for tug with barge to transfer material; work nearly completed; suspended owing to machinist strike. 01, 92, 893.

1902. \$8,255.39 allotted. Vessel completed; named *Gen. Alexander*. 02, 779.

Tool rooms and rammer racks. 1901. \$700 allotted. Work completed. 01, 885.

Part 48, FPTT.**Preservation and Repair.**

1897. Slopes of mortar battery No. 1 repaired; 4 platforms for 2-inch converted rifles nearly finished; minor work. 97, 750.

1898. Four platforms for 3 converted rifles completed and armed; \$3,700 allotted; work begun on 10 others; 3 built on n. side of B. and 3 on an isld. in the B. On the isld. the old timber magazine was repaired. 98, 786.

1899. \$5,375 allotted. General care and preservation. 99, 989.

1900. \$6,480 allotted. General care and preservation. 00, 1005, 1010, 1015.

1901. N. side—\$2,734 allotted for replacing asphalt covering with a concrete roof, emplacements for three 12-inch guns, disappearing battery;

work finished; itemized statement of work given.

01, 869. Islds. in H.—watchman employed, general care of buildings, etc.; \$1,022 allotted. 01, 872. S. side—\$3,244 allotted. Fence constr. around reservation to keep off trespassers; other misc. work done. 01, 886.

1902. N. side—at battery for three 12-inch guns, concrete roof painted; some work done in magazine galleries; whitewashing rooms and passages. 02, 765. Two 5-inch R. F. guns; water piping repaired; earth slope sown with alfalfa. 02, 765. Two 8-inch guns—steel grate installed. 02, 765. Misc. repairs; dry rubble wall erected. 02, 765. S. side—repairs made at various batteries; itemized statement given. 02, 775, 776.

Part 49, FPTT.**Range and Position Finders.**

1898. Shelter of Lewis range finder—gossamer cloth provided. 98, 788.

1899. \$18,000 allotted for building 13 range-finder shelters of type A and 11 of type B. On s. side o. B.—1 shelter completed and work on 4 others; work suspended owing to changes of sites. Piers of emergency range finder, type B, near emplacements 10 and 16, completed. At another point, 1 pier built and work completed for another finder. On n. side of B.—excavation made for 2 piers and concrete work completed, awaiting the

roofs. Work suspended owing to change of sites 99, 989.

1900. N. and s. sides of B.—2 partly completed range-finder shelters that could be utilized for the new system were completed; 2 more stations completed; itemized cost of work. 00, 1015, 1016.

1901. Constr. of a supplementary observing station; work completed. 01, 885. \$800 allotted. Constr. 2 observing stations at emplacements 18 and 19 of 12-inch barbette batteries; work completed. 01, 885. N. side—2 remaining shelters

built. S. side—fourth shelter built. The entire 8 shelters transferred to Artillery. 01, 891. Datum beacons for range finders. \$725 allotted for constr. 3 datum beacons; 2 set. 01, 892.

1902. \$450 allotted. 12-inch mortar battery; observation station built in this battery; itemized

statement given. 02, 774. \$2,100 allotted for constr. battery-commander's station; site selected; plans and ests. in preparation. 02, 778. Installing beacon on n. side of H. completed. 02, 779. \$39.18 allotted for material for base end houses. 02, 779.

Part 50, FPTT. Sea Walls and Embankments—Fort Point.

Excavation of sea wall completed, constr. in progress; bulkhead for protection of roadway built; minor work. 68, 20. Sea wall 600' long completed; work begun on an apron of masses of r. in front of

chan. sides of the fort. 69, 20. Apron 709' long in front of the sea wall on the chan. fronts completed; 3,500 t. of st. used. 70, 27.

Part 51, FPTT.

Sites.

Point Lobos—proceedings in progress for 54.05 acres. 92, 10. S. side of B.—\$40,000 allotted. Proceedings in progress. 00, 1003. \$3,969.20 allot-

ted condemnation suit; proceedings concluded; land acquired; payments made. 01, 886. Records—\$2.70 allotted for correction of records. 02, 778.

Part 52, FPTT.

Submarine Mines.

1891. Two mining casemates completed, work begun on excavation for another one. 91, 8.

1892. Mining casemate completed and storage shed erected. 92, 8.

1893. \$7,590 allotted. Work begun, excavation and concrete work completed, and casemate nearly finished. Itemized cost of work. 93, 623.

1894. Mining casemate completed. 94, 11.

1897. \$8,000 allotted for a torpedo casemate. 97, 745.

1898. Work begun on torpedo casemate in July. 1897, and completed in November, 1897. Overhead traveler installed in the cable tank and 1 in the torpedo shed. 98, 795. \$47,000 allotted for torpedo defense; material purchased and first mine planted June 11, 1898; 42 mines were placed. 98, 796.

1899. \$150 allotted for purchasing electric-light materials; no funds used. \$1,785 allotted for repairs of car tracks that were injured by storm; r. revet. built alongside to protect it from further damage. 99, 991. \$3,000 allotted for casemate

No. 2; completed under contract. \$2,000 allotted for an additional brick engine house at this casemate; work completed under contract. \$3,350 allotted for an additional cable tank and torpedo station; work completed. Laying of mines continued till July 16, but laying of cables continued, and the entire first line of mines across the B, was completed on August 13. All mines and cables removed from water, cleaned, and stored; work completed in November; itemized cost of work. 99, 991. 992.

1900. \$600 allotted for pay of keeper and expenses of torpedo station; racks erected, completing the torpedo shed. Additional cable tank at the torpedo station completed. 00, 1017, 1018.

1901. \$1,200 allotted. Repairs to damaged torpedo shed, keeper's dwelling; searchlight outfits transferred; minor repairs, etc.. 01, 894.

1902. \$610 allotted. Obsolete material shipped to Willets Point; glass replaced in windows and screens put up; torpedo-shed roof repaired. 02, 780.

Part 53, FPTT. Supplies for Seacoast Defenses.

1900. \$1,000 allotted. No expend. 00, 1017.

1901. Electric supplies purchased and alterations made to switchboards. 01, 893.

Part 54, FPTT. Survey for Land Defenses.

1866-68. Survey in progress. 67, 15; 68, 20.

FPWW. COLUMBIA RIVER FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|--|-----------|
| 1 | Contracts..... | 1897 |
| 2 | Engineering features..... | |
| 3 | Engineers—Chief of Engineers..... | 1866-1902 |
| 4 | B E..... | 1882 |
| 5 | In charge..... | 1866-1901 |
| 6 | Assistants..... | 1870-1900 |
| 7 | Forts, etc. (allotments, operations, etc.)..... | 1869-1912 |
| 8 | Fort Stevens, Oreg..... | 1869-1886 |
| 9 | Fort Canby, Wash..... | 1875-1886 |
| 10 | Cape Disappointment, Wash..... | 1870-1872 |
| 11 | 10-inch gun battery, 6 emplacements..... | 1897-1901 |
| 12 | Two emplacements, 8-inch rifles..... | 1897-1901 |
| 13 | Emplacements, eight 12-inch mortars..... | 1898-1901 |
| 14 | Emplacement, one 8-inch rifle, experimental disappearing carriage, model 1894..... | 1899-1901 |
| 15 | Site 1—two emplacements, 15-pounder R. F. guns..... | 1899-1901 |
| 16 | Two emplacements, 6-inch R. F. guns..... | 1899-1900 |
| 17 | Two emplacements, 6-inch rifles, disappearing carriages, model 1898..... | 1899-1901 |
| 18 | Emplacement, 15-pounder R. F. gun..... | 1900-1901 |
| 19 | Emplacements, two 6-inch R. F. guns, pedestal mounts..... | 1901-1902 |
| 20 | Site 2—two emplacements, 15-pounder R. F. guns..... | 1899-1900 |
| 21 | Two emplacements, 6-inch rifles, disappearing carriages, model 1898..... | 1899-1901 |
| 22 | Emplacement, 15-pounder R. F. gun..... | 1900-1901 |
| 23 | Platform, 15-inch S. B. gun..... | 1901 |
| 24 | Miscellaneous (Water; Drainage; Electricity; Hoists, Telautographs)..... | 1898-1902 |
| 25 | Preservation and repair..... | 1898-1902 |
| 26 | Range and position finders..... | 1899-1901 |
| 27 | Sea walls and embankments..... | 1877-1878 |
| 28 | Mines..... | 1897-1900 |
| 29 | Supplies..... | 1901 |

Part 1, FPWW. Contracts.

1897. Portland cement, 3,000 barrels, at \$2.13 per barrel; broken st., 65¢ per c. y. Wharf, \$9,302.97, 762.

Part 2, FPWW. Engineering Features.

Air spaces. 02, 2494 (pl.).
 Asphalt. Courses of asphalt. 02, 2494 (pl.).
 Laying. 02, 2484 (pl.). Courses turned up under coping. 02, 2483, 2494 (pl.). Asphalt. st. joints. 02, 2494 (pl.). Waterproofing with asphalt. 02, 2494 (pl.).

Booths for telautographs. 03, 2424 (pl.). Provisions for booths in walls. 05, 3032 (pl.).

Boards, wire, ceilings. 02, 2494 (pl.).
 Communications, system of. 99, 1003; 03, 2423.

Concrete work, ceilings. 02, 2478. Closets in walls. 02, 2477, 2480, 2494 (pl.). Cracks in, old RR. iron to prevent. 99, 995, 1002. Filling with linseed oil. 99, 1003. Repairing. 00, 1023. Repairing surface cracks. 02, 2487. Finishing, granolithic finish. 99, 1001. Forms. 02, 2486,

2494 (pl.). Good and bad work, examples. 02, 2494 (pl.). Gun blocks. 02, 2479. Leaks in, experiments to prevent. 01, 924. Manufacturing. 02, 2484; 99, 1001. Mixer building. 02, 2494 (pls.). Overhead cover. 02, 2480. Parapets, finishing top surfaces. 00, 1025. Loading platforms. 02, 2478. Reinforcing. 02, 2477, 2494 (pl.). Tamping. 03, 2424.

Condensation, controlling. 00, 1023; 01, 924. "Recent works" give no trouble from. 01, 924. Advantage of ventilators proved. 01, 925. Various methods of assuring ventilation and noncondensation. 02, 2488.

Construction, salient details of. 01, 923. Plant layout. 02, 2494 (pl.). Plant. 97, 756; 99, 1000; 02, 2491. Material bunkers. 02, 2494 (pl.).

Doors, steel doors. **02**, 2494 (pl.).
 Drainage, general arrangement for, battery constr. on beach sand. **02**, 2494 (pl.). Water drain in ventilator. **02**, 2494 (pl.).
 Dryness, providing for. **01**, 923.
 Electricity, plant. **98**, 798; **99**, 997; **00**, 1022.
 Embankments, sand for, placing. **99**, 1002.
 Fireplaces, provisions for, in concrete. **02**, 2480, 2494 (pl.).
 Foundations, beds. **02**, 2475, 2476.
 Gudgeons, setting. **02**, 2490.
 Hydrants, walls, loading platforms. **05**, 3033 (pl.).
 Leaks, methods of preventing. **01**, 924.
 Lighting, conduits and wireboards. **02**, 2482.
 Various arrangements. **02**, 2495.
 Lining, hollow tile for. **05**, 3032 (pl.).
 Lockers, arrangements for. **03**, 2424 (pl.).
 Materials, costs. **97**, 758, 761; **99**, 1000. Obtaining and delivering. **02**, 2493. Handling to mixers. **02**, 2494.
 Paints, paints and washes. **02**, 2494.
 Railings and stanchions. **02**, 2494 (pl.).

Recesses, providing, for wireboards. **02**, 2494 (pl.). Speaking tubes. **02**, 2494 (pl.). Hydrants. **02**, 2494 (pl.). Blackboards. **05**, 3032 (pl.).
 Speaking tubes, arrangements or. **02**, 2481; **03**, 2423; **04**, 3739 (pl.).
 Stairways, details. **05**, 3032 (pl.).
 Stanchions. (See Railings.)
 Switches, 3-way switches. **04**, 3739. Switch-board arrangements. **02**, 2494 (pl.).
 Titles, battery titles formed in cement. **05**, 3033.
 Trackage. **02**, 2492, 2494 (pl.).
 Ventilation, system. **00**, 1023.
 Walls, reinforcing traverse walls. **05**, 3032 (pl.).
 Reinforcing vertical walls. **05**, 3033 (pl.).
 Water, connections. **02**, 2481.
 Waterproofing, various methods. **02**, 2482.
 Wharf, R.R. wharf and unloading arrangements. **02**, 2494 (pl.).
 Windows arrangements for, in concrete. **03**, 2424 (pl.).

Part 3, FPWW.

Engineers.

Chief of Engineers. **R.**, 66, 18; 68, 20; 69, 19; 70, 28; 71, 25; 72, 24; 73, 25; 74, 29; 75, 28; 76, 29; 77, 24; 78, 27; 79, 32; 80, 54; 81, 55; 82, 54; 83, 50; 84, 55; 85, 48; 86, 47; 95, 5, 96, 20; 97,

21, 756; 98, 31, 797; 99, 36, 993; 00, 33, 1018; 01, 34; 02, 35; 03, 9; 04, 5, 9; 05, 5, 10; 06, 5; 07, 5; 08, 9; 09, 10; 10, 12; 11, 8; 12, 7.

Part 4, FPWW.

Board of Engineers.

1882. Constituted to consider and report upon the constr. of fortifications, and what number, if any, could be dispensed with. **82**, 428.

Part 5, FPWW.

Engineers in Charge.

Col. R. E. De Russey, 1866.
 Maj. G. H. Elliott, 1866-69.
 Maj. G. H. Mendell, 1870-71.
 Maj. H. M. Robert, 1871-74.
 Maj. N. Michler, 1874-76.
 Maj. J. M. Wilson, 1876-78.
 Maj. G. L. Gillespie, 1880-82.

Capt. C. F. Powell, 1882-86.
 Maj. J. C. Post, 1896.
 Capt. H. Taylor, 1896.
 Maj. W. L. Fisk, 1896-99.
 Capt. W. C. Langfitt, 1900-02.
 Capt. W. W. Harts, 1900-01.

Part 6, FPWW.

Assistant Engineers.

Capt. C. W. Raymond, 1870.
 Capt. H. Taylor, 1896.
 Capt. A. F. Flagler, 1896-98.

Lt. W. D. Connor, 1898.
 Lt. A. A. Fries, 1899-1900.

Part 7, FPWW—**FORTS AND BATTERIES.****Part 8, FPWW. Fort Stevens, Oreg. (South Side of River).**

1869. Scarp revet. removed and exterior slope of parapet extended to bottom of ditch; covered way with parapet built along the counterscarp; minor repairs. 69, 19.

1870. 300' of facing of counterscarp relaid; slopes resodded. 70, 28.

1871. Picket fence erected. 71, 26.

1875. Postern of work repaired. 75, 28.

1876. New platform built for 15-inch gun, revet. in front renewed; revet. also renewed in front of one 10-inch and three 8-inch guns and the earthwork adjacent graded and sodded. 76, 29.

1877. Revet. of interior slopes renewed, old traverses renewed, and minor work; sea wall protection built. 77, 24.

1878. Shore protection built; minor repairs to gun platform and brs. 78, 28.

1879. Drain to moat put in order, revet. of sally port strengthened; the old lining of the

passage leading to the magazine chamber strengthened, and a substantial interior waterproof lining added. 79, 33.

1880. Earth covering removed from sally port; wooden drain to moat replaced by an 8-inch tile drain; minor work. 80, 54.

1881. Sally port wholly rebuilt; revet. of traverses on both sides of 15-inch gun rebuilt and earth sodded; minor work. 81, 55.

1883. Repair of drains and moat; powder house built, work on breast-high plank walls, and shore protection. 83, 50.

1884. Marsh sod revet. of interior slope repaired; 4 shot platforms and 5 gun platforms built; work on magazine. 84, 55.

1885. Repair of magazine completed. 85, 48.

1886. Seven gun platforms rebuilt; minor work and repairs. 86, 48.

Part 9, FPWW. Fort Canby, Wash. (North Side of Chinook River).

1875. Two new gun platforms built. 75, 28.

1876. Magazines of w. battery built, 10-inch gun platforms in e. battery rebuilt, and new revet. placed in front. 76, 29.

1878. Main magazine painted. 78, 27.

1880. Revet. of interior slopes of center battery and part of revet. of right battery removed; platforms and revet. of 15-inch gun battery rebuilt new roof built on powder magazine; minor work. 80, 54.

1881. Powder magazine painted. 81, 55.

1882. Rampart of center battery extended on the left and a platform placed for a 12-inch rifle

received; repairs of breast-high plank walls; minor repairs. 82, 55.

1884. Service magazine and 3 gun platforms at center battery rebuilt; minor repairs made. 84, 55.

1885. Repair of service magazine and 2 gun platforms at the left battery; minor repairs in center battery and to the power house. 85, 48.

1886. Five gun platforms built at the right battery and shot beds at 3 batteries. 86, 48.

Part 10, FPWW. Cape Disappointment, Wash.

1870. Powder house; concrete foundation built. 70, 28.

1872. Painting powder house with fireproof paint. 72, 24.

Part 11, FPWW. 10-inch Gun Battery, Six Emplacements.

1897. Work begun September, 1896, for 4 emplacements; steam shovel, capacity $1\frac{1}{2}$ c. y., bought; excavation and concrete work completed; 90,140 c. y. excavated and placed in parapet fill, completing it and parados; 3 guns and carriages received and mounted. Description of plant; itemized cost of constr. materials. 97, 756.

1898. The other carriage and gun received and mounted; rear stairways built for the emplacements; handrails put around the loading platforms; parapets, parados, and rear fills completed and sodded; 107,530 c. y. sand placed; 13,208 c. y. concrete placed in the 4 emplacements; 1,105 c. y. of this large r. in pieces; drainage system com-

pleted. The 4 emplacements completed, except the steel cover for the observation station, with ammunition carriers, crane, etc., turned over to the commanding officer, Fort Canby, March 16. 98, 797.

1899. \$25,000 allotted. Work begun, 1898, for 2 additional emplacements; 9,994 c. y. concrete placed; 25 t, old rails embedded in the concrete; 2 courses laid every 12' longitudinally and every 14' transversely to tie together the concrete mass to prevent cracks; 41,267 c. y. sand excavated and placed for parapet fill; machinery installed; emplacements practically completed. 99, 994.

1900. Connection made in rear of traverses

between guns of emplacements 1 to 4 to allow ammunition to be taken from one platform to the next. Necessary changes made in platforms for floor plates of 18 inches instead of 12 inches. One 10-inch disappearing carriage and two 10-inch guns received; the base ring set in emplacement 5 and the carriage and gun mounted by the Artillery troops. The 2 A. R. F. emplacements, 5 and 6, turned over to the commanding officer June 28, 1900. 00, 1019.

1901. Gun and carriage emplacement 6 mounted by Artillery; cables laid; parapet surfaces given 2 coats asphalt to stop leaks; plant dismantled; grounds cleared. 01, 896.

Part 12, FPWW. Two Emplacements for 8-inch Rifles.

1897. Work begun in 1896. Wharf nearly a mile long; built under contract for \$10,867.64; 10,905 c. y. excavated for foundations and necessary buildings; plant erected. Description of work of building wharf; itemized cost of constr. materials. 97, 759.

1898. Concrete work begun July 7. 4,500 c. y. placed and 15,860 c. y. earth excavated, including some excavation in front of the emplacements to

secure the desired field of fire; 9,900 c. y. earth deposited as fill in the parapets; drainage system completed; 2 guns and carriages received and mounted, and apron placed after full settlement of parapet fill. 98, 800.

1899. Emplacements wired; lamps and switches put in. Several rooms and passages leak slightly because of cracks in parapet. 99, 997.

1901. Storage battery installed. 01, 897.

Part 13, FPWW. Emplacements for Eight 12-inch Mortars.

1898. Work begun in August. 6,173 c. y. concrete and 39,740 c. y. sand filling placed; drainage system completed; 7 carriages received and mounted; wiring for electric lights completed, and a storage battery of 52 cells, with switchboard, installed. Battery nearly completed. 98, 798.

1899. The other mortar carriage received and mounted. Granolithic finish placed on the pits and the completed battery turned over to the

Artillery on Jan. 17, 1899. Cracks appearing in the apron of each mortar pit, causing slight leaks in the shell rooms. 99, 996.

1900. Eight mortars mounted by the Artillery in July. \$2,000 allotted for a new drainage system; work completed. 00, 1020.

1901. Pit aprons given thin coat of asphalt. 01, 897.

Part 14, FPWW. Emplacement for One 8-inch Rifle, Experimental Disappearing Carriage, Model 1894.

1898. Work begun in August. 5,615 c. y. excavated and 2,805 c. y. concrete placed, of which amount 17% was large st. Drainage system completed. 98, 800.

1899. Emplacement wired. Some trouble experienced from dampness and small leaks. 99, 997.

1901. Carriage and gun mounted by Artillery June, 1901. 01, 898.

Part 15, FPWW. Site 1—Two Emplacements for 15-pounder R. F. Guns.

1899. \$12,000 allotted. Some constr. materials received. 99, 997.

1900. Work completed, including the wiring for electric light. 756 c. y. concrete placed and 3,384 c. y. sand placed in parapet. Fence built

around battery. No armament received. Emplacements were turned over to the commanding officer June 28, 1900. 00, 1020.

1901. Base castings set; guns mounted. 01, 897.

Part 16, FPWW. Site 1—Two Emplacements for 6-inch R. F. Guns.

1899. Plans submitted; action deferred; kind of mount not definitely determined. 99, 998.

1900. \$15,000 allotted. No money to be expended till receipt of further instructions. Detail of mount not perfected. 00, 1024.

Part 17, FPWW. Site 1—Two Emplacements for 6-inch Rifles, Disappearing Carriages, Model 1898.

1899. \$57,600 allotted. Constr. materials received. 99, 998.

1900. Work begun; 4,342 c. y. concrete placed and 12,036 c. y. sand used for parapet fill; drainage system installed; fence built around battery; carriages received and base rings set; carriages mounted by the Artillery; changes made in the system of electric lighting; rearrangement of the

storage battery. \$1,500 allotted for a water-supply system; work begun; emplacements turned over to the commanding officer on June 28, 1900. 00, 1020.

1901. Grounds cleared and graded; macadam road made; emplacements wired and storage battery installed; guns not yet received. 01, 897.

Part 18, FPWW. Site 1—Emplacement for 15-pounder R. F. Gun.

1900. \$5,450 allotted. Material advertised for. 00, 1024.

1901. Work completed and turned over Nov 12, 1900. 01, 897.

Part 19, FPWW. Site 1—Emplacements for Two 6-inch R. F. Guns on Pedestal Mounts.

1901. \$29,000 allotted. Drawings and est. submitted; excavation commenced: 15-inch S. B. gun moved from its platform to the banquette tread entirely clear of proposed emplacements. 01, 897.

1902. Work completed; turned over Jan. 17 1902; ammunition hoists and electric plant installed; guns and mounts not yet delivered. 02 782.

Part 20, FPWW. Site 2—Two Emplacements for 15-pounder R. F. Guns.

1899. Revised plans approved. \$10,610 allotted. Sand for concrete received. 99, 998.

1900. Work begun in August, 1899. 7,755 c. y. excavated and 723 c. y. concrete placed. A macadam roadway built to connect with the 6-inch

emplacement. Battery to be lighted from the electric-light plant in the 6-inch battery. No armament received. Emplacements turned over to the commanding officer on June 28, 1900. 00 1023.

Part 21, FPWW. Site 2—Two Emplacements for 6-inch Rifles, Disappearing Carriages, Model 1898.

1899. Revised plans approved. \$57,600 allotted. Work begun clearing site of the battery. 99, 998.

1900. Work begun; excavation completed: 8,765 c. y. removed; 3,859 c. y. concrete placed; all drainage and water systems completed; all machinery installed; macadam roadway built connecting with the 15-pounder battery. Two carriages received and unloaded, then turned over to the

Artillery for mounting; work completed. Battery is designed to accommodate duplicate oil engine and dynamo, electric light and power plant, doing away with all outside wiring and the storage battery; contract made for this plant. Emplacements turned over to the commanding officer on June 28, 1900. 00, 1022.

1901. Electric-light plant installed. 01, 898.

¹Refers to 6" B. L. R., 99, 998.

Part 22, FPWW. Site 2—Emplacement for 15-pounder R. F. Gun.

1900. \$4,840 allotted. Materials advertised for.
00, 1024.

1901. 3,200 c. y. excavated; 295 c. y. concrete laid; emplacement completed Oct., and turned over to Artillery Oct. 28, 1900. **01, 898.**

Part 23, FPWW. Platform for 15-inch S. B. Gun.

1901. Dismounted and removed to permit constr. of two 6-inch emplacements; pedestal mounts. **01, 897.**

Part 24, FPWW. Miscellaneous.

Electric-light stations. **1898.** Site 1—683 c. y. concrete placed for foundations; wiring finished and station completed; description of plant. **98, 798.** Site 2—1,985 c. y. earth and 380 c. y. r. excavated for foundations; 400 c. y. concrete placed; building nearly completed. **98, 801.**

1899. Site 2—floors of the 2 rooms finished; work completed June 16, 1898, and turned over to the commanding officer. **99, 997.**

1900. Site 2—plant installed and in operation or direct lighting of the three 8-inch emplacements; storage battery received, ready for installation. **00, 1022.** Both plants completed and turned over to Artillery Oct. 29, 1900, and Jan. 19, 1901, respectively. **01, 898.**

1902. \$1,400 allotted for electric-light station, site 1; old boiler condemned and replaced by a vertical boiler. **02, 782.**

Water supply. **1901.** The 10-inch, 12-inch, and 6-inch batteries provided with their own water-supply system. **01, 897.**

Drainage system. **1901.** Work of changing drainage system of 10-inch mortar batteries completed. **01, 897.**

Searchlights, chain hoists, telautographs. **1902.** Est. for proposed location and installation of two 36-inch and six 24-inch searchlights submitted; plans for providing older batteries with suitable chain hoists submitted; detailed drawings submitted of cost for installing telautographs for guns of 8-inch caliber. **02, 783.**

Part 25, FPWW. Preservation and Repair of Fortifications.

1898. Two 10-inch S. B. guns dismounted and a new platform for a 15-inch front-pintle platform built on their site. Carriage received and mounted and the 15-inch S. B. gun moved from the old center-pintle platform and mounted on new carriage. The old jetty, shore, and wharf trestle repaired; 10,767 c. y. sand filling placed in the trestles; foundation of the water-supply tank renewed, new windmill tower built, and a new well driven. **98, 800.** Wharf and plant repaired. **98, 801.** S. side of R.—\$2,000 allotted; quarter; and buildings repaired and a wooden platform for 15-inch Rodman S. B. gun built. N. side of R.—\$150 allotted for repairs to powder magazine; a new tin roof placed. **98, 803.**

1899. \$1,775 allotted. Old fort repaired; electric plants operated and cared for, storage batteries

regularly charged, new quarters built for accommodation of 180 men, and general repair o. constr. plant. **99, 996, 999, 1,004.**

1900. \$2,550 allotted. Cracks in the pits, aprons o the mortar battery and 8-inch battery partly repaired; method of work. \$1,410 allotted for care of electric-light plant and storage batteries. **00, 1023.**

1901. \$480 allotted. Electric-light plants charged and cared for; stoppage of leaks; storing and caring or mining material; materials transferred to Artillery. **01, 899.**

1902. Leaks in passages stopped; repairs at 6-inch and 8-inch emplacements; leaks in apron stopped by asphaltting. **02, 782.**

Part 26, FPWW. Range and Position Finders.

1899. An 8-inch cast-iron pipe set in the concrete for a type B range finder; platform with pipe railing built around it for convenience in working the instrument. **99, 995.**

1900. \$2,729 allotted for a battery-commander's station, type A, for the 10-inch battery; station completed in May; given extra protection of concrete because of its exposed position. \$1,666 allotted for a battery-commander's station, type A, for the 8-inch battery; work completed in May.

00, 1021. \$225 allotted for mounting bases for type B, range and position finders at 2 sites. One mounting was installed at the first site with a wooden stairway leading to it and another mounted at the second site. **00, 1022.**

1901. Site 1—battery-commander's station turned over to Artillery Nov. 29, 1900. **01, 897.** Site 2—battery-commander's station turned over to Artillery Nov. 29, 1900. **01, 898.**

Part 27, FPWW. Sea Walls and Embankments.

Fort Stevens—1,000 l. f. st. and brush revet. built to protect sea wall. **77, 24.** New revet. of

brush and st. and several small wing dams built along the shore of Point Adams. **78, 28.**

Part 28, FPWW. Submarine Mines.

1897. \$7,500 allotted. Work begun in April on a mining casemate. R.R. trestle 1,200' long built for transporting materials to site of work; 1,267 c. y. excavated and 489 c. y. concrete placed, nearly completing the work. **97, 759.** \$6,000 allotted for a second mining casemate; constr. materials received. **00, 762.**

1898. Site 1—mining casemate completed, including 750' of gallery; 12,263 c. y. sand for protection and 718 c. y. concrete placed. **98, 798.** \$2,000 allotted for a cable tank; work begun in April and completed in May. **98, 799.** Site 2—mining casemate; 4,177 c. y. excavated; 635 c. y. concrete placed; work nearly completed. **98, 801.** \$8,000 allotted for torpedo defense; materials received and cables laid, but no mines planted. \$1,000 allotted for gun platforms; no money expended. **98, 802.**

1899. Site 1—mining casemate; \$734 allotted for concrete culvert in place of the 12-inch cast-iron pipe and for installing a blower; work com-

pleted. **99, 996.** Second cable tank built; house built over it; the track for the overhead traveler extended from the tank first built. **99, 996.** \$5,800 allotted for a torpedo storehouse, which was completed. **99, 996.** Site 2—mining casemate; \$1,885 allotted for altering casemate for the machinery required; work in progress. **99, 997.** All torpedo material cleaned and stored; 2 searchlight outfits received, 1 set up and operated. **99, 999.**

1900. Site 1—inside of casemate and engine rooms painted white and a blower provided. **00, 1020.** Torpedo storehouse; Steel roof trusses painted black and the ceilings and inside walls white; doors and windows were also painted. **00, 1020.** Site 2—mining casemate; Oil, engine, and dynamo room completed and a small blower provided. **00, 1022.** All torpedo material overhauled, cleaned, and stored. One drum of multiple cable found to have a defective core; new cable received. **00, 1024.**

Part 29, FPWW. Supplies for Seacoast Defenses.

1901. \$800 allotted. Electric supplies furnished commanding officer. **01, 899.**

FPXX. PUGET SOUND, WASH., FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Contracts..... | 1897-1901 |
| 2 | Engineering features..... | 1896-1912 |
| 3 | Engineers—Chief of Engineers..... | 1901-1902 |
| 4 | In charge, and assistants..... | 1898-1902 |
| 5 | Forts, etc. (allotments, operations, etc.)..... | 1898-1902 |
| 6 | Site 1—Battery, four 10-inch and two 12-inch guns, nondisappearing carriages..... | 1898-1902 |
| 7 | Emplacements, two 5-inch R. F. guns, balanced pillar mounts..... | 1899-1902 |
| 8 | Emplacements, sixteen 12-inch mortars, mortar battery No. 3..... | 1900-1902 |
| 9 | Site 2—Emplacements, four 10-inch guns, disappearing carriages..... | 1898-1902 |
| 10 | Mortar battery, sixteen 12-inch mortars, No. 1..... | 1898-1902 |
| 11 | Emplacements, two 5-inch R. F. guns, balanced pillar mounts..... | 1899-1902 |
| 12 | Site 3—Battery, five 10-inch and two 12-inch guns, nondisappearing carriages..... | 1898-1902 |
| 13 | Emplacements, sixteen 12-inch mortars..... | 1899-1902 |
| 14 | Emplacements, two 5-inch R. F. guns, balanced pillar mounts..... | 1899-1901 |
| 15 | Site 4—Emplacements, three 8-inch guns, disappearing carriages..... | 1899-1902 |
| 16 | Emplacements, four 15-pounder R. F. guns, balanced pillar mounts..... | 1900-1902 |
| 17 | Emplacements, three 5-inch R. F. guns, Navy pattern, pedestal mounts..... | 1900-1901 |
| 18 | Emplacements, two 15-pounder R. F. guns, balanced pillar mounts..... | 1900-1902 |
| 19 | Site 5—Emplacements, two 6-inch R. F. guns, Brown's segmental pattern, Navy mounts..... | 1899-1902 |
| 20 | Emplacements, two 15-pounder R. F. guns, balanced pillar mounts..... | 1900-1902 |
| 21 | Emplacements, three 10-inch guns, disappearing carriages..... | 1901-1902 |
| 22 | Miscellaneous (Tug; Lighthouse; Mounting guns and carriages)..... | 1898-1902 |
| 23 | Preservation and repair..... | 1900-1902 |
| 24 | Range and position finders..... | 1900-1902 |
| 25 | Sites..... | 1897-1900 |
| 26 | Submarine mines..... | 1899-1901 |
| 27 | Supplies..... | 1900 |

Part 1, FPXX.**Contracts.**

1897. Battery of four 10-inch guns and two 12-inch guns on nondisappearing carriages, \$163,-453.50. 97, 768. Four emplacements for 10-inch guns on disappearing carriages, \$34,980.50; battery for sixteen 12-inch mortars, \$78,052.01. 98, 809.

1898. Wharf, \$7,080.20; steel-hull tugboat, \$37,-000; sand, large gravel and small gravel, 65¢ to \$1 per c. y. 99, 1011, 1015.

1899. Sand, small gravel, or broken st., 55¢ per c. y. 00, 1029.

1901. Sand and gravel: constr. torpedo storehouse; clearing and excavating for three 8-inch gun batteries; for mortar battery No. 3; observation towers for fire and battery commander's stations, at sites 1 and 4. 01, 909.

Part 2, FPXX.**Engineering Features.**

Concrete, cost per c. y. 00, 1027, 1040, 1042.

Concrete, ingredients of. 00, 1027.

Concrete mixing, method. 99, 1009; 00, 1043.

Plant, arrangement of (tracings). 99, 1010.

Waterproofing, method of. 99, 1006; 00, 1026, 1027, 1028, 1037.

Work, cost of. 98, 804, 805; 99, 1005, 1007, 1008; 00, 1038, 1040, 1041, 1042.

Part 3, FPXX.**Engineers.**

Chief of Engineers. R., 96, 21; 97, 21, 763; 98, 32, 803; 99, 36, 1005; 00, 33, 1026; 01, 35; 02, 36; 03, 9; 04, 5, 9; 05, 5, 10; 06, 5; 07, 5; 08, 9; 09, 10; 10, 12; 11, 8; 12, 7.

Part 4, FPXX.**Engineers in Charge.**

Capt. H. Taylor, 1896-01.
Lt. M. L. Walker, 1899.

Maj. John Millis, 1901-02.
Assistant. Lt. M. L. Walker, 1897-1901.

Part 5, FPXX—**FORTS AND BATTERIES.****Part 6, FPXX. Site 1—Battery for Four 10-inch and Two 12-inch Guns, Non-disappearing Carriages.**

1898. \$175,000 allotted. Work begun July 31, 1897, under contract. Wharf built. Two 10-inch emplacements completed, except installing machinery; 2 others have the concrete about half laid and two 12-inch emplacements have the excavation completed; floors laid and forms built for concrete. 94,781 c. y. excavated for foundations and 6,292 c. y. concrete placed. Four 10-inch platforms ready for carriages; the 12-inch platforms ready in about 3 weeks. Two 10-inch and two 12-inch carriages received. Itemized cost of work. 98, 803, 811.

1899. \$2,000 allotted. Work under contract completed Mar. 28, 1899. Part of the rooms covered with asphalt and a facing of hollow brick put on outside the concrete. These have proved perfectly dry, while the rooms where these precautions were not taken have proved damp. Itemized cost of work. Three 10-inch and two

12-inch carriages mounted and three 10-inch and two 12-inch guns received. 99, 1005, 1014.

1900. Earth abutment again: the wall through which moisture came excavated; the outside walls cleaned, plastered, and waterproofed with an alum-and-lye wash: a facing of hollow brick laid against the wall and the earth refilled. Three 10-inch and two 12-inch guns mounted on the 12-inch guns fired. The remaining 10-inch gun and carriage received; mounting in progress by the Artillery. All ordnance property turned over to ordnance officers. 00, 1026, 1037, 1038.

1901. Traverses nearly completed; slope trimmed and seeded; fixtures placed; 10-inch gun mounted, and all 10-inch guns fired with service charges. 01, 902.

1902. Additional work done on traverse roads, and gutters; repairs to latrines; battery transferred to Artillery June 30, 1902. 02, 785.

Part 7, FPXX. Site 1—Emplacements for Two 5-inch R. F. Guns on Balanced Pillar Mounts.

1899. \$12,000 allotted. Plans prepared and part of plant accumulated. 99, 1013.

1900. \$3,000 allotted. Work begun July 25, 1899, by hired labor. Small wharf built. 1,116 c. y. concrete placed, completing the work; awaiting

arrival of mount. Itemized cost of concrete also total cost per c. y. Work suspended Mar. 3, 1900. 00, 1031, 1037.

1902. Transferred to Artillery June 16, 1902, 02, 785.

Part 8, FPXX. Site. 1—Emplacements for Sixteen 12-inch Mortars, Mortar Battery No. 3.

1900. Survey made of proposed site and plans and ests. prepared. 00, 1038.

1901. \$91,000 allotted. Site cleared, grubbed, and excavation done; constr. work in progress; drains placed; floors laid; mortar carriages received. 01, 902.

1902. \$1,025.10 allotted. Battery built; 8 mortar carriages mounted by Artillery; plans for electric service prepared. 02, 785.

Part 9, FPXX. Site 2—Emplacements for Four 10-inch Guns, Disappearing Carriages.

1898. \$95,000 allotted. Work begun Aug. 31, 1897, under contract. 37,154 c. y. excavated for foundations and 9,244 c. y. concrete placed; 2 emplacements practically finished, except lifts, trolleys, and other metal work. The platforms of the other 2 emplacements laid; floors laid and forms nearly all up. Itemized cost of work. **98**, 805.

1899. \$7,600 allotted. Work under contract completed Dec. 15, 1898. Four carriages received. Itemized cost of work. **99**, 1006, 1014.

1900. Slopes and drains repaired; minor work to be done. Four carriages assembled and 3 rifles received and mounted. All ordnance turned over to the ordnance officer. **99**, 1026, 1039.

1901. Superior slope filled out; guns fired with service charges. **01**, 902.

1902. Railings placed about gun platforms; minor repairs made; plans and est. for electric service prepared; emplacements transferred to Artillery June 16, 1902. **02**, 784.

Part 10, FPXX. Site 2—Mortar Battery for Sixteen 12-inch Mortars, No. 1.

1898. \$90,000 allotted. Work begun under contract. 6,291 c. y. excavated for foundations. Six carriages received. **98**, 808, 811.

1899. Work completed Mar. 14, 1899. Itemized cost of all work: 10 carriages received and 13 mounted. **99**, 1008, 1014.

1900. Slopes and drains repaired and battery whitewashed. Twelve mortars received and

mounted. All ordnance property turned over to ordnance officer. **00**, 1039.

1901. \$6,000 allotted. Slopes regraded and seeded; road completed; mortars fired with service charge. **01**, 902.

1902. Minor repairs; plans and est. for electric service prepared; battery transferred to Artillery June 16, 1902. **02**, 785.

Part 11, FPXX. Site 2—Emplacements for Two 5-inch R. F. Guns on Balanced Pillar Mounts.

1899. \$12,000 allotted. Plans prepared. **99**, 1013.

1900. \$6,850 allotted. Work begun Aug. 12, 1899, by day labor, and continued till Mar. 15, 1900,

when work was suspended on account of lack of funds. Work to be resumed. **00**, 1031, 1039.

1902. Finishing work done; transferred to Artillery June 16, 1902. **02**, 785.

Part 12, FPXX. Site 3—Battery for Five 10-inch and Two 12-inch Guns, Non-disappearing Carriages.

1898. Plans being prepared. **98**, 810.

1899. \$191,000 allotted. Work begun Sept. 6, 1898, by day labor. Excavation completed; 5,526 c. y. concrete placed. This included the man-holes of drainage system, retaining walls, foundation throughout, all the storerooms at the ends of the emplacements, and practically the completion of all the gun platforms. **99**, 1010.

1900. \$35,000 allotted. 18,456 c. y. excavated for foundations by day labor and 43,560 excavated by contract upon the superior slope put into back fill; 17,309 c. y. concrete placed and minor work. Battery completed, except whitewashing and

finishing of the walls, painting, and minor work. Description of work, with itemized cost. Four 10-inch guns and one 12-inch carriage received and mounted and one 10-inch rifle received. **00**, 1027, 1040, 1043.

1901. Slope graded and seeded; mounting of all guns and carriages, except one 12-inch gun, completed; 3 special ammunition trucks constr. **01**, 901.

1902. One 12-inch gun and carriage mounted; plans and est. for electric service prepared; battery transferred to Artillery June 16, 1902. **02**, 784.

Part 13, FPXX. Site 3—Emplacements for Sixteen 12-incl Mortars.

1899. \$160,000 allotted. Battery to be built by hired labor. 99, 1012.

1900. Work begun July 6, 1899. 65,861 c. y. excavated for foundations and 10,290 c. y. concrete placed. Battery practically completed: erecting trolleys, whitewashing and painting, installing electric system, and minor work to be done. Summary of work, with itemized cost. Ten carriages received and mounted and 16 mortars and 2 carriages on hand. 00, 1028, 1041, 1043.

1901. \$6,300 allotted. Sixteen mortars and carriages mounted and partly cleaned and painted 01, 902.

1902. Repair work on slopes and roads; mortar and carriage dismounted; carriage sent away for repairs; plans for electric service; battery transferred to Artillery June 16, 1902. 02, 785.

Part 14, FPXX. Site 3—Emplacements for Two 5-inch R. F. Guns on Balanced Pillar Mounts.

1899. \$11 000 allotted. Plans prepared. 99, 1013.

1900. Work begun April 7. Excavation completed and 1,095 c. y. concrete placed; mounts not

yet received. Itemized cost of a c. y. of concrete 00, 1031 1043.

1901. Emplacements finished. 01, 902.

Part 15, FPXX. Site 4—Emplacements for Three 8-inch Guns on Disappearing Carriages.

1899. Work in progress on a detailed survey of site. 99, 1014.

1900. \$103,000 allotted. Work begun Mar. 1, 1900. Wharf built, site cleared, and excavation made by contract; 12,637 c. y. removed for excavation and placed in back fill. Erecting constr. plant. 00, 1030, 1044.

1901. \$15,000 allotted. Battery constr.: nearly finished; guns received. 01, 902.

1902. Work finished; plant removed; 2 carriages received. 02, 785.

Part 16, FPXX. Site 4—Emplacements for Four 15-pounder R. F. Guns on Balanced Pillar Mounts.

1900. Plans and ests. prepared. 00, 1032, 1044.

1901. \$20,700 allotted. Excavation made; drainage system laid; plant prepared. 01, 903.

1902. Battery practically finished, except electric-lighting plant and some painting. 02, 785

Part 17, FPXX. Site 4—Emplacements for Three 5-inch R. F. Guns, Navy Pattern, on Pedestal Mounts.

1900. \$16,000 allotted for 2 emplacements. Some materials purchased. 00, 1032, 1044.

1901. \$3,200 allotted. Emplacements for 3 guns completed as far as possible. 01, 903.

Part 18, FPXX. Site 4—Emplacements for Two 15-pounder R. F. Guns on Balanced Pillar Mounts.

1900. \$8,500 allotted. Some materials purchased. 00, 1032, 1044.

1901. \$1,700 allotted. Battery partly constr.: over half of concrete in place. 01, 903.

1902. Battery practically finished, except electric-lighting plant. 02, 785.

Part 19, FPXX. Site 5—Emplacements for Two 6-inch R. F. Guns, Brown's Segmental Pattern, on Navy Mounts.

1899. \$5,000 allotted. Detailed survey of site made. Condemnation proceedings instituted for possession of title. **99**, 1013.

1900. \$15,000 allotted. Plans prepared; require modification to adapt them to the new style

of mount; no information is at hand in regard to the requirements of the mounts; no work has been done. **00**, 1030, 1044.

1901. \$30,000 allotted. **02**, 902.

1902. \$30,000 allotted. **02**, 786.

Part 20, FPXX. Site 5—Emplacements for Two 15-pounder R. F. Guns on Balanced Pillar Mounts.

1900. \$8,500 allotted. Some materials purchased: **00**, 1032, 1044.

1901. Excavation completed; drainage system laid; plant prepared. **01**, 903.

1902. \$720 allotted. Rough concrete placed and doors hung. **02**, 786.

Part 21, FPXX. Emplacements for Three 10-inch Guns on Disappearing Carriages.

1901. \$102,700 allotted. Excavation for foundation completed; drains laid; concrete plant prepared. **01**, 902.

1902. \$40,000 allotted. Rough concrete com-

pleted; constr. work actively in progress; two 10-inch guns, 2 disappearing carriages received. **02**, 784.

Part 22, FPXX.

Miscellaneous.

Construction of a steel tug. **1899.** \$16,000 allotted. Work begun under contract. **99**, 1015.

1900. Work completed. Used for hauling scows and making surveys and inspections. Of great service in facilitating and cheapening the constr. work carried on since she was built. **00**, 1036.

New lighthouse station at Admiralty Head.

1900. \$8,000 allotted. Plans prepared for a new station by the Lighthouse Department: turned over to the Engineer Department. **00**, 1035.

1902. Work in progress on constr. **02**, 790.

Mounting guns and carriages.

1898. \$7,000 allotted. Two 10-inch and two 12-inch nondisappearing carriages and 6 mortar carriages received. Materials for mounting purchased. **98**, 811.

1899. \$15,000 allotted. Three 10-inch and two 12-inch nondisappearing carriages and 16 mortar carriages mounted. Four 10-inch disappearing carriages, three 10-inch and two 12-inch guns received. **99**, 1014.

1900. \$5,000 allotted. Six 10-inch guns, thirty-two 12-inch mortars, one 12-inch and five 10-inch nondisappearing gun carriages, and twelve 12-inch mortar carriages received. Two 12-inch and three 10-inch guns mounted on nondisappearing car-

riages, three 10-inch guns on disappearing carriages, and 12 mortars on their carriages. One 12-inch and four 10-inch nondisappearing carriages, four 10-inch disappearing carriages, and four 12-inch mortar carriages mounted. One 10-inch nondisappearing gun carriage and eight 12-inch mortar carriages partly mounted. Six 12-inch mortars moved to the emplacements ready for mounting. Two 12-inch and three 10-inch guns mounted on nondisappearing carriages, three 10-inch guns mounted on nondisappearing carriages, three 10-inch guns mounted on disappearing carriages, twelve 12-inch mortars mounted, two 10-inch guns not mounted, four 12-inch mortars not mounted, one 10-inch disappearing gun carriage mounted, one 10-inch nondisappearing carriage partly mounted, and 4 mortar carriages mounted, were turned over to the Artillery garrisons during the year. Since the above ordnance was turned over, the Artillery mounted one 10-inch gun on disappearing carriage and 4 mortars. **00**, 1033.

1901. \$2,725 allotted. One 10-inch, twelve 12-inch mortars, two 5-inch, five 10-inch, one 12-inch, sixteen 12-inch B. L. mortars mounted. **01**, 908.

1902. \$1,000 allotted. One 12-inch gun and carriage mounted; guns, mortars, and carriages painted. **02**, 790.

Part 23, FPXX. Preservation and Repair.

1900. \$5,800 allotted Slopes repaired; white-washing and painting finished; waterproofing roofs of magazines; care of torpedo material and misc. work. **00,** 1034. \$5,000 allotted for road betterment, retrimming and regrading slopes, and planting a windbreak at 10-inch and 12-inch gun battery at site 1. \$3,700 allotted for repair of slopes of mortar battery No. 1. \$2,934 allotted for clearing, grubbing, grading, and seeding certain areas at site 1. No work done under the above allotment. **00,** 1035.

1901. \$3,200 allotted for latrines and water-supply system, site 4; \$6,350 allotted for grading and road constr., site 1. **01,** 906.

1902. \$900 allotted for road betterment, site 4. **02,** 789. \$1,020 allotted for care and putting torpedo material in condition for permanent storage. **02,** 790. \$575.10 allotted for care of batteries. **02,** 790.

Part 24, FPXX. Range and Position Finders.

1900. \$4,926 allotted for a fire-commander's station at site 1; \$2,370 allotted for 1 at site 2, and \$5,000 allotted for 1 at site 3. Plans being prepared. **00,** 1035, 1038, 1039.

1901. \$6,000 allotted for battery-commander's station, sites 2 and 3; \$10,200 allotted for battery commander's station, site 4. **01,** 905, 906.

1902. Stations built. **02,** 787.

Part 25, FPXX.**Sites.**

1897. \$650.74 allotted for surveys and incidental expenses; \$3,480 for purchase of site 1; \$7,200 for site 2; and \$43,075 for site 3. Two sites were obtained partly by purchase and partly by condemnation; negotiations in progress for purchase of as much as possible of a third one. **97,** 763.

1898. Site 3 acquired partly by purchase and partly by condemnation proceedings. Proceedings begun for acquiring 2 more sites. **98,** 810.

1899. \$475 allotted for purchase of site 4. Condemnation proceedings in progress. One addi-

tional tract of land purchased. Title of lands abutting on the reservations at the sites of 2 groups of batteries already built deeded to the U. S. by the State of Washington. Arrangements made whereby the lighthouse reservation at the same locality is to be transferred to the War Department in exchange for 2 pieces of land now part of the military reservation. **99,** 1014.

1900. \$38,600 allotted. Proceedings for acquiring title to sites 4 and 5 completed and amount of award paid. **00,** 1037.

Part 26, FPXX.**Submarine Mines.**

1899. \$1,008.85 allotted for a cable tank and torpedo storehouse. Title to proposed site not yet secured. Temporary storage tank for cable on hand prepared by throwing a crib and earthen dam across a small creek. **99,** 1016.

1900. \$9,000 allotted for torpedo storehouse. Work begun April 25, under contract, the U. S. furnishing sand, gravel, and cement. Building partly completed. **00,** 1033, 1044.

1901. Building for storehouse for torpedo material practically completed; material moved into it. **01,** 903.

Port Angeles, Wash. \$75,000 allotted for a reconnaissance to obtain data for developing a plan for defense. **98,** 811.

Part 27, FPXX. Supplies for Coast Defense.

1900. \$500 allotted for purchase of approved supplies for the Artillery garrisons. No requisitions received. **00,** 1086.

FOPR.¹ PORTO RICO FORTIFICATIONS.

(NOTE.—Reports on these works from 1903 to 1912 are of a general character only. See the first 15 pages of each annual report from 1903 to 1912.)

| Part. | Title. | Period. |
|-------|---|-----------|
| 1 | Engineers (Chief of Engineers; in charge) | 1901-1912 |
| 2 | Preservation and repair..... | 1901-1902 |
| 3 | Range and position finders | 1901-1902 |

¹ PR= Porto Rico office.

Part 1, FOPR. Engineers.

Chief of Engineers. R., 01, 36; 02, 37; 03, 8, 9, 14, 17; 04, 10, 12; 05, 12; 07, 12, 15.

Engineers in charge:
Capt. W. V. Judson, 1901.
Capt. C. A. F. Flagler, 1902.
Capt. F. R. Shunk, 1902.

Part 2, FOPR. Preservation and Repair.

1901. \$16,000 allotted. Slight repairs to masonry work, El Morro. 01, 909. \$3,500 allotted for civilian assistants to engineer officers; \$500 allotted or equipment of engineer troops. 01, 910. Road constr. and misc. work. 01, 910.

1902. \$500 allotted. El Morro and outworks. Sentry box repaired; storeroom refloored; other misc. work done. 02, 791. San Cristobal and outworks. Floors repaired; wire fence built; wooden br. rebuilt, etc. 02, 791.

Part 3, FOPR. Range and Position Finders.

1901. \$1,000 allotted. Plans prepared for conversion of an existing semaphore station on El Morro into a practice station for a type A finder. No work done. 01, 909.

1902. Work on above completed in February, 1902. 02, 791.

FOPC.¹

THE PANAMA CANAL.

See Part V of this index.

¹ PC=Panama.

FOHL.¹ HAWAIIAN ISLAND FORTIFICATIONS.

Chief of Engineers. R., 00, 6, 7; 01, 6; 02, 7; 03, 8, 9, 14, 17; 04, 10, 11, 12; 05, 12, 15; 06, 10, 13, 14; 07, 11, 12, 14, 15; 08, 16, 17, 19, 20; 09, 17, 18, 19; 10, 19, 20, 23; 11, 19; 12, 17.

See also pp. 1809-1815.

¹ HI=Hawaiian Islands office

FOPL.¹ PHILIPPINE ISLANDS FORTIFICATIONS.

Chief of Engineers. R., 02, 7; 03, 8, 9; 04, 10, 12; 05, 12, 14, 15; 06, 10, 11, 13, 14; 07, 11, 12, 14, 15; 08, 16, 17, 19, 20; 09, 17, 18, 19; 10, 19, 20, 23; 11, 19; 12, 17.

See also pp. 1809-1815.

¹ PI= Philippine Islands office.

PART III.

MISCELLANEOUS REPORTS.

GUIDE TO THE USE OF PART III.

1. ALPHABETICAL FINDING LIST AT THE BACK OF THIS INDEX.

(See also Abbreviations, page vii, Vol. II.)

There is a finding list at the back of this index, composed of the names of rivers, harbors, or works referred to in the abstracts throughout this index. The names are arranged alphabetically, with proper references following them to pages of this index.

The first page of the finding list presents information useful to the user of this index.

2. EXPLANATION OF SUBHEADS USED IN PART III.

The same general plan is followed as is outlined on page 21 of this index.

3. CONTENTS OF THE "MISCELLANEOUS" INDEX.

This Part III is intended as an index to—(a) matter which, in the reports of the Chief of Engineers, has been entitled "Miscellaneous;" that is, concerning public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors, and fortifications; (b) matter which, in the reports of the Chief of Engineers, relates in a general way to river and harbor improvement, fortifications, or other works.

A complete list of the abstracts arranged under the term "Miscellaneous" is printed on page 2039 of this index.

The list referred to forms a general outline of the duties devolving upon the Corps of Engineers.

CONTENTS.

MISCELLANEOUS INDEX.

REPORTS, THE CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

| Part. | Title. | Period. |
|-----------------------|--|-----------|
| APPROPRIATIONS. | | |
| Misc. 1 | Appropriations, estimates, and expenditures..... | 1789-1912 |
| CORPS OF ENGINEERS. | | |
| Misc. 2 | Boards—The Board of Engineers..... | 1912 |
| Misc. 3 | Chief of Engineers—List..... | 1775-1912 |
| Misc. 4 | Assistants to..... | 1866-1912 |
| Misc. 5 | Corps of Engineers..... | 1912 |
| Misc. 6 | Depots—Fort Leavenworth, Kans..... | 1903-1912 |
| Misc. 7 | Fort Mason, Cal..... | 1905-1912 |
| Misc. 8 | Fort Totten, N. Y..... | 1902 |
| Misc. 9 | Honolulu, Hawaii..... | 1911-1912 |
| Misc. 10 | Manila, P. I..... | 1910-1912 |
| Misc. 11 | New York City, N. Y..... | 1902-1904 |
| Misc. 12 | Vancouver Barracks, Wash..... | 1909-1912 |
| Misc. 13 | Washington Barracks, D. C..... | 1901-1912 |
| Misc. 14 | Divisions, Engineer..... | 1901-1912 |
| Misc. 15 | Field service (Military departments or divisions) (see Misc. 29, 85-96)—Arizona..... | 1872-1885 |
| Misc. 16 | California (Dept.)..... | 1883-1898 |
| Misc. 17 | California and Oregon (Dept.)..... | 1866 |
| Misc. 18 | Colorado (Dept.)..... | 1897-1900 |
| Misc. 19 | Columbia (Dept.)..... | 1880-1900 |
| Misc. 20 | Dakota (Dept.)..... | 1867-1887 |
| Misc. 21 | Missouri (Dept.)..... | 1872-1893 |
| Misc. 22 | Missouri (Div.)..... | 1874-1891 |
| Misc. 23 | New Mexico (Dept.)..... | 1879-1881 |
| Misc. 24 | Pacific (Div.)..... | 1867-1900 |
| Misc. 25 | Philippines (Div.)..... | 1899-1901 |
| Misc. 26 | Platte (Dept.)..... | 1867-1899 |
| Misc. 27 | Porto Rico (Dept.)..... | 1900 |
| Misc. 28 | Texas (Dept.)..... | 1877-1885 |
| Misc. 29 | Field service of officers with troops, etc..... | 1901-1903 |
| Misc. 30 | Officers, Corps of Engineers—Duties..... | 1901-1912 |
| Misc. 31 | Posts—Fort Foote, Md..... | 1901-1903 |
| Misc. 32 | Fort Totten, N. Y..... | 1866-1901 |
| Misc. 33 | Jefferson Barracks, Mo..... | 1866-1873 |
| Misc. 34 | Washington Barracks, D. C..... | 1902-1912 |
| Misc. 35 | Yerba Buena Island, Cal..... | 1868-1872 |
| Misc. 36 | Schools—Engineer School of Application (see Misc. 37)..... | 1901-1904 |
| Misc. 37 | United States Engineer School, Fort Totten (see Misc. 32, 36)..... | 1900-1901 |
| Misc. 38 | Troops, Engineer (see Misc. 29)..... | 1901-1912 |
| Misc. 39 | Equipment of, and civilian assistants..... | 1900-1904 |
| Misc. 40 | Equipment of..... | 1905-1912 |
| Misc. 41 | Civilian assistants..... | 1905-1912 |
| Misc. 42 | Noncommissioned officers..... | 1908-1912 |
| DISTRICT OF COLUMBIA. | | |
| Misc. 43 | Bridges—Aqueduct Bridge (see Misc. 64, 65)..... | 1889-1912 |
| Misc. 44 | Cabin John Bridge (see Misc. 64, 65)..... | 1911-1912 |
| Misc. 45 | Highway Bridge, Potomac River..... | 1901-1912 |
| Misc. 46 | Maintenance, etc..... | 1906-1912 |
| Misc. 47 | Memorial Bridge, Potomac River..... | 1898-1900 |
| Misc. 48 | Potomac River, South Capitol Street..... | 1896 |
| Misc. 49 | Potomac River, Eastern Branch..... | 1898 |
| Misc. 50 | Rock Creek..... | 1898 |
| Misc. 51 | Buildings—Extension beyond building line (see Misc. 65)..... | 1900-1912 |
| Misc. 52 | Engineer School..... | 1903-1912 |
| Misc. 53 | Government Printing Office..... | 1899-1905 |
| Misc. 54 | Lincoln House, etc. (see Misc. 65)..... | 1901-1912 |
| Misc. 55 | War Collège..... | 1902-1911 |
| Misc. 56 | White House (Executive Mansion)..... | 1912 |
| Misc. 57 | Flats of Anacostia River (see Misc. 61, 65)..... | 1875-1912 |
| Misc. 58 | Lots, sale of (see Misc. 65)..... | 1881 |

| Part | Title. | Period. |
|---|--|-----------|
| DISTRICT OF COLUMBIA—continued. | | |
| Misc. 59 | Memorials—McMillan Fountain (see Misc. 65, 70) | 1910-1912 |
| Misc. 60 | Monuments—Washington Monument (see Misc. 65, 70) | 1912 |
| Misc. 61 | Parks (see Misc. 65) | 1900-1912 |
| Misc. 62 | Lighting (see Misc. 65) | 1900-1912 |
| Misc. 63 | Potomac Park (see Misc. 65) | 1908-1912 |
| Misc. 64 | Potomac River, fishways (see Misc. 65) | 1882-1895 |
| Misc. 65 | Public Buildings and Grounds (see Misc. 51, 60, 66) | 1912 |
| Misc. 66 | Reservations—Occupancy (see Misc. 65) | 1900-1912 |
| Misc. 67 | In violation of law | 1900-1912 |
| Misc. 68 | Roads—Aqueduct Bridge to Mount Vernon | 1886-1900 |
| Misc. 69 | Conduit Road, reconstruction | 1868-1912 |
| Misc. 70 | Statues (see Misc. 59, 60, 65) | 1900-1912 |
| Misc. 71 | Telegraphs, etc.—Putting wires underground | 1888 |
| Misc. 72 | Departmental lines | 1898-1912 |
| Misc. 73 | Water supply—Washington Aqueduct | 1850-1912 |
| Misc. 74 | Lining tunnel | 1912 |
| Misc. 75 | Filtration plant | 1912 |
| Misc. 76 | 48-inch main | 1889-1892 |
| Misc. 77 | Increasing | 1882-1912 |
| Misc. 78 | Investigation of filtration methods (see Misc. 75, 80) | 1898-1900 |
| Misc. 79 | Metering, United States buildings and grounds | 1910-1912 |
| Misc. 80 | Preliminary treatment plant | 1908-1912 |
| Misc. 81 | Reservoirs—Improving Dalecarlia Receiving Reservoir | 1893-1896 |
| Misc. 82 | Remodeling Georgetown Reservoir | 1908-1912 |
| Misc. 83 | Parking grounds, McMillan Park Reservoir | 1908-1912 |
| Misc. 84 | Wharves, etc. (see Misc. 65) | 1900-1912 |
| EXPLORATIONS, RECONNOISSANCES, MAPPINGS, ETC. | | |
| Misc. 85 | Explorations and reconnoissances (see Misc. 15-28) | 1867-1900 |
| Misc. 86 | Explorations, reconnoissances, and work in the field (see Misc. 15-28) | 1901-1912 |
| Misc. 87 | Fortieth parallel—Geological explorations | 1867-1881 |
| Misc. 88 | Irrigation (arid lands, California, etc.) | 1873-1912 |
| Misc. 89 | Lava beds, Modoc campaign | 1873 |
| Misc. 90 | Maumee Valley | 1889 |
| Misc. 91 | Military maps, geological maps, etc. | 1858-1912 |
| Misc. 92 | One hundredth meridian | 1871-1885 |
| Misc. 93 | Stones, tests of | 1864 |
| Misc. 94 | Sutro Tunnel | 1871 |
| Misc. 95 | Utah Mountains | 1872 |
| Misc. 96 | Yukon River (Raymond exploration) | 1871 |
| FORTIFICATIONS. | | |
| Misc. 97 | United States, etc. (see page 1793 of this index) | 1912 |
| Misc. 98 | Panama Canal (see page 2357 of this index) | 1912 |
| LAWS. | | |
| Misc. 99 | Laws affecting the Corps of Engineers | 1873-1912 |
| MONUMENTS. | | |
| Misc. 100 | Fort Recovery | 1911-1912 |
| Misc. 101 | Frederick the Great | 1904-1905 |
| Misc. 102 | Generals Nash and Davidson | 1903-1906 |
| Misc. 103 | Guilford Courthouse | 1911-1912 |
| Misc. 104 | Kings Mountain | 1906-1912 |
| Misc. 105 | Monterey | 1908-1910 |
| Misc. 106 | New Orleans | 1907-1909 |
| Misc. 107 | Point Pleasant | 1908-1910 |
| Misc. 108 | Sergeant Floyd | 1899-1901 |
| Misc. 109 | General Shields | 1910-1911 |
| Misc. 110 | Valley Forge | 1910-1912 |
| NATIONAL PARKS. | | |
| Misc. 111 | Crater Lake, Oreg. | 1910-1912 |
| Misc. 112 | Yellowstone | 1883-1912 |

| Part. | Title. | Period. |
|---------------------|--|-----------|
| RIVERS AND HARBORS. | | |
| Misc. 113 | Appropriations—Uniformity (see Misc. 1)..... | 1909-1911 |
| Misc. 114 | Assistants (see p. 21 of this index)..... | 1866-1912 |
| Misc. 115 | Board of Engineers for Rivers and Harbors..... | 1902-1912 |
| Misc. 116 | Bridges—Drawbridges—Rules and regulations (see p. 2137 of this index)..... | |
| Misc. 117 | Obstructing navigation (see p. 2137 of this index)..... | |
| Misc. 118 | Over navigable waters (see p. 2137 of this index)..... | |
| Misc. 119 | Canals (see p. 2107 of this index)..... | |
| Misc. 120 | Chesapeake and Delaware Bays (see p. 2106 of this index)..... | 1906-1912 |
| Misc. 121 | Chicago Drainage Canal (see p. 2106 of this index)..... | 1899-1903 |
| Misc. 122 | Bishops Canal Lock—Examination..... | 1869 |
| Misc. 123 | Rules for navigation..... | 1894-1912 |
| Misc. 124 | Commissions—California Débris (see p. 2108 of this index)..... | 1893-1912 |
| Misc. 125 | Mississippi River (see p. 2108 of this index)..... | 1879-1912 |
| Misc. 126 | Missouri River (see p. 2108 of this index)..... | 1884-1902 |
| Misc. 127 | Dams, dolphins, weirs, etc., in navigable waters..... | 1912 |
| Misc. 128 | Funds contributed from non-Federal sources..... | 1910-1912 |
| Misc. 129 | Harbor lines (see p. 2137 of this index)..... | |
| Misc. 130 | Abrogation of..... | 1911-1912 |
| Misc. 131 | Private river and harbor works (non-United States)..... | 1912 |
| Misc. 132 | Logs—Rules and regulations governing floating of..... | 1900-1912 |
| Misc. 133 | Missouri River—Six-foot channel..... | 1910-1911 |
| Misc. 134 | Navigation, Permanent International Congress of..... | 1902-1912 |
| Misc. 135 | New York Harbor—Supervision of channels..... | 1888-1912 |
| Misc. 136 | Niagara Falls—Control, etc..... | 1906-1912 |
| Misc. 137 | Ohio River—Canalization..... | 1910-1912 |
| Misc. 138 | Plant, floating..... | 1909-1912 |
| Misc. 139 | Porto Rico—Structures in waters of..... | 1906-1912 |
| Misc. 140 | Water power (see Misc. 127)..... | |
| Misc. 141 | Michigan-Lake Superior Power Co..... | 1902-1903 |
| Misc. 142 | Waterways—Intracoastal..... | 1909-1912 |
| Misc. 143 | Works, river and harbor—Deterioration..... | 1899-1900 |
| Misc. 144 | Occupied by private parties..... | 1888-1900 |
| Misc. 145 | Wrecks (see p. 2137 of this index)..... | |
| Misc. 146 | Steamship Cristobal Colon, Porto Rico..... | 1901 |
| Misc. 147 | Steamship Maine, Habana..... | 1911-1912 |
| ROADS. | | |
| Misc. 148 | Alaska..... | 1904-1905 |
| Misc. 149 | Mount Rainier National Park..... | 1903-1912 |
| Misc. 150 | Fort Washakie to Buffalo Fork, Wyo..... | 1899-1903 |
| SURVEYS. | | |
| Misc. 151 | Erie Canal—Preservation of bench marks..... | 1897-1900 |
| Misc. 152 | Frontiers—Mexican..... | 1881-1882 |
| Misc. 153 | Geological and geographical surveys of the War Department (see Misc. 85-96)..... | 1878 |
| Misc. 154 | Instruments issued, mappings, etc. (see Misc. 85-96)..... | |
| Misc. 155 | Lake Erie—Shoals in (see Misc. 161)..... | 1892-1897 |
| Misc. 156 | Water-level observations (see Misc. 161)..... | 1890 |
| Misc. 157 | Lake Superior—Magnetic survey..... | 1902-1910 |
| Misc. 158 | Reef near Gooseberry River..... | 1890 |
| Misc. 159 | Longitude, etc.—Detroit, Mich., and Fort Leavenworth, Kans..... | 1872 |
| Misc. 160 | Colorado, Kansas, and California..... | 1873 |
| Misc. 161 | Northern and northwestern lakes—Charts, bulletins, etc..... | 1866-1912 |
| Misc. 162 | Surveys, etc..... | 1866-1912 |
| Misc. 163 | Gauging outlets..... | 1870-1893 |
| Misc. 164 | Valley of—Outflow, rainfall, and evaporation..... | 1903 |
| Misc. 165 | Water levels..... | 1888-1912 |
| Misc. 166 | Lake Michigan—Reef north of Manitowoc, Wis..... | 1903 |
| Misc. 167 | Reef near Wind Point, Wis..... | 1903 |
| UNITED STATES ARMY. | | |
| Misc. 168 | Equipment of Coast Artillery, armories, etc..... | 1911-1912 |
| Misc. 169 | Equipment of officers' schools, military posts, etc..... | 1912 |
| Misc. 170 | Military structures, Philippine Islands..... | 1912 |
| Misc. 171 | Reservations—Enlargement of Governors Island (N. Y.) Harbor..... | 1901-1912 |

MISC. 1. APPROPRIATIONS, ESTIMATES,¹ AND EXPENDITURES.

Each annual report of the Chief of Engineers refers to the appropriations made by Congress for the works referred to in the reports.

See each abstract in this index.

See summaries on pages 2279 of this index.

The "Laws affecting the Corps of Engineers" printed in each annual report also name the appropriations made for each work or locality named in those laws. See "Laws affecting the Corps of Engineers," on page 2329 of this index for the page references.

Additional details concerning appropriations are contained in H. D. 421, 57th Congress, 2d session, and also in Treasury Document 373, 1882 (now out of print). These two latter documents have been

used to make a complete statement of the money devoted to any work named in the reports of the Chief of Engineers, particularly for the period preceding 1866.

Estimates are submitted in several ways. For example, each report of a survey usually contains an estimate of the cost of a proposed work. Each annual report also contains estimates of funds required for the work of subsequent periods, in the case of almost every work named in the report, if there is need of further appropriations.

The reports are, in the main, accounts relating to the expenditures of whatever funds have been appropriated.

Estimates of appropriations required (1901-1912).

Fortifications. 01, 37; 02, 38; 03, 17; 04, 12; 05, 15; 06, 13; 07, 15; 08, 20; 09, 23; 10, 24; 11, 19, 24; 12, 17, 22.

U. S. Engineer depots. 01, 42; 02, 45; 03, 23; 04, 17; 05, 18; 06, 16; 07, 17; 08, 23; 09, 25; 10, 27; 11, 27; 12, 25.

U. S. Engineer School. 01, 42.

Engineer equipment of troops. 11, 29; 12, 26.

Rivers and Harbors. 01, 118; 02, 61; 03, 36; 04, 18; 05, 20; 06, 17; 07, 20; 08, 25; 09, 29; 10, 32; 11, 33; 12, 31.

Philippine Islands.—Contingencies, Engineer Department, Philippine Islands.

In the prosecution of work of great importance in the Philippine Islands in remote and almost inaccessible localities the operations of the Engineer Department require funds of wide applicability and limited restrictions as to expenditure. Owing to the circumstances under which the work

must be performed an appropriation of this character has been found essential to its satisfactory prosecution. Appropriations of \$5,000 each for this purpose have been made for the fiscal years 1911, 1912, and 1913. 09, 27; 10, 31; 11, 30; 12, 27.

MISC. 2. BOARDS—THE BOARD OF ENGINEERS.

This is a board composed mainly of Engineer officers, acting in an advisory capacity to the Chief of Engineers in important questions of military engineering, fortifications, and river and harbor works related thereto.

Additions to the membership of the board have been made at times from various departments of

the Army for the consideration of questions relating to the defenses of the coasts of the United States.

See list of members, "Fortifications" index, page 1799 of this book.

For references to reports, see page 1799 of this index.

¹ Special estimates for maintenance of R. and H. work, etc., for 1909, H. D. 1462, 60th, 2d.

MISC. 3. CHIEF OF ENGINEERS—CHIEFS OF THE CORPS OF ENGINEERS.¹

| Name. | Rank. | Title. | Date of appointment. |
|----------------------------|-------------------------|---|----------------------|
| Richard Gridley..... | Colonel..... | Chief Engineer..... | June —, 1775 |
| Rufus Putnam..... | do..... | do..... | Aug. 5, 1776 |
| Lewis du Portail..... | do..... | do..... | July 22, 1777 |
| | Brigadier general..... | do..... | Nov. 17, 1777 |
| | Major general..... | do..... | Nov. 16, 1781 |
| Stephen Rochefontaine..... | Lieutenant colonel..... | Commander, Corps of Artillerists and Engineers. | Feb. 26, 1795 |
| Henry Burbeck..... | do..... | Commander, First Regiment Corps Artillerists and Engineers. | May 7, 1798 |
| Jonathan Williams..... | do..... | Principal Engineer..... | July 8, 1802 |
| | do..... | Chief Engineer..... | Apr. 19, 1805 |
| | Colonel..... | do..... | Feb. 23, 1808 |
| Joseph G. Swift..... | do..... | do..... | July 31, 1812 |
| Walker K. Armistead..... | do..... | do..... | Nov. 12, 1818 |
| Alexander Macomb..... | do..... | do..... | June 1, 1821 |
| Charles Gratiot..... | do..... | do..... | May 28, 1828 |
| Joseph G. Totten..... | do..... | do..... | Dec. 7, 1838 |
| J. J. Abert..... | do..... | Chief, Topographical Engineer..... | July 7, 1838 |
| Stephen H. Long..... | do..... | do..... | Sept. 9, 1861 |
| Joseph G. Totten..... | Brigadier general..... | Chief Engineer..... | Mar. 3, 1868 |
| Richard Delafield..... | do..... | do..... | Apr. 22, 1864 |
| | do..... | Chief of Engineers..... | July 13, 1866 |
| Andrew A. Humphreys..... | do..... | do..... | Aug. 8, 1866 |
| Horatio G. Wright..... | do..... | do..... | June 30, 1879 |
| John Newton..... | do..... | do..... | Mar. 6, 1884 |
| James C. Duane..... | do..... | do..... | Oct. 11, 1886 |
| Thomas L. Casey..... | do..... | do..... | July 6, 1888 |
| William F. Craighill..... | do..... | do..... | May 10, 1895 |
| John M. Wilson..... | do..... | do..... | Feb. 1, 1897 |
| Henry M. Robert..... | do..... | do..... | Apr. 30, 1901 |
| John W. Barlow..... | do..... | do..... | May 2, 1901 |
| George L. Gillespie..... | do..... | do..... | May 3, 1901 |
| Alexander Mackenzie..... | do..... | do..... | Jan. 23, 1904 |
| W. L. Marshall..... | do..... | do..... | July 2, 1908 |
| W. H. Bixby..... | do..... | do..... | June 12, 1910 |

¹ See Table of reports on page viii, Vol. II, of this index.

MISC. 4. CHIEF OF ENGINEERS—OFFICERS ON DUTY IN THE OFFICE OF THE CHIEF OF ENGINEERS.

| | |
|---|---------------------------------|
| Maj. Q. A. Gilmore, 1866. | Lt. E. Jadwin, 1897-98. |
| Lt. Col. H. G. Wright, 1866-67. | Maj. J. L. Lusk, 1898-03. |
| Lt. Col. J. D. Kurtz, 1866-70. | Capt. E. Burr, 1898-99. |
| Lt. Col. I. C. Woodruff, 1866-70. | Capt. W. L. Fisk, 1899. |
| Maj. W. P. Craighill, 1866-70. | Capt. J. C. Sanford, 1900. |
| Capt. W. E. Merrill, 1866-67. | Lt. C. S. Bromwell, 1900-02. |
| Col. J. G. Parke, 1868-87. | Lt. S. Cosby, 1900. |
| Lt. Col. T. L. Casey, 1868-78. | Maj. F. V. Abbot, 1900-10. |
| Maj. J. B. Wheeler, 1870-72. | Lt. Col. W. R. Livermore, 1902. |
| Lt. Col. J. G. Foster, 1866-67 and 1872-74. | Capt. M. M. Patrick, 1901-03. |
| Maj. G. H. Elliot, 1874-82. | Maj. H. F. Hodges, 1902-07. |
| Maj. W. J. Twining, 1877-78. | Capt. W. V. Judson, 1903-04. |
| Maj. H. M. Adams, 1879-95. | Capt. C. W. Kutz, 1903-06. |
| Lt. Col. J. M. Wilson, 1882-86. | Capt. W. J. Barden, 1906-09. |
| Maj. C. W. Raymond, 1886-88. | Col. S. S. Leach, 1908-09. |
| Maj. J. C. Post, 1887-89. | Maj. J. B. Cavanaugh, 1907-11. |
| Maj. T. Turtle, 1887-94. | Lt. R. R. Ralston, 1908. |
| Capt. C. B. Sears, 1888-90. | Maj. W. B. Ladue, 1909. |
| Maj. J. G. D. Knight, 1890-95. | Capt. E. N. Johnston, 1908. |
| Col. A. Mackenzie, 1895-03. | 1st Lt. R. C. Moore, 1908-10. |
| Capt. G. W. Goethals, 1894-98. | Lt. Col. E. Burr, 1910. |
| Capt. W. M. Black, 1895-97. | 1st Lt. C. K. Rockwell, 1910. |
| Capt. J. E. Kuhn, 1896-1900. | Lt. Col. H. Taylor, 1911. |
| Lt. C. Harding, 1896. | Maj. E. Jadwin, 1911. |
| Lt. J. S. Sewell, 1898. | |

MISC. 5. ENGINEERS, CORPS OF. (1900-1912.)

(For information on the same subject for preceding years, see each annual report at the beginning.)

1900-01. Holding commissions, 131. Five officers separated from corps: Brig. Gen. John M. Wilson; retired; Brig. Gen. Henry M. Robert, retired; Brig. Gen. John W. Barlow, retired, 1st Lt. Louis C. Wolf, retired; 2d Lt. W. H. Lee, killed. Added, by promotion of graduates from U. S. Military Academy, 10 second lieutenants. By act Feb. 2, 1901, corps consists of 160 officers and 3 battalions of 4 companies each of enlisted men. Actual strength: Peace footing, 100 men to company; war footing, 164 men. 32 officers and 8 companies of battalion on duty in Philippines, China, Porto Rico, and Alaska. Recommended that increase be made in number of field officers to reestablish ratio prevailing before passage of act Feb. 2, 1901. Table of distribution of officers. **01, 3, 4.**

1901-02. Holding commissions, 150. Separated from corps, 1: Capt. Jas. J. Meyler, died. Added to corps, by transfer from the line, 4 first lieutenants, 9 second lieutenants; by promotion of U. S. Military Academy graduates, 7 second lieutenants, 5 promotions to first lieutenants. Table of distribution. **02, 3.**

1902-03. Holding commissions, 153. Lost 7 officers: 2d Lt. Francis F. Longley, resigned; Capt. R. N. McGregor, died; Lt. Col. Andrew N. Damrell, retired; Col. S. M. Mansfield, Col. Jared A. Smith, and Col. Peter C. Haines, appointed brigadier generals; and 1st Lt. Edmund M. Rhett, resigned. Added, by promotion from U. S. Military Academy graduates, 10 second lieutenants. Table of distribution. At present it is necessary to so combine works and districts as to throw upon many officers such a number and variety of duties as to make it difficult at times for them to devote to the separate districts and the various items of work the proper detailed consideration. **03, 3.**

1903-04. Holding commissions, 159. Lost 4 officers: Brig. Gen. G. L. Gillespie, commissioned a major general, U. S. Army; Lt. Col. Chas. J. Allen, commissioned a brigadier general, U. S. Army, Col. Chas. W. Raymond, retired; 1st Lt. Nathaniel E. Bower, killed. Added, by promotion of graduates from U. S. Military Academy, 10 second lieutenants. Table of distribution. **04, 3.**

1904-05. Holding commissions, 163. Lost 4 officers: Maj. Theo. A. Bingham, commissioned a brigadier general, U. S. Army; Col. Alex. M. Miller, died; Col. D. P. Heap, retired; Col. W. A. Jones, retired. Added, by promotion from U. S. Military Academy, 13 second lieutenants. Table of distribution. **05, 3.**

1905-06. Holding commissions, 170. Lost 7 officers: Col. Thos. H. Handbury, retired; Maj. Eugene W. Van C. Lucas, resigned; Maj. Cassius E. Gillette, resigned; Lt. Col. C. F. Powell, commissioned a brigadier general, U. S. Army; Col.

Chas. R. Suter, retired; 1st Lt. Ferd. William died; Col. O. H. Ernst, retired. Added, by promotion from U. S. Military Academy, 9 second lieutenants. Table of distribution. **06, 3.**

1906-07. Holding commissions, 171. Lost officers: Col. Wm. S. Stanton, retired; Capt. R. Johnston, resigned; Lt. Col. Jas. L. Lusk, died; Col. Wm. R. Livermore, retired; Col. W. I. Heuer, retired; Lt. Col. Geo. McC. Derley, retired; Col. Jas. B. Quinn, retired. Added, by promotion of graduates from U. S. Military Academy, 8 second lieutenants. Selection of Lt. Col. Geo. W. Goethals, Maj. David DuB. Gaillard, and Maj. W. L. Sibert as Isthmian Canal Commissioners. Also Maj. Edgar Jadwin in charge of a division of canal. Table of distribution. **07, 3.**

1907-08. Holding commissions, 172. Lost officers: Col. Amos Stickney, retired; Col. Garret J. Lydecker, retired; Maj. John S. Sewell, resigned; Col. Chas. E. L. B. Davis, commissioned a brigadier general; Col. Jos. H. Willard, retired; Col. H. K. Adams, retired; Brig. Gen. A. Mackenzie, retired; Col. Clinton B. Sears, retired. Added, by promotion of U. S. Military Academy graduates, second lieutenants. Table of distribution. Increasing amount of work necessitates more officers to fill duties; 60 are recommended. **08, 3.**

1908-09. Holding commissions, 183. Lost officers: Col. T. W. Symons, retired; Col. R. I. Hoxie, retired; Col. M. B. Adams and Col. E. B. Ruffner, retired. Added, by promotion from U. S. Military Academy, 15 second lieutenants. Table of distribution. **09, 3.**

1909-10. Holding commissions, 186. Lost officers: Lt. Col. H. M. Chittenden, commissioned a brigadier general; 2d Lt. John A. Holabird, resigned; Col. John G. D. Knight, commissioned a brigadier general; Col. Smith S. Leach, died; Col. D. W. Lockwood, retired; Brig. Gen. W. L. Marshall, retired; Capt. John H. Poole, resigned; 1st Lt. Carlos J. Stolbrand, dismissed. Added by promotion from U. S. Military Academy, 1 second lieutenants. Table of distribution. **10, 3.**

1910-11. Holding commissions, 190. Lost officer: 1st Lt. Frederic E. Humphreys. Added by promotion from U. S. Military Academy, second lieutenants. Table of distribution. Act of Feb. 27, 1911, an increase of 5 colonels, 6 lieutenant colonels, 19 majors, 17 captains, and 1 first lieutenants. **11, 3.**

1911-12. Holding commissions, 194. Lost officers: Col. Walter L. Fisk, retired; Col. Thos. L. Casey, retired; Maj. Edw. R. Stuart, appointed professor of drawing, U. S. Military Academy. Added, 1 probational second lieutenant, from civil life, and 6 second lieutenants from U. S. Military Academy by promotion. Table of distribution. **12, 3.**

MISC. 6. DEPOTS—ENGINEER DEPOT, FORT LEAVENWORTH, KANS.

In charge: Maj. S. S. Leach, 03, 04. Capt. H. Deakyne, 04, 05. Maj. T. H. Rees, 05, 06; 07, 08. Maj. C. A. F. Flagler, 09, 10. Maj. M. L. Walker, 11, 26.

1902-03. Additional pontoon material purchased, and repairs to that on hand. Purchase of

various supplies and equipment for the Engineer shop of instruction. 03, 21, 703; 04, 15, 773; 05, 17, 775; 06, 14, 845; 07, 16, 873; 08, 21, 917; 09, 24, 961; 10, 25, 1075; 11, 26, 1137; 12, 24.

MISC. 7. DEPOTS—ENGINEER DEPOT, FORT MASON.

1905-06. At this depot the reserve and advance guard pontoon trains kept in repair and the

tool equipment of, kept up to date. 06, 15, 847; 07, 17, 875; 08, 22.

MISC. 8. DEPOTS—ENGINEER DEPOT, FORT TOTTEN, WILLETS POINT (1900-1902).

(For similar information for preceding years, see Misc. 32, p. 2053 of this index.)

1900-01. Materials for repairs and instruction issued. Additions made to pontoon and bridge equipage, repairs to old pontoon wagons. Engineering Field Manual in preparation. Tools, etc., purchased and issued for troops on insular work. Material for road constr. purchased. Over 1,000,000

pounds submarine mining material issued. Torpedo manuals called in with view to their transfer to Artillery Corps. 01, 41, 947.

1901-02. Transferred to Washington Barracks, D. C. 02, 41.

MISC. 9. DEPOTS—ENGINEER DEPOT, HONOLULU.

This depot assembles and issues property and materials for the military survey of the island of Oahu, cares for property in store, makes such minor repairs to instruments as can be made locally,

and obtains and issues such engineer supplies as are required by the Engineer troops stationed at Honolulu. 11, 26; 12, 4.

MISC. 10. DEPOTS—ENGINEER DEPOT, MANILA, P. I.

1909. This depot is the repository of two divisions of the advance guard ponton equipage, and for miscellaneous tools, property, and supplies required for issue and for reserve equipment in the

Philippine Division. The depot also makes all ordinary repairs to instruments used in the military surveys in the Philippine Division. 10, 26, 1079; 11, 26, 1141; 12, 24.

MISC. 11. DEPOTS — ENGINEER DEPOT, NEW YORK CITY.

In charge: Lt. Edw. H. Schulz.

1902-03. Depot at Willets Point, N. Y., closed June 30, 1902, and transferred to Army Building, New York City. All property disposed of by transfer and condemnation. Purchases of Engineering supplies; instruments purchased and repaired. 03, 21, 705.

1903-04. All property and records transferred to the Engineer Depot, Washington Barracks, D. C., and this depo. discontinued on June 30, 04, 15, 775.

MISC. 12. DEPOTS — ENGINEER DEPOT, VANCOUVER BARRACKS.

1908-10. A ponton train consisting of the principal items of one division advance, and one division reserve, equipage transferred from Engineer depot at Fort Mason, Cal., to this depot. Overhauling done. 09, 24; 10, 26, 1077.

1910-11. Two Artillery gun sheds turned over to the depot for storage of equipment. Materials, tools, and supplies purchased and issued. 11, 26; 12, 24.

MISC. 13. DEPOTS — ENGINEER DEPOT, WASHINGTON BARRACKS.

1901-02. General property transferred from Willets Point to Washington Barracks. Purchase and issuance of material as required. 02, 41, 807.

1902-03. No suitable building for an Engineer storehouse available. Many minor repairs and alterations made to old buildings. 03, 19, 694.

1903-04. Routine work of repairs, etc. Minor repairs made to a number of Engineering models, and some sent to Louisiana Purchase Exposition at St. Louis, Mo. Details of work at depot given. 04, 13, 760.

1904-05. Purchase and issue to the companies, troops, batteries, and posts of reconnaissance instruments prescribed in G. O. No. 24, W. D., Feb. 14, 1905. 05, 15, 757.

1905-06. New storehouse practically completed; used for storage of depot property 06, 14, 837.

1906-09. New depot storehouse completed; new building for shops should be provided. Est. \$12,500 for constr. of shed for protection of ponton wagons. 07, 16, 867; 08, 21, 909; 09, 23, 957.

1909-10. Provision made for constr. shed. An additional shed needed. Large number of instruments turned into depot, and large number of new ones purchased. 10, 25, 1067; 11, 25, 1127; 12, 23.

MISC. 14. ENGINEERS, CORPS OF — ENGINEER DIVISIONS (1901-12).

(For similar information for preceding years, see annual reports.)

Northeast Division:

Col. G. L. Gillespie, 1901.
Col. C. R. Suter, 1901, 04-06.
Col. Amos Stickney, 1906-07.
Col. John G. D. Knight, 1907-10.
Col. Wm. M. Black, 1910-12.

Eastern Division:

Col. Amos Stickney, 1904-07.
Col. D. W. Lockwood, 1907-10.
Col. W. T. Russell, 1910-12.

Chesapeake Division:

Col. W. A. Jones, 1904-05.

Southeast Division:

Col. P. C. Hains, 1903.
Col. J. B. Quinn, 1903-06.
Col. Amos Stickney, 1906.
Lt. Col. Dan C. Kingman, 1906-07, 1909-10; Col., 1911-12.

Gulf Division:

Lt. Col. H. M. Adams, 1904-05.
Lt. Col. Clinton B. Sears, 1905-07.
Col. E. H. Ruffner, 1907-09.
Lt. Col. L. H. Beach, 1909-12.

Central Division:

Lt. Col. T. H. Handbury, 1902.
Col. G. J. Lydecker, 1903-08.
Col. C. E. L. B. Davis, 1908.
Col. W. T. Russell, 1908-10.
Lt. Col. J. G. Warren, 1910.
Lt. Col. H. C. Newcomer, 1911-12.

Lakes Division:

Lt. Col. W. L. Fisk, 1903-09; Col., 1910-11.
Col. C. McD. Townsend, 1911-12.

Northwest Division:

Col. J. W. Barlow, 1901.
Col. S. M. Mansfield, 1901.
Lt. Col. O. H. Ernst, 1901-05.
Lt. Col. W. H. Bixby, 1905-08.

Southwest Division:

Col. H. M. Robert, 1901.
Col. A. Stickney, 1901.

Western Division:

Col. A. Stickney.
Col. W. H. Bixby, 1908-11.
Lt. Col. C. L. Potter, 1911-12.

North Pacific Division:

Lt. Col. W. H. Heuer, 1901-04; Col., 1905-06.
Lt. Col. S. W. Roessler, 1907-08.
Lt. Col. John Biddle, 1909-12.
Lt. Col. Thos. H. Rees 1912.

Pacific Division:

Col. S. M. Mansfield, 1900.

Col. Jared A. Smith, 1900-01.

Col. D. P. Heap, 1901-05.

Col. T. H. Handbury, 1905-08.

Col. W. H. Heuer, 1906-07.

Lt. Col. John Biddle, 1907-10; Col., 1911-12.

Lt. Col. Thos. H. Rees, 1912.

MISC. 15. FIELD SERVICE—ARIZONA.

ENGINEERS.

Lt. G. M. Wheeler. R., 72, 1124 (Arizona, Nevada, and Utah).

Lt. E. D. Thomas, 5th Cav. R., 77, 1449.

Lt. T. A. Toney, 6th Cav. R., 78, 1881.

Lt. C. F. Palfrey. R., 80, 2547; 81, 2859; 82, 2847.

Lt. G. J. Fiebeger. R., 83, 2404.

Lt. T. A. Bingham. R., 84, 2399; 85, 2531.

MISC. 16. FIELD SERVICE—CALIFORNIA.

ENGINEERS.

Maj. W. A. Jones. R., 83, 2402; 84, 2392.

Lt. T. L. Casey. R., 85, 2529; 87, 3147.

Lt. C. G. Lyman, 2d Cav., A. D. C. R., 92 3459; 93, 4403; 94, 3453.

Lt. J. L. Sehon, 20th Inf. R., 95, 4254.

Lt. J. F. Reynolds Landis, 1st Cav., A. D. C. R., 95, 4256; 96, 4076.

Lt. J. D. Miley 5th Art. R. 97, 4133; 98, 3783.

MISC. 17. FIELD SERVICE—CALIFORNIA AND OREGON.

ENGINEERS.

Chief of Engineers. R., 66, ii, 22.

MISC. 18. FIELD SERVICE—COLORADO.

ENGINEERS.

Chief of Engineers. R., 97, 547; 99, 639; 00, 718.

In charge:

Lt. J. L. Sehon, 20th Inf. R., 97, 4134.

Lt. J. R. Bennet, 16th Inf. R., 99, 3880; (Capt.) 00, 5451.

MISC. 19. FIELD SERVICE—COLUMBIA.

ENGINEERS.

Chief of Engineers. R., 80, 249; 81, 343; 82, 329; 83, 344; 84, 349; 85, 345; 88, 317; 89, 386; 90, 355; 91, 450; 92, 424; 93, 488; 94, 443; 95 497; 96, 442; 97, 547; 98, 552; 99, 639; 00, 718.

In charge:

Lt. T. W. Symons. R., 80, 2549; 81, 2863, 82, 2851.

Lt. G. W. Goethals. R., 83, 2407; 84, 2403.

Lt. W. C. Langfitt. R., 87, 3151; 88, 2816.

Lt. L. A. Lovering, 4th Inf. R., 89, 2878.

Maj. G. J. Lydecker. R., 90, 3599.

Capt. C. H. Clark, Ord. Dept. R., 91, 3945.

Maj. T. McCrea, 5th Art. R., 92, 3458; 93, 4402; 94, 3452.

Lt. J. L. Sehon, 20th Inf. R., 95, 4254; 96, 4074.

Maj. T. H. Barry. R., 97, 4132.

Lt. J. B. Bennet, 7th Inf. R., 98, 3784.

Capt. H. P. McCain, 14th Inf. R., 99, 3879; 00, 5450.

Assistants:

A. Downing. R., 83, 2410.

Lt. W. C. Brown, 1st Cav. R., 81, 2873.

MISC. 20. FIELD SERVICE—DAKOTA.**ENGINEERS.**

Chief of Engineers. **R.**, 67, 53; 74, 123; 75, 131; 76, 123; 77, 130; 78, 147; 79, 189; 80, 247; 81, 340; 82, 328; 83, 343; 84, 348; 85, 377; 87, 345.

In charge:

Capt. W. Ludlow. **R.**, 74, ii, 626.

Reconnaissance, Black Hills. 74, ii, 628; 75, ii, 1113; 76, iii, 569.

Reconnaissance, Fort Carroll, Mont., to Yellowstone National Park. 76, iii, 570.

Lt. E. Maguire. **R.** (Custer massacre), 76, iii, 699; 77, ii, 1337, 1338 (expedition against hostile Sioux, 1876); 78, iii, 1671; 79, 2359; 80, 2509; 81, 2843; (Capt.) 82, 2843.

Lt. H. S. Taber. **R.**, 83, 2392; 84, 2387.

Lt. J. Biddle. **R.**, 85, 2527; 87, 3149

Assistants:

Prof. N. H. Winchell. Geologist and botanist. **R.**, 74, ii, 630; 75, ii, 1131, 1172.

G. B. Grinnell. Paleontology and zoology. 74, ii, 632, 633; 75, ii, 1177; 76, iii, 634, 657.

Prof. J. M. Coulter. **R.**, 75, ii, 1173.

R. P. Whitfield. New fossils. **R.**, 75, ii, 120; 76, iii, 694.

Lt. R. E. Thompson, 6th Inf. **R.**, 76, iii, 631.

E. S. Dana. Geological report. 76, iii, 657.

Lt. E. J. McClernand, 2d Cav. **R.**, 77, ii, 1361

Lt. G. D. Wallace, 7th Cav. 77, ii, 1376 (Yellow stone expedition).

Sergt. J. E. Wilson. **R.**, 77, ii, 1373 (Yellow stone expedition); 80, 2530.

Lt. L. R. Hare, 7th Cav. **R.**, 78, iii, 1672.

Asst. Surg. V. Havard, U. S. A. Botany. **R.** 78, iii, 1681; 80, 2513.

Lt. O. F. Long, 5th Inf. **R.**, 78, iii, 1688 (journal of marches under Col. N. A. Miller).

Topographical Asst. J. J. Durage. Survey, military reservation, Fort Keogh. **R.**, 79, iii, 2363.

Lt. W. Hoffman, 11th Cav. Reconnaissance, Moreau, or Owl, River, Dakota. **R.**, 79, iii, 2367.

A. A. Surg. C. E. McChesney. Mammals and birds. **R.**, 79, iii, 2371.

W. W. Payne. Astronomy. **R.**, 81, 2844.

MISC. 21. FIELD SERVICE—MISSOURI.**ENGINEERS.****In charge:**

Lt. E. H. Ruffner. **R.**, 72, 1121; 73, 1221; 74, ii, 622 (completion of military road, Santa Fe to Taos, N. Mex.), 625; 75, ii, 1233; 76, iii, 718, 724 (lines of communication between southern Colorado and northern New Mexico); 77, ii, 1399, 1401 (survey of headwaters of Red River), 1410 (meteorology), 1422 (botany), 1431 (geology); 78, iii, 1749, 79, 2329.

Maj. J. W. Barlow. **R.**, 74, ii, 607.

Lt. T. N. Bailey. **R.**, 81, 2837 (district of Missouri and New Mexico; 82, 2833 (district of Missouri and New Mexico).

Lt. O. M. Carter. **R.**, 83, 2389 (district of Missouri and New Mexico); 84, 2383 (district of Missouri and New Mexico)

Capt. W. L. Marshall. **R.**, 94, 3451; (Maj.) 95, 4253; 96, 4073; 97, 4131.

Capt. C. E. Gillette. **R.**, 92, 3457; 93, 4401.

Assistants:

T. H. Safford. **R.**, 73, 1243 (difference of longitude, Denver, Colo., and Pueblo, Colo.).

Lt. G. S. Anderson, 6th Cav. **R.** (survey) wagon road, Fort Garland, Colo., to Fort Wingata, N. Mex.), 76, iii, 739.

Lt. T. M. Woodruff, 5th Inf. **R.**, 77, ii, 1409, 1467 (insects).

Lt. C. A. H. McCauley, 3d Art. **R.**, 78, iii, 1730 (San Juan reconnaissance; entomology).

Prof. A. Gray. **R.**, 78, iii, 1832 (botany).

T. S. Brandegee, C. E. **R.**, 78, iii, 1841 (botany).

Prof. C. T. Thomas. **R.**, 78, iii, 1843 (orthoptera).

Prof. H. Strecker. **R.**, 78, iii, 1847 (lepidoptera).

Asst. Surg. C. Smart, U. S. A. **R.**, 79, iii, 2331 (analysis of Pagosa Spring, Colo.).

Capt. H. W. Lawton, 4th Cav. **R.**, 83, 2391.

MISC. 22. FIELD SERVICE—MISSOURI.**ENGINEERS.****In charge:**

Maj. J. W. Barlow. **R.**, 74, ii, 607.

Maj. W. E. Merrill (Bvt. Col.). **R.**, 68, 1196.

Maj. G. L. Gillespie. **R.**, 75, ii, 1112; 76, iii, 565.

Capt. G. J. Lydecker. **R.**, 77, ii, 1135; 78, iii, 1669.

Capt. J. F. Gregory. **R.**, 79, iii, 2315; 80, 2501; 81, 2829; 82, 2827; 83, 2383.

Maj. T. H. Handbury. **R.**, 84, 2379; 87, 3145.

Capt. W. L. Marshall. **R.**, 88, 2813; 89, 2875; 90, 3600; 91, 3493.

MISC. 23. FIELD SERVICE—NEW MEXICO.

ENGINEERS.

Chief of Engineers. R., 79, 189; 81, 340.

In charge:

Lt. E. H. Ruffner. R., 79, 2343

Lt. C. A. Stedman, 9th Cav. R., 79, 2343.

Reconnaissance, Santa Fe to Fort Stanton, 79, iii, 2348. North Star Road, Fort Bayard to the canyon on the Black R., 79, iii, 2351.

Lt. T. N. Bailey. R., 81, 2837; 82, 2833 (Dept. of Missouri and district of New Mexico).

2d Lt. R. T. Emmet. R., 81, 2841.

MISC. 24. FIELD SERVICE—PACIFIC DIVISION.

ENGINEERS.

Chief of Engineers. R., 67, 53; 68, 76; 75, 131; 76, 124; 77, 130; 78, 148; 79, 189; 80, 248; 81, 340; 82, 328; 83, 343; 88, 317; 89, 386; 90 354; 91, 449; 99, 639; 00, 718.

In charge:

Maj. R. S. Williamson (Bvt. Lt. Col.). R., 68, 870.

Lt. J. C. Mallory. R., 75, ii, 1238; 76, iii, 750; 77, ii, 1441; 78, iii, 1878.

Capt. J. H. Coster, 8th Cav. R., 78, iii, 1878.

Lt. C. F. Palfrey. R., 79, iii, 2307.

Capt. W. A. Jones. R., 80, 2543; 81, 2855; (Maj.) 82, 2845.

Lt. J. E. Runcie, 1st Art. R., 88, 2817; 89, 2879; 90, 3603; 91, 3947.

Capt. C. L. Potter (Lt. Col. U. S. Vols.). R. (Dept. of the Pacific), 99, 3871 (Manila).

Assistants:

Lt. E. D. Thomas, 5th Cav. R., 76, iii, 753; 77, 1448.

Lt. W. G. Haan, 3d Art. R., 99, 3875 (Manila).

Lt. W. P. Wooten. R., 99, 3876 (Manila).

Capt. F. R. Shunk. R., 99, 3878 (Manila).

MISC. 25. FIELD SERVICE—PHILIPPINES.

ENGINEERS.

Chief of Engineers. R., 99, 639; 00, 718.

In charge:

Capt. C. L. Potter. R., 99, 3871.

Capt. J. Biddle. R., 00, 5445.

Maj. J. Biddle, 1901.

Maj. C. B. Sears, 1901.

Assistants:

Lt. W. G. Haan, 3d Art. R., 99, 3875.

2d Lt. W. P. Wooten. R., 99, 3876.

Capt. F. R. Shunk. R., 99, 3878.

1st Lt. F. W. Altstaetter, 1901.

Capt. C. F. O'Keefe (36th Inf. U. S. V.), 1901.

1st Lt. A. B. Baskette (37th Inf. U. S. V.), 1901.

2d Lt. G. E. Stewart (19th U. S. Inf.), 1900-01.

Special reports:

Capt. G. A. Zinn, 1901 (northern Luzon).

1st Lt. J. C. Oakes, 1901 (southern Luzon).

1st Lt. S. A. Cheney, 1901 (southern Luzon).

Operations:

1900-01. First battalion organized in Manila from old companies A, B, and E, G. O. No. 22, A. G. D., Maj. C. B. Sears, commanding. Routine office work; large quantity of tools, lumber, and other material purchased; 8,800 maps distributed throughout division; about 700 miles road in Luzon repaired and rebuilt, including bridges and fences. Lack of sufficient number of officers and troops a serious handicap. 01, 43, 975.

MISC. 26. FIELD SERVICE—PLATTE.

ENGINEERS.

Chief of Engineers. R., 67, 53; 68, 77; 74, 123; 75, 131; 76, 123; 77, 130; 78, 147; 79, 188; 80, 247; 81, 340; 82, 327; 83, 342; 84, 348; 85, 377; 88, 317; 89, 386; 90, 354; 91, 449; 92, 424; 93, 488; 99, 639.

In charge:

Lt. R. W. Petriken. R., 68, 1197.

Capt. W. A. Jones. R., 74, ii, 620.

Capt. W. S. Stanton. R., 75, ii, 1231; 76, iii, 704; 77, ii, 1381; 78, iii, 1705; 79, iii, 2319; 80, 2505; 81, 2835.

Lt. D. C. Kingman. R., 82, 2831; 83, 2387; 84, 2381; 85, 2525.

Lt. H. M. Chittenden. R., 88, 2818.

Lt. F. W. Roe, 3d Inf. R., 89, 2877.

Lt. C. A. Worden, 7th Inf. R., 90, 3601 91, 3946; 92, 3459; (Capt.) 93, 4403.

MISC. 27. FIELD SERVICE—PORTO RICO, ENGINEERING OPERATIONS.**APPROPRIATIONS.**

1900, ¹ \$2,385
 1900, ² 500
 Total, 2,885

ENGINEERS.

Chief of Engineers. R., 00, 718.
 In charge. Capt. W. V. Judson. R., 00, 1

MISC. 28. FIELD SERVICE—TEXAS.**ENGINEERS.**

Chief of Engineers. R., 77, 130; 78, 148; 84, 348; 85, 377.

In charge:

Capt. J. F. Gregory. R., 77, II, 1439; 78, 1873.
 Maj. W. R. Livermore. R., 84, 2391; 85, 2

MISC. 29. ENGINEERS, CORPS OF—SERVICE OF OFFICERS ABROAD AND IN THE FIELD.

Lt. E. M. Adams. 03, 30.
 Lt. F. W. Altstaetter. 01, 103.
 Lt. W. J. Barden. 01, 95; 02, 49.
 Maj. J. Biddle. 01, 58.
 Maj. Wm. M. Black. 01, 52.
 Lt. E. I. Brown. 01, 112; 02, 53; 03, 27.
 Lt. L. Brown. 01, 110; 02, 52; 03, 26.
 Lt. H. Burgess. 01, 96; 02, 50.
 Capt. E. Burr. 01, 63.
 Lt. W. G. Caples. 01, 117; 02, 50; 03, 33.
 Capt. J. B. Cavanaugh. 01, 94; 02, 49.
 Lt. S. A. Cheney. 01, 102; 02, 50.
 Capt. H. M. Chittenden. 01, 70.
 Lt. Wm. D. Connor. 01, 97.
 Capt. Spencer Cosby. 01, 91; 03, 26.
 Capt. Wm. E. Craighill. 01, 76; 02, 47.
 Lt. Col. C. E. L. B. Davis. 02, 45; 03, 24.
 Lt. E. J. Dent. 01, 117; 02, 59; 03, 33.
 Lt. C. P. Echols. 01, 93.
 Engineer Troops. 01, 80.
 Lt. Col. O. H. Ernst. 01, 46.
 Lt. H. B. Ferguson. 01, 104; 02, 52.
 Capt. G. D. Fitch. 01, 66.
 Capt. C. A. F. Flagler. 01, 85; 02, 47.
 Lt. A. H. Fries. 01, 112; 02, 54; 03, 27.
 Capt. D. D. Gaillard. 01, 71.
 Brig. Gen. G. L. Gillespie. 01, 45.
 Maj. G. W. Goethals. 01, 57.
 Col. P. C. Hains. 01, 45.
 Lt. W. T. Hammum. 03, 35.
 Capt. W. W. Harts. 01, 89; 02, 47; 03, 25.
 Maj. H. F. Hodges. 01, 61; 02, 46.
 Lt. G. M. Hoffman. 01, 96.
 Capt. E. Jadwin. 01, 90.
 Capt. H. Jervey. 01, 83; 02, 47; 03, 25.
 Lt. H. C. Jewett. 03, 34.
 Lt. E. N. Johnson. 01, 115; 02, 58; 03, 31.
 Lt. R. Johnston. 01, 95.
 Capt. W. V. Judson. 01, 83.
 Capt. C. Keller. 03, 26.

Lt. W. Kelly. 01, 113; 02, 55; 03, 28.
 Lt. R. D. Kerr. 01, 112.
 Capt. J. E. Kuhn. 01, 76.
 Capt. W. C. Langfitt. 01, 68.
 Lt. W. H. Lee. 01, 118.
 Lt. Col. W. R. Livermore. 01, 50; 02, 45.
 Capt. E. W. Van C. Lucas. 01, 82.
 Lt. Col. Wm. Ludlow. 01, 49.
 Lt. G. R. Lukesh. 01, 115; 02, 57; 03, 30.
 Maj. J. L. Lusk. 01, 56.
 Lt. E. M. Markham. 01, 114; 02, 56; 03, 29.
 Maj. G. McDerby. 01, 55.
 Capt. R. McGregor. 01, 90; 02, 48; 03, 25.
 Lt. Wm. A. Mitchell. 03, 34.
 Capt. J. J. Morrow. 01, 93; 02, 48; 03, 26.
 Lt. J. C. Oakes. 01, 100.
 Lt. C. W. Otwell. 02, 58; 03, 31.
 Lt. E. D. Peek. 01, 116; 02, 59; 03, 32.
 Lt. G. B. Pillsbury. 01, 115; 02, 56; 03, 29.
 Lt. J. H. Poole. 03, 32.
 Capt. C. L. Potter. 01, 79.
 Lt. L. H. Rand. 01, 114; 02, 56; 03, 29.
 Capt. T. H. Rees. 01, 78.
 Capt. C. S. Riche. 01, 78.
 Maj. C. B. Sears. 01, 51; 02, 45; 03, 24.
 Capt. J. Sewell. 01, 92.
 Lt. C. O. Sherrill. 01, 115; 02, 58; 03, 31.
 Capt. F. R. Shunk. 01, 81.
 Capt. Wm. L. Sibert. 01, 74.
 Lt. J. R. Slattery. 01, 115; 02, 57; 03, 30.
 Lt. G. R. Spalding. 01, 116; 02, 59; 03, 33.
 Lt. H. W. Stickle. 01, 113.
 Lt. Wm. P. Stokes. 03, 31.
 Maj. C. McD. Townsend. 03, 24.
 Lt. H. L. Wigmore. 02, 58; 03, 31.
 Lt. A. Williams. 01, 117; 02, 60; 03, 34.
 Capt. E. E. Winslow. 01, 84.
 Lt. J. A. Woodruff. 01, 112; 02, 54; 03, 28.
 Lt. W. P. Wooten. 01, 109.
 Capt. G. A. Zinn. 01, 67; 02, 46.

¹ Civilian assistants, 00, 5450.² Equipment, Engr. Troops, 00, 5450.

MISC. 30. CORPS OF ENGINEERS—DUTIES OF OFFICERS.

Each annual report of the Chief of Engineers refers briefly to the character of the duties performed during the preceding fiscal year by the members of the Corps of Engineers, U. S. Army.

From 1901-1912 alone the time of the members of the corps has been distributed according to the following classifications:

Absence (sickness, leave, etc.).
Adjutant General's Office, U. S. Army.
Agriculture, Department of, buildings for.
Aid-de-camp.
Alaska, Board of Road Commissioners in.
Alaska, road work in.
Army Field Engineer School, Fort Leavenworth, Kans.
Army War College, on duty.
Assistant Chief Engineer Officer, military mapping, Philippine Islands.
Assistant Chief Engineer Officer, military division.
Assistant to Engineer Commissioner, District of Columbia.
Assistants to the Chief of Engineers.
Atlantic Division, Engineer Officer.
Battalion of Engineers, Second.
Board for improvement of harbor at Guam.
Board of Engineers.
Board of Ordnance and Fortification.
Board of road commissioners in Alaska.
Building for Department of Agriculture.
Buildings for Government Printing Office.
Building for Soldiers' Home.
Building for War College.
Building for Washington Barracks.
California Débris Commission.
Changing stations.
Chief Engineer officer, military department.
Chief Engineer officer, military division.
Chief Engineer officer, Pacific Division.
Chief Engineer officer, Philippine Division.
Chief Engineer officer, Southwestern Division.
Chief of Engineers.
Chief of Engineers, assistants to the.
Chief of Engineers, office of.
Columbia, Department of the.
Command of Engineer troops, Hawaiian Islands
Cornell University, under instruction at.
Cuba.
Cuban affairs.
Cuba, Department of.
Cuba, en route from.
Department of California, Engineer officer.
Department of Cuba.
Department of the Columbia.
Department of the East.
Department of the East, Engineer officer.
Department of the Lakes, Engineer officer.
Department of the Missouri, Engineer officer.
District of Columbia, assistants to Engineer Commissioner.
District of Columbia, Engineer Commissioner.
District of Columbia, government of.
Division Engineer.
Division of the Philippines.

East, Department of the.
Engineer Commissioner, District of Columbia.
Engineer Commissioner, District of Columbia, assistants to.
Engineer Department.
Engineer Department at Willets Point.
Engineer district, under instructions.
Engineer officer, Atlantic Division.
Engineer officer, Department of California.
Engineer officer, Department of Missouri.
Engineer officer, Department of the East.
Engineer officer, Department of the Lakes.
Engineer officer, Department of Texas.
Engineer School.
Engineer School of Application.
Engineer secretary to lighthouse board.
En route from Cuba.
En route from Philippine Islands.
En route to Philippine Islands.
First Battalion of Engineers.
Fortifications.
Fortifications at Guantanamo Bay, Cuba.
Fortification work in the Hawaiian Islands.
Fortification work in the Philippine Islands.
Fortification work in the United States.
Ft. Bayard, N. Mex., general hospital.
Ft. D, A. Russel, Wyo., troops.
Ft. Leavenworth, Kans., post of.
Ft. Leavenworth, Kans., Service School, on duty.
Ft. Leavenworth, Kans., troops.
Ft. Mason, Cal., post of.
Ft. Recovery, monument at.
Ft. Riley Military Reservation.
Ft. Totten, post of.
Ft. Washakie Military Road.
General Hospital, Ft. Bayard, N. Mex.
General Staff, Philippine Division.
Government of the District of Columbia.
Government Printing Office, buildings for.
Graduating leave of absence.
Guam, harbor at, board for improvement of.
Guantanamo Bay, Cuba, fortification at.
Hawaiian Islands, Engineer troops, command of.
Hawaiian Islands, fortification work in.
Hawaiian Islands, troops.
Infantry and Cavalry School and Staff College.
Inland Waterway Commission.
International Congress.
Isthmian Canal Commission.
Leave of absence.
Lighthouse Board.
Lighthouse Board, engineering secretary to.
Lighthouse duty.
Lighthouse Establishment.
Maine, the battleship, removal of.
Maneuver division, troops.
Military attachés with Russian and Japanese Armies.
Military attachés, Tokio, Japan.
Military attaché to United States legations.
Military Department, chief Engineer officer.
Military Division.
Military Division, assistant chief Engineer officer.
Military Division, chief Engineer officer.

- Military mapping in the Philippine Islands.
 Mississippi River Commission.
 Mississippi River improvement.
 Missouri River Commission.
 Monument at Ft. Recovery.
 National rifle competition.
 Northern and northwestern lakes, survey of.
 Office, Chief of Staff.
 Office of the Chief of Engineers.
 On duty, Army War College.
 On duty, Service School, Ft. Leavenworth,
 Kans.
 Ordnance and Fortification, Board of.
 Pacific Coast, troops.
 Pacific Division, chief Engineer officer.
 Panama Canal.
 Panama Canal, defense of, preparation of plans.
 Philippine Division, chief Engineer officer.
 Philippine Division, general staff.
 Philippine Islands, en route from.
 Philippine Islands, en route to.
 Philippine Islands, fortification work.
 Philippine Islands, troops.
 Philippine Islands, military mapping in.
 Philippine Islands, military mapping, assistant
 chief Engineer officer.
 Philippines, The Division of.
 Post of Ft. Leavenworth.
 Post of Ft. Mason, Cal.
 Post of Ft. Totten.
 Post of Washington Barracks.
 Preparation plans, defense of Panama Canal.
 Provisional General Staff.
 Public Buildings and Grounds.
 Removal of the battleship *Maine*.
 River and harbor works.
 Road work in Alaska.
 Russian and Japanese Armies, military attachés
 with.
 School of the Line.
 Second Battalion of Engineers.
 Sick, absent.
 Soldiers' Home, building for.
 Southwestern Division, chief Engineer office
 State, War, and Navy Building, superinte-
 of.
 Superintendent, State, War, and Navy Bui-
 Survey duty, Yosemite National Park.
 Survey, northern and northwestern lakes.
 Texas, Department of, Engineer officer.
 Third Battalion of Engineers.
 Tokyo, Japan, military attaché.
 Troops at Vancouver Barracks, Wash.
 Troops, Pacific coast.
 Troops, Ft. D. A. Russel, Wyo.
 Troops, Ft. Leavenworth, Kans.
 Troops, maneuver division.
 Troops, Philippine Islands.
 Troops, Hawaiian Islands.
 Twelfth International Congress of Navigatio-
 Under instruction at Cornell University.
 Under instruction in Engineer district.
 United States Engineer School.
 United States, fortification work.
 United States legation, military attaché to.
 United States Military Academy.
 Vancouver Barracks, Wash., troops at.
 Vicksburg National Military Park.
 War College, building for.
 War College Board.
 Washington Aqueduct.
 Washington Barracks, building for.
 Washington Barracks, post of.
 Willets Point, Engineer Department.
 Yellowstone National Park.
 Yosemite National Park, survey duty.

MISC. 31. POSTS—SUBPOST OF FORT FOOTE, MD.

1901-02. Situated on Maryland bank of the
 Potomac R., 8 miles s. of the city of Washington.
 Used for drill purposes. Buildings are old and in
 a bad state of repair. **02**, 795.

1902-03. Minor repairs to wharf, road,
 water supply. **03**, 18, 685.

MISC. 32. POSTS—FORT TOTTEN, N. Y. (INCLUDING U. S. ENGINEER SCHOOL, BATTALION OF ENGINEERS, AND ENGINEER DEPOT), 1866-1901.

(See Misc. 8 on p. 2045 of this index.)

CONTRACTS.

1897. 30 m. of single-conductor cable and 9 m. 7-core cable, \$24,916.50; 26 rotary transformers, \$3,965.52; 26 oil engines, complete, \$17,316; 26 electric storage batteries, complete, \$7,384; 28 switchboards, complete, \$6,867.84. **98**, 576

1898. 46 operating boxes, complete, \$1,297.20, **98**, 576; 25 m. multiple cable, \$47,500; 100 m. single cable, \$36,500; 75 m. single cable, \$26,212.50; 100 m. multiple cable, \$159,500; 1,600 torpedoes, complete, \$180,000; 7 wooden pontoon boats, complete, \$1,372; 1 fireproof instrument repair shop, \$7,550. **99**, 682.

1899. 6 yawl boats, complete, \$702; white-pine lumber for bridge equipage, \$1,333.47; 18 wooden pontoon boats, complete, \$4,050; 2 frame storage sheds, \$745 each. **99**, 683. Repairs to wharf, \$2,560.75. **00**, 1068.

1900. 50,000 brass washers, 78¢ per pound; compound plugs and glands, \$1,689.66; 12,000 fuses, 8¢; 8,000 7" and 4,000 9" wire cut-outs, 6¢; 1,050 aluminum metal cases, \$2.10; 66,000' No. 16 kerite insulated wire, \$11.50, and 26,400' No. 12, \$23.50 per 1,000'; 5 slow-speed rotary transformers, \$174 each; 6 oil engines, 4-horsepower, \$660; 6 electric switchboards, \$380; 500 thermometers, 66¢; 100 hygrometers, \$2.45; 18,138' b. m. Oregon white-pine timber, \$50 M; 200 500-pound anchors, \$1,290; 400 cut-out boxes, \$760; 7,500 split keys for shackles, \$45; 1,100 split keys for mines, \$49.50; 1,700 mine and 2,600 anchor shackles and 3,500 mooring sockets at 60¢ each. **00**, 1068.

ENGINEERS.

Chief of Engineers. **R.**, 66, ii, 19; 67, 15; 68, 21; 69, 20; 70, 28; 71, 26; 72, 26; 73, 27; 74, 32 75, 33, 131; 76, 32, 122; 77, 28; 78, 32; 79, 39 80, 60; 81, 61; 82, 61; 83, 56; 84, 65; 85, 52; 86, 52; 87, 12; 88, 8; 89, 12; 90, 10; 91, 15; 92, 19; 93, 17; 94, 17; 95, 18; 96, 6; 97, 4; 98, 5; 99, 5, 8; **00**, 35, 36; **01**, 38.

In charge:

Capt. F. Harwood, 1866.

Lt. Col. H. L. Abbot, 1866-85. **R.**, 80, 297; 81, 419; 82, 443; 83, 389; 84, 425; 85, 425.

Lt. Col. J. C. Duane, 1868.

Lt. Col. C. B. Comstock, 1886. **R.**, 86, 471.

Lt. Col. W. R. King, 1886-95. **R.**, 86, 489; 87, 419; 88, 345; 89, 467; 90, 389; 91, 537; 92, 473; 93, 647; 94, 467; 95, 521.

Maj. W. T. Rossell, 1896.

Maj. J. G. D. Knight, 1896-1900. **R.**, 96, 451; 97, 559; 98, 563; 99, 650; **00**, 1045.

Maj. W. M. Black, 1901. **01**, 927.

Battalion of Engineers—Company A—In charge:

Capt. A. Stickney, 1868.

Capt. A. Mackenzie, 1869-73.

Lt. W. T. Rossell, 1874.

Capt. J. W. Cuyler, 1875.

Capt. J. A. Mercer, 1876.

Capt. T. H. Handbury, 1877-79.

Capt. J. B. Quinn, 1880.

Lt. F. V. Abbott, 1881.

Capt. C. W. Raymond, 1882.

Capt. E. H. Ruffner, 1883-84.

Capt. J. G. D. Knight, 1885-87.

Capt. S. W. Roessler, 1888-89.

Capt. C. B. Sears, 1890.

Capt. W. A. Fisk, 1894-95.

Capt. S. W. Roessler, 1896-97.

Capt. W. C. Langfitt, 1898.

Capt. F. R. Shunk, 1899.

Company B—In charge:

Capt. A. H. Burnham, 1868-70.

Capt. W. R. King, 1871-75.

Lt. J. B. Quinn, 1876.

Capt. A. M. Miller, 1877-81.

Capt. J. H. Willard, 1882-83.

Capt. C. F. Palfrey, 1884.

Capt. T. N. Bailey, 1885.

Lt. H. M. Chittenden, 1886.

Capt. E. Maguire, 1887-88.

Capt. R. L. Hoxie, 1889-90.

Capt. W. T. Rossell, 1894-95.

Capt. W. C. Langfitt, 1896-97.

Capt. S. W. Roessler, 1898.

Capt. W. L. Sibert, 1899.

Company C—In charge:

Capt. A. H. Holgate, 1868.

Capt. O. H. Ernst, 1869-70.

Capt. W. C. Raymond, 1871-72.

Capt. J. C. Post, 1873.

Capt. W. R. Livermore, 1874-77.

Capt. J. F. Gregory, 1878-79.

Capt. J. C. Mallory, 1880-83.

Capt. P. M. Price, 1884-85.

Lt. W. C. Langfitt, 1886.

Capt. E. Bergland, 1887-90.

Capt. W. M. Black, 1894-95.

Capt. T. A. Bingham, 1896.

Capt. G. D. Fitch, 1897.

Capt. E. Burr, 1898-99.

Capt. G. D. Fitch, 1899.

Capt. Thos. H. Rees, 1900.

Capt. H. Jervey, 1900.

Company D—In charge:

Capt. S. M. Mansfield, 1867-70.

Practically abandoned in 1871; exists only in name, and is commanded by the battalion adjutant.

Maj. J. Millis, 1898-1900.

Company E—In charge:

Capt. W. Ludlow, 1867.

Capt. J. W. Cuyler, 1868.
 Capt. P. C. Hains, 1869-70.
 Capt. O. H. Ernst, 1872-78.
 Capt. C. W. Raymond, 1880-81.
 Maj. W. S. Stanton, 1882-85.
 Capt. P. M. Price, 1886-88.
 Capt. G. McC. Derby, 1889-90.
 Capt. J. L. Lusk, 1894-97.
 Maj. G. W. Goethals, 1898-1900.

Assistants.

Reports:

Capt. J. B. Quinn. 80, 302; 81, 425.
 2d Lt. W. L. Fisk. 80, 302, 312, 314; (1st Lt.) 318, 319.
 Lt. J. C. Mallery. 80, 305, 307; (Capt.) 84, 430.
 Lt. E. Griffin. 81, 425, 429; 82, 448; 83, 394.
 Lt. J. H. Willard. 81, 431, 433, 449, 452; 82, 449, 452.
 Lt. W. H. Bixby. 83, 395, 398.
 Lt. J. L. Lusk. 84, 429; 85, 432.
 Lt. J. Millis. 84, 431.
 Lt. H. F. Hodges. 84, 434; 85, 432.
 Capt. S. W. Roessler. 85, 455; 86, 477; 87, 425, 433; 88, 360, 364; 89, 495; 90, 413, 419.
 Lt. J. R. Warren. 88, 360; 89, 485; 91, 553.
 Lt. I. Hale. 88, 370.
 Lt. C. Harding. 90, 418.
 Lt. A. M. D'Armit. 90, 421; 91, 565; 92, 490.
 Lt. H. Jervey. 91, 559.
 Lt. R. McGregor. 92, 484.
 Lt. J. Morrow. 95, 532; 96, 455.
 Lt. W. E. Craighill. 96, 460; 97, 564.
 Lt. W. V. Judson. 97, 568.

Summary of reports:

1865. Place constituted an engineer post and depot, selected as the headquarters of the Battalion of Engineers, and as the depot for the storage of the Engineer material. 68, 21.

1867. By act of July 28, 1866, the 5 companies of the Corps of Engineer troops were constituted a Battalion of Engineers to be composed of 752 enlisted men. Three companies stationed at Willets Point, N. Y.; 1 at Jefferson Barracks, Mo.; and 1 en route for Yerba Buena Island, Cal. Act of July 13, 1866, separated the Military Academy from the Corps of Engineers. It had been a part of that corps, by law, for more than 64 years. 67, 15.

1868. Constr. of quarters in progress. In compliance with G. O. 56, dated Aug. 1, 1866, schools were opened for the enlisted men. 68, 21.

1869. Permanent hospital completed; work on other buildings. Survey of the battlefield of Gettysburg in progress under command of Lt. T. Turtle. 69, 20.

1870. By au. of the Sec. of War, post constituted the torpedo school of the Army; experimental work in progress. Work on buildings in progress. 70, 29.

1871. G. O. 122, series of 1870, reduced the strength of the 5 companies constituting the bat-

talion, June 30, 1871, to 12 officers and 303 enlisted men. Companies A, B, and C stationed at West Point. Company E, composed of the detachments heretofore kept at the Military Academy to be instructing the cadets, increased to a full company and stationed at West Point. Company D tactically disbanded by the reduction of the battalion. 71, 27.

1877. Table giving a synopsis of the recruit service and of desertions from June 30, 1866, to June 30, 1877. 77, 28.

1880. New astronomical observatory completed. Total cost, \$342.49. \$9,000 allotted quarters; work in progress; general repair of buildings. Statement of receipts and issues of materials. Calcium chloride used to dry the air in storerooms; formula given of the solution. 80, 322; 81, 453; 82, 481.

1881. A field astronomical observatory erected in 1868; regular series of meteorological observations and practice in making reconnaissance and survey begun in that year. Use of photography for delineating maps in the field begun in 1873. Tidal current measurements begun in 1871. 81, 423.

1882. Willets Point transferred from an auxiliary military post into the Engineer School Application. 82, 446.

1883. Photographic laboratory built. 83,

1884. Sapping or molding shed built; \$6,385. 84, 455.

1886. Board of officers constituted by S. 187, A. G. O., Aug. 17, 1885, to consider and report upon the questions of water supply, sewers, hospital accommodations at Willets Point. 86, 484. (Col. Q. A. Gillmore, Corps of Engineers Lt. Col. H. G. Hodges, Q. M. G., and Maj. I. Huntington, surgeon, U. S. A.) Plan and estimate of brick barrack at Willets Point. 86, 486.

1888. The Quartermaster's Department completed the water supply and sewerage system; necessary plumbing for sanitary purposes in racks and quarters, and the double set of officers' quarters and the new hospital building. 88, Experiments in electro-magnetism on a large machine with 2 15" guns, a large quantity of tor cable, and a dynamo (photograph). 88, 354.

1889. Laboratory for enlisted men to target range improved and extended, and remade to buildings. A post canteen and a combined mess for enlisted men established. Detachment of officers and soldiers sent to Johnstown, Pa., on June 5, 1889, to assist in bridge streams. 89, 467. Experiments—Tests of explosives, crater gauge, pressure gauge, range fin transition indicators, Sim's torpedo, with record of tests and photographs. \$200,000 app. for pedoes for H. defense. Statement of funds estimated required for the following year. 89, Report of board of officers upon torpedo mat-

with recom.—Reports on shackles and mooring rope, bronze torpedo case, cut-off boxes, operating box, and on a system of firing without the automatic switching on of the firing battery; McIntire jointer and tests of fuses. 89, 489. Board of Engineers constituted by S. O. 31, to witness a test of the "automobile controllable torpedo" of J. H. Patrick; report giving description of torpedo and trials witnessed. 89, 497. (Maj. W. R. King, Capt. S. W. Roessler, and Lt. I. Hale.)

1890. Experiments—Trials of Sim's fish torpedo; torpedo drills; tests of explosives; crater gauge; sensitiveness of explosives; tests of insulated cable; self-acting mine; and building materials (photographs). 90, 401, 413.

1891. New building for Engineer models completed; cost, \$8,000. \$9,000 allotted for guardhouse and \$1,692.67 allotted for fire engines by the Quartermaster's Department. The title of "Engineer School of Application" changed, Sept. 24, 1890, by the Acting Sec. of War to "U. S. Engineer School." Lectures delivered—Foundations under difficulties, Mr. John Anderson; English engineering in Egypt, Dr. R. W. Raymond; Improvement of tidal rivers, Maj. C. W. Raymond; Concrete breakwaters, Capt. F. A. Mahan. Experiments—Sim's fish torpedo, tests of explosives, mortar practice with wooden projectiles described, building materials tested, and other torpedo experiments made. 91, 539, 553.

1892. Fireproof storehouse for pontoon, siege, and torpedo materials nearly completed. Small steam tug for planting torpedoes completed. Cable storage tank built, and minor work. Property cared for and repaired. Sims-Edison fish torpedo delivered and tested. Tests of cables, circuit closers, self-acting mine mechanism, new form of electric current meter, building stone and cement, electric fuses, and other special tests made. 92, 479, 490.

1893. Term of enlistment discussed; advantages to be gained by reducing it from 5 to 3 years. 93, 652. Experiments—Artificial heat used in drying mining casemates, 36 drums of cable received from England and tested; trials of Sims-Edison fish torpedo continued. 93, 656.

1894. Experiments—Blasting concrete platforms, explosives, Sims-Edison torpedo, building materials; minor tests. 94, 477.

1895. New barrack building completed, quarters moved, work on retaining wall around ice pond. Contracts for submarine mining material completed, cable tested. Experiments—Explosives for breaking ice to improve navigation, Sims-Edison torpedo, pressure gauge improved; minor tests. 95, 529.

1896. Old frame barrack and stable removed, new magazine rifle, U. S. model 1892, caliber .30, issued to the troops in July, 1895. Engineer models shipped to Atlanta, Ga., for the War Department exhibit. 96, 451, 465.

1897. 4 batteries of Artillery came to the post for Artillery practice. Disputes concerning the commanding officer while in camp. 97, 560.

1898. New regulations for the government of the U. S. Engineer School given. 98, 565. On Apr. 4, 1898, Sec. of War au. the increase of the battalion of Engineers from 500 to 702 enlisted men. Detachments for submarine mine defense of harbors sent out during Apr., 1898, from the 3 companies. Company D (a skeleton company for several years) was reorganized. Company A serving with troops at the Philippine Islands. Companies C and E serving with the army in Cuba. Company D detached for submarine mining duty at 19 harbors on the Atlantic, Gulf and Pacific coasts. Company B engaged at the Engineer depot at Willets Point receiving, storing, and distributing the vast amount of torpedo material, pontoon equipage, siege materials, and instruments purchased and distributed from the depot. 98, 6. Submarine mine material—Lists of materials received with statement of funds, abstracts of proposals, etc. 98, 571.

1899. G. O. 106, War Department, A. G. O. Washington, July 23, 1898, changed the name of the fort at Willets Point, N. Y., to Ft. Totten, in honor of Brig. Gen. Joseph G. Totten, Chief of Engineers, who died Apr. 22, 1864. 99, 651. Discussions on the Army canteen. 99, 652. Stations of the various companies given. 99, 652. By act of Mar. 2, 1899, the enlisted strength of the battalion of Engineers was established as 752, its previous legal strength, and the battalion of Engineers, and the officers serving therewith, to constitute a part of the line of the Army. 99, 657. Extracts from reports as to the service rendered by the battalion of Engineers. 99, 658. List of submarine mine materials, etc., and equipment of Engineer troops. 99, 664, \$150,000 app. May 4 and July 7, 1898, for procurement of pontoon trains, intrenching tools, instruments, drawing materials, etc., and \$60,000 app. July 7, 1898, for employment of civilian assistants to Engineer officers in the field. Engineering supplies purchased for Engineer officers of 7 Army corps and for 3 regiments of Volunteer Engineers in equipping them for duty in the field in Cuba, Porto Rico, and the Philippine and Hawaiian Islands. 99, 8.

1900. \$50,000 app. Mar. 3, 1899, and \$25,000 app. for the fiscal year 1901, for equipment of Engineer troops and civilian assistants to Engineer officers. 00, 35. Stations of the different companies of the battalion of Engineers given. 00, 1051. Discussion on the legislation contemplating the transfer of submarine mining defenses to the Artillery arm of the service. 00, 1046.

1900-01. \$7,202.45 allotted for repair of buildings, roads, and walks; \$34,258 for new Artillery barracks; \$6,909 for new ordnance storehouses; and \$775 for a boathouse; new buildings completed and occupied. Est. \$163,000 for quarters. Est. \$114,000 for enlarging post. 01, 38, 927. Defective arrangement of barracks. 01, 928. Reclamation of

adjacent marshes would go far to remove source of malarial troubles. **01, 931.**

MISCELLANEOUS REPORTS.

Temporary detachments during the year. **80, 297; 81, 419.**

Engineer recruiting and desertions and discipline. **80, 208; 81, 420; 82, 445; 83, 390; 84, 426; 85, 428; 86, 491; 87, 421; 88, 350; 89, 473; 90, 394; 91, 541; 92, 475; 93, 650; 94, 470; 95, 524; 96, 463; 97, 573.**

Stations of the battalion at the end of the year. **80, 299; 81, 421.**

Drills and instruction. **80, 300; 90, 397; 91, 544; 92, 477; 93, 653; 94, 473; 95, 525; 96, 462; 97, 563, 571.**

Course of instruction and drills given for future work. **80, 302; 81, 429; 82, 472; 83, 395; 84, 449; 85, 495; 86, 474; 87, 425.**

Military duties of the battalion. **80, 299; 81, 422; 82, 445; 83, 391; 84, 426; 85, 429; 86, 491.**

Results of astronomical observations. **80, 307; (maps) 81, 433; 82, 458; 85, 436.**

Results of meteorological observations. **80, 312; 81, 449; 84, 448; 85, 454.**

The standing of the noncommissioned officers of the several companies of the battalion as determined by their recitations to their company officers during the winter season. **80, 313; 81, 448; 82, 475; 84, 453; 85, 455.**

Results of target practice (maps). **80, 314; 81, 425; 82, 448; 84, 430; 85, 446.** Modification of the system of target practice. **80, 318.**

Engineer School of Application. **81, 422; 82, 446; 83, 392; 84, 427; 85, 429; 86, 474; 87, 415, 433; 88, 347; 89, 471; 90, 392; 91, 539; 92, 474; 93, 649; 94, 468; 95, 523; 96, 453; 97, 562; 98, 565; 99, 653; 00, 1047.**

Operations of the photographic laboratory. **302; 81, 425; 82, 448; 83, 394; 84, 429; 85, 88, 370; 90, 401.**

Organization of the Engineer School of Application. **86, 474.**

Course of winter instruction. **86, 477; 87, 88, 357; 89, 484; 90, 409; 91, 553; 92, 484; 662; 94, 481; 95, 532; 96, 457; 97, 566.**

Course of summer instruction. **86, 481; 87, 88, 360; 89, 487; 90, 407, 411; 91, 556; 92, 93, 660; 94, 485; 95, 530; 96, 460; 97, 568.**

Assignment to charge of departments of Institution. **86, 483; 87, 430; 88, 363.**

Water supply, sewers, and hospital accommodations. **86, 484.**

Plan and ests. for brick barrack. **86, 486.**

Experiments and results. **87, 417 (photograph); 88, 351 (photographs); 89, 478; 90, 401; 91, 559; 92, 481, 490; 93, 656; 94, 477 (photograph); 95, 529.**

Public buildings and construction. **87, 422; 355; 89, 476; 90, 398; 91, 547; 92, 479; 93, 654; 94, 468, 474; 95, 527; 97, 574; 00, 1052.**

Depot property. **87, 423; 88, 355; 89, 478; 399; 91, 548; 92, 480; 93, 655; 94, 475; 95, 527.**

Quartermaster and Subsistence Department. **95, 522.**

Marching, camping, and parades. **97, 571; 1047.**

Torpedoes, list of material, etc. **97, 577; 572; 99, 675; 00, 1056.**

Instruments, depot. **75, ii, 1109; 76, iii, 178, iii, 1667; 97, 576; 99, 674; 00, 1054, 1061.**

Work of the different departments. **99, 600, 1047.**

Statement of funds given in each report.

MISC. 33. POSTS—JEFFERSON BARRACKS, MO.

ENGINEERS.

Chief of Engineers. **R., 66, ii, 19; 67, 15; 68, 22; 69, 21; 70, 29; 71, 28; 72, 28; 73, 29.**

In charge:

Capt. W. Ludlow, 1867-68.

Capt. P. C. Hains, 1868-71.

OPERATIONS.

1868. The post of Jefferson Barracks (about 300 acres of land) transferred to the Corps of Engineers by G. O. No. 9, dated Oct. 21, 1867, Headquarters Military Division of the Missouri. \$20,000 paid to the Quartermaster's Department for the

property. Alterations to barracks and repairs buildings. **68, 22.**

1869-70. Work on quarters in progress. **71; 70, 29.**

1871. Company E reduced and reorganized left for West Point Mar. 1, 1871. Engineer property left under the care of a small detachment Engineer soldiers. Post, with all lands appertaining thereto, transferred to the Ordnance Department. **71, 28.**

1873. Engineer material stored at the post disposed of by auction in June, and the detachment left to guard it was ordered to Willets Point. **73, 29.**

MISC. 34. POSTS—WASHINGTON BARRACKS.

In charge:

Maj. W. M. Black. 02, 793; 03, 683.

Maj. Edw. Burr. 03, 683.

1901-02. Reservation located at southern extremity of city of Washington, D. C., lying between Washington chan. of the Potomac R. and the James Creek Canal. Contracts made for filling in low lands and protecting them by sea wall. Post of Ft. Foote, Md., placed under charge of the post

commander Nov. 26, 1901, and is used by the Engineer battalion for engineering instruction and target practice. 01, 39, 793.

1902-03. Plans preparing for reconstruction of post building and constr. of War College Building commenced. Target facilities most unsatisfactory. Necessity for a Government rifle range. 03, 17, 683.

MISC. 35. POSTS—YERBA BUENA ISLAND, CAL.

ENGINEERS.

Chief of Engineers. R., 68, 22; 69, 21; 70, 30; 71, 28; 72, 28.

In charge: Capt. S. M. Mansfield, 1868-71.

OPERATIONS.

1868. This post and depot were constituted by S. O. 34, dated A. G. O., Feb. 10, 1868, and was first occupied on Mar. 25. Work begun on making roads, clearing, and preparing part of the land for permanent occupation, and improving the supply of water. 68, 22.

1869. Wharf built and necessary barracks, guardhouse, hospital, and other buildings completed. 69, 21

1870. A military survey of the island in progress. 70, 30.

1871. By G. O. 122, series of 1870, from the War Department, Company D, stationed at this post, was reduced and the skeleton company ordered temporarily to Willets Point. The Engineer property was left in charge of a small detachment left for that purpose. On June 30, 1871, this post was transferred, by orders of the Sec. of War, to the Quartermaster's Department. 71, 28.

1872. Engineer property was destroyed by fire on May 3, 1871. The small detachment of Company D, left to guard it, was ordered to Willets Point. 72, 28.

MISC. 36. SCHOOLS—ENGINEER SCHOOL OF APPLICATION, U. S. A.

In charge:

Maj. Wm. M. Black.

1901-02. Name changed from "U. S. Engineer School" to above title. Method of instruction by lectures, course of reading, students taking notes, preparation of theses and projects on subjects selected by the instructors. Trade school established for training enlisted in the various mechanical trades. 02, 40, 796.

1902-03. Route work done. Imp. of bridge equipage and preparation of Engineer Field Manual considered. 03, 19, 689.

1903-04. Instruction of officers suspended. Instruction of enlisted men and other duties continued; equipment of school continued. 04, 12, 13, 751.

MISC. 37. SCHOOLS—U. S. ENGINEER SCHOOL, FORT TOTTEN.

(See Misc. 31-36 above.)

In charge:

Maj. John G. D. Knight, 1901.

Maj. Wm. M. Black, 1901.

1900-01. School work interrupted by neces-

sity for organizing and training additional companies of Engineer troops. Work of compiling field manual begun. 01, 39, 937.

MISC. 38. TROOPS, ENGINEER (1901-1912).

(See also Misc. 2-42 on p. 2039-2053 of this index.)

1900-01. Companies C and D at garrison; Companies A, B, and E duty in Philippines; portion of Companies A and B accompanied Pekin relief expedition. Battalion reorganized into 3 battalions., au. act Feb. 2, 1901. Est. \$10,000 for plant for railroad instruction. **01, 39, 943.**

1907-08. Work of troops greatly increased. Under date Sept. 25, 1907, War Department authorized recruiting existing battalions to their war strength.

Schedule of proposed increase in the commissioned personnel of the Corps of Engineers, U. S. Army

| Increase on account of— | Grades. | | | | | | | |
|---|---------------|--------------|--------------|--------------|----------------|--------------|--------------|--------------|
| | Brig. gen. | Col. | Lt. col. | Maj. | Chap- lain. | Capt. | 1st lt. | 2d lt. |
| Additional officers for military and civil works of construction..... | | 4 | 7 | 13 | | 18 | 18 | |
| Officers for additional 3 battalions..... | | | | 3 | | 12 | 30 | 12 |
| Officers for regimental organization..... | | 3 | 3 | | | 9 | | |
| Total increase..... | | 7 | 10 | 16 | | 39 | 48 | 12 |
| Present authorized strength..... | 1 | 10 | 16 | 32 | 1 | 43 | 43 | 43 |
| Total strength with proposed increase..... | 1 | 17 | 26 | 48 | 1 | 82 | 91 | 55 |
| Proportion of each grade to total number: | | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| Now..... | | 5.3 | 8.0 | 16.9 | 0.5 | 21.8 | 22.8 | 22.8 |
| With proposed increase..... | | 5.3 | 8.0 | 15.0 | 0.3 | 25.5 | 28.3 | 17.1 |

08, 6, 7.

Engineer troops. **1908-10.** Difficult to raise companies to full strength. **09, 7, 8; 10, 9.**

Act Feb. 27, 1911, provides for increase. **11 12, 5.**

Battalions of Engineers, First, Second, and Third.

Chief of Engineers. **R., 01, 945, 979; 02, 40, 607, 802; 03, 5, 7, 19, 686.**

NOTE.—See above references for list of officers of Companies A-E, and p. 2053 of this index.

Under the requirements of section 11 of the act of Congress approved Feb. 2, 1901, fixing the enlisted force of the Corps of Engineers at 1 band and 3 battalions of 4 companies each, G. O. No. 22, Headquarters of the Army, Adjutant General's Office, Feb. 26, 1901, prescribed the following organization:

The First Battalion, to consist of Companies A, B, C, and D, at Manila, P. I.

The band and the Second Battalion, to consist of Companies E, F, G, and H, at Ft. Totten, Willets Point, N. Y.

The Third Battalion, to consist of Companies I, K, L, and M, at Ft. Totten, Willets Point, N. except Company M, which was ordered to be formed at West Point, N. Y., from the detachment there. The remaining companies of the battalion were not to be formed until the organization of the Second Battalion was effected.

The designation of the existing Companies E and D, of the Battalion of Engineers, was changed as follows:

Company E to Company C.

Company C to Company E.

Company D to Company F. **01, 944.**

MISC. 39. TROOPS, ENGINEER — EQUIPMENT OF ENGINEER TROOPS AND CIVILIAN ASSISTANTS TO ENGINEER OFFICERS (1900-1904).

(See Misc. 40 on p. 2059 of this index.)

APPROPRIATIONS.

| | Troops. | Civilian assistants. | |
|------------|---------|----------------------|--------------------|
| 1900 | 25,000 | 25,000 | { 00, 35 01, 37 |
| 1901 | 20,000 | 25,000 | 01, 37 |
| 1902 | 25,000 | 25,000 | 02, 38 |
| 1903 | 25,000 | 25,000 | 03, 23 |
| 1904 | 25,000 | 25,000 | 04, 17 |

Equipment of Engineer Troops and Civilian Assistants to Engineer Officers.

1900-01. Provisions made for equipment of Engineer troops in the field, procurement of pontoon trains, intrenching tools, instruments, drawing materials, etc., and for civilian assistants to Engineer officers serving on the staffs of division, corps, and department commanders, to enable them to secure the employment of surveyors, draftsmen, photographers, and clerks. Supplies

furnished for various military departments in the U. S., the Philippines, and Porto Rico, and the several Engineer officers of important military commands and departments. 01, 37; 02, 38; 03, 23, 697; 04, 17, 766. (After 1904 equipment of troops reported on independent of civilian assistants.)

MISC. 40. TROOPS, ENGINEER — ENGINEER EQUIPMENT OF TROOPS (1905-1912).

(See Troops, Engineer, 1900-1904, above.)

APPROPRIATIONS.

| | | |
|-------|-----------|---------|
| 1905, | \$15,000, | 05, 18. |
| 1906, | 40,000, | 06, 15. |
| 1907, | 40,000, | 07, 18. |
| 1908, | 72,500, | 08, 24. |
| 1909, | 90,000, | 09, 26. |
| 1910, | 90,000, | 10, 30. |
| 1911, | 90,000, | 12, 26. |
| 1912, | 90,000, | 12, 26. |

Total, 527,500

1904-05. Unfit condition of pontoon bridge equipment. Should be thoroughly overhauled and parts rebuilt. Purchase and issue of reconnaissance instruments prescribed by G. O. No. 24, War Department. To entirely fit out all organizations will require \$15,000. 05, 19, 764.

1905-06. Importance of searchlights in both siege and field operations. Proposed to apply

\$15,000 to investigation and to purchase of outfit for experimental tests. 06, 15.

1906-07. Demand for Engineer Field Manual. Decided to prepare a new edition. Numerous repairs to material, purchase of 3 battery and forge wagons, steel pontoon boat, 60 waterproof floats, 2 canvas pontoon covers. 07, 18, 869.

1907-08. 37 chess wagons delivered and distributed, numerous repairs to material on hand, purchase of 1 steel pontoon boat and 1 pontoon tool wagon. 08, 24, 911.

1908-09. Considerable additions made to equipment. 09, 26, 959.

1909-12. Engineer equipment distributed to various military divisions and departments in the U. S. and insular possessions. 10, 30, 1070; 11, 28; 12, 25.

MISC. 41. ENGINEERS, CORPS OF — CIVILIAN ASSISTANTS TO ENGINEER OFFICERS.

(See Misc. 39 on p. 2059 of this index.)

APPROPRIATIONS.

| | | |
|--------|-----------|---------|
| 1905, | \$25,000, | 05, 19. |
| 1906, | 25,000, | 06, 17. |
| 1907, | 25,000, | 07, 19. |
| 1908, | 25,000, | 08, 24. |
| 1909, | 40,000, | 09, 27. |
| 1910, | 40,000, | 10, 31. |
| 1911, | 42,000, | 12, 27. |
| 1912, | 40,000, | 12, 27. |
| Total, | 262,000 | |

1904-07. Est. \$25,000 submitted. 05, 19; 06, 16; 07, 19.

1907-08. Increase in map work, Philippine Division, necessitated a large allotment to the division. Est. \$40,000 submitted. 08, 25; 09, 2

1909-10. Est. \$42,000 submitted. 10, 31.

1910-11. Est. \$40,000 submitted. 11, 3 12, 27.

MISC. 42. TROOPS, ENGINEER — NONCOMMISSIONED OFFICERS OF ENGINEERS.

Chief of Engineers. 08, 8; 09, 8; 10, 9; 11, 5; 12, 5.

1907-08. Recommendation establishing one grade of "Sergeant," first class; two, grades of "Military overseer"; three, each battalion increased by battalion train sergeant and battalion commissary sergeant. 08, 9.

1908-09. Grade of "private, second class," should be changed to "private." There should

be added to each battalion of engineers 1 color sergeant, 1 commissary sergeant, 1 train sergeant and 1 trumpeter-corporal, and to each company 1 sergeants, first class, 2 mechanics, 2 wagoners, farriers, 1 blacksmith, and 1 saddler. Number of sergeants in each company should be increased to 22, corporals to 26, cooks to 4; "privates, first class," reduced to 36, "private" to 54. 09, 10, 9; 11, 5; 12, 5.

MISC. 43. D. C.—BRIDGES—AQUEDUCT BRIDGE.

NOTE.—The piers of this bridge, originally constructed to carry a canal across the Potomac at Washington, D. C., were built between 1835 and 1840, of Potomac R. gneiss, laid in the form of rough rubble masonry, except the ice breakers, which are of cut granite.

In 1868 a floor system and approaches were added and the structure was used as a highway toll bridge until 1886, when the Government purchased it and erected the present superstr. on the old piers.

Shortly after the freshet of June, 1889, pier No. 1 (the first from the Virginia end) was observed to have moved several inches, and defects in other piers were noticed. An ex. and the first repairs of which there is any record were made at that time under the direction of the Commissioners of the District of Columbia, to whose custody the bridge had been transferred.

Examinations by diver and such minor repairs as were found necessary have been made from time to time since under the direction of the Sec. of War.

These exs. have shown that there is in process a gradual deterioration of the masonry of the piers

below the water line. The defects show usually in the form of cavities caused by the dropping out, during freshets, of one or more of the str. in or near the face.

These cavities have usually been repaired by filling them with concrete in bags, deposited by diver. In some instances the repaired portion have been protected by placing riprap in front of them. In 3 of the piers, Nos. 1, 4, and 5, the defects became so serious that this method of repair was impracticable; and new piers have been built to replace the old ones.

The first repairs made under the direction of the War Department were provided for by an act of Congress of Aug. 7, 1894, which app. \$51,070 for this purpose.

Piers 2, 3, 5, 6, 7, and 8 were repaired by the use of concrete in bags, placed by a diver, and repair to pier 4 by the use of a cofferdam were commenced. The total expend. was \$46,379.70. The balance of \$4,690.30, being insufficient to complete the work at pier 4, reverted to the Treasury.

Piers 4, 5, and 1 were subsequently entirely rebuilt under separate apps. of \$65,000, \$65,000 and \$80,000, respectively.

Congress, by joint resolution approved July 1, 1902, enacted as follows:

"That the Secretary of War be, and he is hereby, authorized to spend an amount not exceeding three thousand dollars from the balance of appropriations for the reconstruction of pier numbered four of the Aqueduct Bridge, District of Columbia, for the purpose of the examination of and immediate temporary repairs to the remaining piers of said bridge in cases of need arising from flood or ice."

The act of Congress approved Mar. 2, 1907, making apps. for the expenses of the government of the District of Columbia for the fiscal year ending June 30, 1908, contains the following item:

"And the unexpended balance, amounting to about fourteen thousand dollars, of the appropriations for the reconstruction of piers numbered four and five of said bridge is hereby reappropriated and made available for the periodical examination of the remaining piers of the bridge and making of such repairs as may be found necessary."

The last ex. of the old piers by diver was made during October, 1911, and such defects as were found were repaired in the usual manner, by the use of concrete in bags and the piers left in as good condition as practicable; only a question of time when all of the old piers will have reached a stage when this method will be impracticable, even for temporary repairs.

Tentative plans and ests. have been prepared for a more radical scheme of repair, and soundings and probings have been made to determine the amount of work required.

Ests. for 3 plans for remedying existing conditions submitted in annual report for fiscal year 1910:

A. For complete removal of the present bridge and replacing it with a new one, including new superstr., \$950,000.

B. For complete removal of the remaining 5 old piers and replacing them with new ones and repairing the abutments, using the present superstrs., \$350,000.

C. For thoroughly and permanently repairing the remaining 5 old piers and 2 abutments, using the present superstr., \$150,000.

A possible objection to project C above is that the repairs under this project might detract from the appearance of the bridge. Suggested that the proper committee of Congress might direct the Commission of Fine Arts, established by act of the second session, Sixty-first Congress, to render an opinion. 12, 1310, 1311.

APPROPRIATIONS.

| | |
|--------|---------------------|
| 1895, | \$51,070, 95, 4099. |
| 1896, | 65,000, 96, 3886. |
| 1902, | 65,000, 03, 2483. |
| 1907, | 80,000, 07, 832. |
| Total, | 261,070 |

CONTRACTS.

1903. Penn Bridge Co., reconstr. Pier No. 5, \$54,956. 03, 2484.

1907. Chas. McDermott, reconstr. Pier No. 1, prices listed. 08, 2347.

ENGINEERS.

Chief of Engineers. R., 95, 484; 96, 429; 97, 536; 98, 539; 99, 626; 00, 703; 01, 669; 02, 591; 03, 652; 04, 723; 05, 731; 06, 810; 07, 830; 08, 875; 09, 921; 10, 1033; 11, 1092; 12, 1310.

In charge:

Maj. C. E. L. B. Davis. R., 95, 4085.

Lt. Col. C. J. Allen. R., 96, 3883; 97, 3987; 98, 3571; 99, 3777; 00, 5123; 01, 3637; 02, 2651; 03, 2483.

Col. A. M. Miller. R., 04, 3877.

Lt. Col. S. S. Leach. R., 05, 2603.

Capt. Spencer Cosby. R., 06, 2079; 07, 2271; 08, 2345.

Maj. J. J. Morrow. R., 09, 2301.

Capt. W. T. Hannum. R., 10, 2623.

Lt. Col. W. C. Langfitt. R., 11, 2933; 12, 3455.

Assistant. J. Meigs, jr. R., 01, 3641.

OPERATIONS.

1900-01. Old masonry of Pier No. 4 removed; new pier practically completed. Other piers examined; several in bad condition. Cavities filled with concrete, and protected with riprap. 01, 669, 3637.

1901-02. Remaining work completed. 02, 591, 2652.

1903-04. On Pier No. 5 work started; cofferdam completed; cavities of remaining piers repaired. 04, 723, 3877.

1904-05. Work on Pier No. 5 completed. 05, 731, 2603.

1906-07. Piers 2, 3, 6, 7, and 8 repaired. Plans prepared for reconstr. Pier No. 1. 07, 2271.

1907-08. Masonry work on Pier No. 1 completed; portions above water of other piers pointed. 08, 875, 2345.

1908-09. Repairs to cavities in old piers; reconstr. Pier No. 1 completed. 09, 921, 2301; 10, 1033, 2623; 12, 1310, 3455.

MISC. 44. D. C.—BRIDGES—PRESERVATION AND REPAIR OF CABIN JOHN BRIDGE.

For many years considerable leakage has occurred in the section of the conduit which passes through Cabin John Bridge.

In 1863, when the water-supply system of the District of Columbia was first put in service, the water was not allowed to rise high enough to fill the conduit completely. With the increased consumption of water, however, the elevation of its surface has been raised, until in recent years even the crown of the conduit has been under pressure, due to a head of about 2 feet.

When first used, leakage was observed and the water was drawn off and the lower part of the conduit was plastered. In a "recent" attempt to stop the leaks the upper portion of the conduit was plastered. While this doubtless reduced the leakage, there was still a very noticeable flow through the joints of the lining and the masonry in cold weather. This caused disintegration of some of the masonry and an unsightly appearance as well as a considerable waste of water.

Several cracks developed in the lining of the conduit. These were kept filled with mortar, but continued to open until this feature became so serious that an app. was requested in a report published as Doc. 1329, H. R., 61st Congress, 3d session, for placing a metal lining in the conduit.

An app. of \$35,000 for the preservation and repair of the bridge was contained in the District of Columbia app. act approv. Mar. 2, 1911, \$20,000 of which was made immediately available.

This work, completed in 1912, consisted of a cast-iron lining through the bridge, steel tie rods across both ends, a new roadway, and a reset coping.

The lining is composed of 501 linear feet of cast-iron plates three-fourths inch thick, cast in the form of arcs of an 8' circle 3" wide. Six of these plates form a circle and are bolted to one another

longitudinally and circumferentially through flanges cast on the plates. This form of lining is typical of many tunnel linings, both in this country and abroad, and is the same as was used in the Washington Aqueduct tunnel under Rock Creek.

Between the cast-iron lining and the old brick ring the space was filled with Portland cement grout poured in through holes cut in the bridge paving. On the inside of the ring, where the flanges project 3 inches from the plates, the space was filled with concrete to form a perfectly smooth waterway. Some of this concrete was placed by hand, with forming, and some was placed by use of the cement gun.

Directly beneath this lining at each end of the bridge 6 tie rods of 1½" steel, with turnbuckles, were placed transversely through the bridge to prevent further spreading.

The old brick roadway over the bridge was replaced with one of asphalt blocks by contract for \$2,012.40, and in order to make this surface impervious to water it was treated with Tarvia A and screenings in the usual manner. The coping, which was badly out of alignment, was taken up and reset.

Since the installation of the lining the bridge passed through a very severe winter without leakage. 12, 3463, 3464.

ENGINEERS.

Chief of Engineers R., 11, 1096; 12, 1313.

In charge. Lt. Col. W. C. Langfitt. 11, 2935, 2942; 12, 3463.

Assistants.

Capt. W. T. Hannum, 1911-12.
1st Lt. J. S. Bain, 1912.

MISC. 45. D. C.—HIGHWAY BRIDGE OVER POTOMAC RIVER.

APPROPRIATIONS.

| | |
|-------|---------------------|
| 1901, | \$568,000, 01, 119. |
| 1904, | 428,000, 04, 3880. |
| 1905, | 200,000, 05, 734. |

Total, 1,196,000

CONTRACTS.

1903. Pennsylvania Steel Co., for constr bridge, unit prices listed. 04, 3881.

1904. The Cranford Paving Co., depositing material, 25¢ c. y.; Chas. G. Smith & Son, riprap st., 3,000 c. y., \$1.53 c. y. 05, 2607. Cranford Paving Co., constr. macadam roadway, unit prices listed; Martin McNamara, constr. terra-cotta pipe

sewers, unit prices listed; Penn Bridge Co., constr. concrete-steel arch bridge, prices listed; Potomac Electric Power Co., furnishing, installing, maintaining arc lights on bridge, 6¢ kilowatt hour, \$85 per lamp per year for arc lights. 06, 2085.

1905. Ernest L. Miner, constr. earth embankment approach to highway bridge, 700,000 c. y. earth, 64¢ c. y.

1906. Rudolph S. Blome Co., constr. of paving, etc., on approaches to highway bridge, prices given. 07, 2281.

1907. Sand, Gravel & Supply Co., constr. of macadam roadway on Virginia approach, prices

listed; American Street Lighting Co., lighting bridge, \$20.85 per burner. **07**, 2281; **08**, 2351.

ENGINEERS.

Chief of Engineers. **01**, 119; **02**, 592; **03**, 653; **04**, 724; **05**, 734; **06**, 811; **07**, 832; **08**, 876; **09**, 923.

In charge:

Lt. Col. C. J. Allen. **R.**, **02**, 2651; **03**, 2484.

Col. A. M. Miller. **R.**, **04**, 3879.

Lt. Col. S. S. Leach. **R.**, **05**, 2605.

Capt. Spencer Cosby. **R.**, **06**, 2080; (Maj.) **07**, 2273; **08**, 2347; **09**, 2303.

Board of Engineers.

Au. Sec. of War; constituted to select site to formulate plans, specifications, and ests. for bridge. Submitted **R.** Oct. 25, 1901.

OPERATIONS.

1902-03. Preparatory work. **03**, 2484.

1903-04. Constr. work commenced; considerable progress made in excavation, pile driving, and cofferdam constr. Work on steel for superstr. started in mills and shops. **04**, 725, 3879.

1904-05. Substr. and superstr. practically completed; embankment for Washington approach now completed; work started on Virginia approach. **05**, 733, 2605.

1905-06. Bridge opened to traffic Feb. 12; on Washington approach work done toward in-

stallation of drainage and electric-light systems, etc. Work started on a reinforced concrete arch bridge across Washington Chan. **06**, 813, 2080.

1906-07. All Government work in connection with constr. of highway bridge practically completed, except minor details, as placing lamps, finishing macadam road, etc. **07**, 835, 2273.

1907-08. Macadam roadway on Virginia approach completed; small tool house erected; erection of lamp-posts, etc.; other misc. work. **08**, 2348. A standard underground electric railway system installed by the Washington, Alexandria & Mount Vernon Ry. Co. from foot of 14th Street to plow pits. From plow pits to north end of bridge an overhead trolley system with ground return, is in use and legislation au. the permanent retention of this system is pending before Congress. **08**, 877.

1908-09. Transferred to Public Buildings and Grounds. **09**, 2303.

PROJECTS.

Act Feb. 12, 1901, au. Sec. of War to contract with Baltimore & Potomac R. R. Co. or others to build within 2 years at point not less than 500' above site of "present" long bridge a new switch drawbridge for highway travel. **01**, 119.

Board submits 2 designs—No. 1, \$575,000; No. 2, \$996,000. Favors No. 2. Plans given in detail (H. D. No. 138, 57th Cong., 1st sess.). **02**, 2652.

MISC. 46. D. C.—BRIDGES—HIGHWAY BRIDGE OVER POTOMAC RIVER—MAINTENANCE AND OPERATION.

APPROPRIATIONS.

| | |
|----------------|---------------------------|
| Mar. 3, 1905, | \$7,000. |
| June 27, 1906, | 11,600, 06 , 814 |
| Mar. 2, 1907, | 16,000, 08 , 2351. |
| May 26, 1908, | 16,000; 08 , 2351. |
| Mar. 3, 1909, | 16,000, 09 , 2303. |
| Total, | 66,600 |

ENGINEERS.

Chief of Engineers. **R.**, **06**, 818; **07**, 835; **08**, 877.

In charge. Capt. Spencer Cosby. **R.**, **06**, 2082; **07**, 2277; **08**, 2349.

OPERATIONS.

1905-07. Repairs of minor nature; tools and supplies purchased; lockers and shelters constr.; riprap placed along foot of slopes. **06**, 2083; **07**, 2277.

1907-09. Repairs to various parts of the operating machinery; steelwork repainted, etc. **08**, 2350; **09**, 2303.

1908-09. Repairs made to fender system of highway bridge and portions of ironwork painted. **09**, 930, 2355; **11**, 2986; **12**, 3507.

MISC. 47. D. C. — BRIDGES — MEMORIAL BRIDGE ACROSS POTOMAC RIVER.

APPROPRIATION.

1899, \$5,000.

Chief of Engineers. R., 98, 540; 99, 42, 627;
00, 43, 704; 01, 670; 02, 591; 03, 653.

Board of Engineers. BE. and of architects
upon certain designs for a memorial bridge across
Potomac R. from Washington, D. C., to Arlington,
Va., ordered by act of Feb. 5, 1900. R., 00, 5126.
(Lt. Col. C. J. Allen, Maj. T. W. Symons, Capt.

D. D. Gaillard, and Stanford White and Jas.
Hill.)

In charge. Lt. Col. C. J. Allen. R., 98, 35
99, 3777; 00, 5125; 01, 3648; 02, 2652; 03, 2434

Designers and architects: W. H. Barr, W.
Hutton, L. L. Burk, and G. S. Morison. R., 0
5146.

OPERATIONS.

Nothing ever done toward the constr. of the
bridge.

MISC. 48. D. C.—BRIDGES—BRIDGE ACROSS POTOMAC AT FOOT OF SOUTH CAPITOL STREET.

ENGINEERS.

Chief of Engineers. R., 96, 430.

In charge. Maj. C. E. L. B. Davis. R., 96,
3590.

SURVEYS.

Survey plan and est. called for, through Sec.

of War, by act Mar. 2, 1895, for a bridge from the
foot of South Capitol St., or below it, across Eastern
Branch of the Potomac, with recom. Made by
Maj. Davis. Most suitable location found to be
at the foot of First St. SW.; est., \$779,130; but
"no such bridge should ever be permitted to be
built." H. D. 163, 54th, 1st.

MISC. 49. D. C.—BRIDGES—ACROSS EASTERN BRANCH OF THE POTOMAC, IN LINE OF MASSACHUSETTS AVENUE EXTENDED.

ENGINEERS.

Chief of Engineers. R., 98, 541.

In charge. Lt. Col. C. J. Allen. R., 98, 3598.

SURVEYS.

R. required by act Feb. 17, 1897, submitted
Nov. 29, 1897. By Col. Allen. Steel truss bridge

on masonry piers proposed; decked, except where
it crosses the Baltimore & Potomac R. R. Plan
submitted for fixed spans and total length of 2,51
and width of 52'; est., \$441,208. Est., including
draw, \$476,843; necessity of draw not apparent
H. D. 140, 55th, 2d.

MISC. 50. D. C.—BRIDGES—ROCK CREEK BRIDGE IN LINE OF MASSACHUSETTS AVENUE EXTENDED.

APPROPRIATION.

Mar. 3, 1897, \$2,000, 98, 541.

ENGINEERS.

Chief of Engineers. R., 98, 541.

In charge. Capt. D. D. Gaillard. R., 98,
3606.

SURVEYS.

Act Mar. 3, 1897, au. Chief of Engineers to report
plans and cost of erecting st. arch bridge, also
steel bridge with st. foundations, over Rock Creek
on line of Massachusetts Ave. extended. Co
(Vols.) Gaillard submitted designs and est. for
bridge, \$568,545; steel bridge, \$199,204. St. bridge
deemed better. H. D. 163, 55th, 2d.

MISC. 51. D. C.—BUILDINGS—EXTENSION OF BUILDINGS BEYOND THE BUILDING LINES IN THE CITY OF WASHINGTON (1900-1912).

1900-01. Act of Congress approved Mar. 3, 1891, provides that no permits shall thereafter be granted for the extension of buildings beyond the building line except with the concurrent approval of the Sec. of War.

436 applications referred to War Department and reported on. **01**, 3725.

1901-02. 515 applications referred to War Department. **02**, 2745.

1902-03. 486 applications referred to War Department. **03**, 2570.

1903-05. 515 applications referred to War Department. **04**, 3957; **05**, 2661.

Approval of Sec. of War only on applications for protection to buildings on private lots adjoining public reservations, act June 21, 1906. **06**, 2150; **07**, 2343; **08**, 2416; **09**, 2367; **10**, 2682; **11**, 2995; **12**, 3518.

MISC. 52. D. C.—BUILDINGS—ENGINEER SCHOOL.

APPROPRIATIONS.

| | | |
|----------------|-----------|-------------------|
| June 30, 1902, | \$500,000 | 03 , 2935. |
| Mar. 2, 1903, | 360,000 | |
| Mar. 2, 1905, | 150,000 | 05 , 2826. |
| Mar. 2, 1907, | 32,500 | 07 , 2474. |
| July 25, 1912, | 100,000 | 12 , 29. |
| Total, | 1,142,500 | |

CONTRACTS.

List of. **03**, 2936; **04**, 4196; **05**, 2831.

ENGINEERS.

Chief of Engineers. **R.**, **03**, 675; **04**, 740; **05**, 748; **06**, 829; **07**, 860; **08**, 900; **09**, 946; **10**, 1057; **11**, 31; **12**, 28.

In charge. Capt. J. S. Sewell. **R.**, **03**, 2931; **04**, 4183; **05**, 2826; **06**, 2259; **07**, 2474; **08**, 2555.

OPERATIONS.

1902-03. Work begun; excavation well advanced on 2 mess-hall and kitchen buildings;

foundations for band, barracks, also officers' quarters under way, etc. **03**, 675, 2934.

1903-04. Work well advanced on the quartermaster and commissary storehouse, and on foundations of engineer storehouse and bachelors' quarters for officers. **04**, 741, 4191.

1904-05. Following buildings completed and occupied: 13 sets of officers' quarters, the officers' mess, 1 barrack building for 2 companies, 1 band barrack, 2 mess-hall buildings, 1 quartermaster and commissary storehouse, 1 new stable, and 1 new wagon shed. **05**, 748, 2825.

1905-06. Various buildings completed in addition to above. **06**, 829, 2259; **07**, 2474; **08**, 2555; **09**, 946; **10**, 1057.

Allotment \$100,000 for constr. at Engineer School of building with library accommodations and other facilities. **12**, 28.

MISC. 53. D. C. — GOVERNMENT PRINTING OFFICE ERECTION.

APPROPRIATIONS.

| | | |
|---------------|-----------|-------------------------------|
| Mar. 3, 1899, | \$350,000 | |
| June 6, 1900, | 775,000 | 01 , 686. ¹ |
| Mar. 3, 1901, | 1,304,000 | |
| Total, | 2,429,000 | |

CONTRACTS.

List. **01**, 3821; **02**, 3068; **03**, 2924; **04**, 3861.

ENGINEERS.

Chief of Engineers: **01**, 687; **02**, 611; **03**, 673; **04**, 739; **05**, 747.

In charge. Capt. J. S. Sewell. **R.**, **01**, 3801; **02**, 3065; **03**, 2919; **04**, 3819, 4179; **05**, 2823.

OPERATIONS.

1900-01. Act Mar. 3, 1899, au. constr. of a fireproof building for use of Government Printing Office, cost not to exceed \$2,000,000; increased by resolution Congress, Feb. 17, 1900, to \$2,429,000. Mr. J. G. Hill appointed architect.

Actual work commenced; old buildings removed from site. At close of year foundations, steelwork, and underground drains practically completed

¹ \$19,163.33 deposited in U. S. Treas.

walls built to second floor; power-house extension under roof; 80% of plans and drawings completed. **01**, 686, 3801, 3822.

1901-02. Steelwork entirely finished; fireproofing entirely completed; exterior walls finished; interior partitions about 80% finished; nearly all door and window frames in place; roof weather tight and half finished; beginning made on plastering and leveling up floor arches, etc. **02**, 611, 3065.

1902-03. Building practically completed; details of work done. **03**, 673, 2921.

1903-04. Entirely completed and turned over to the Public Printer. **04**, 739, 3819, 4179.

Technical details. **04**, 3819.

MAPS, PLANS, SKETCHES, ETC.

Plans, architect's pen sketch of proposed building; typical floor plan, elevation on North Capitol St.; elevation on G St. **01**, 3822; **04**, 3860.

Photographs, excavation, concreting of pier underpinning at laundry, column covering, floor covering, girder covering, general view from southeast corner, under view of fireproofing. **01**, 3804, 3860.

Sketch, framing plan, second and upper floor typical fireproofing details; steelwork, first floor steelwork, 2d, 3d, 4th, 5th, 6th, and 7th floor foundation and drainage plan. **04**, 3860.

Steelwork cross section main building; general detail of exterior and section wall; general method of piping for plumbing fixtures. **04**, 3860.

Photographs, general view of steelwork; work block floor in process of construction; seventh floor after work was practically completed; new building entirely completed. **04**, 3861.

MISC. 54. D. C. — BUILDINGS — ABRAHAM LINCOLN HOUSE, ETC. (1901-1912).

(See Misc. 65 on p. 2072 of this index.)

Inspections made from time to time in connection with their care, repair, and safety. **01**, 675, 3696; **02**, 596, 2723; **03**, 659, 2527; **04**, 3909; **05**, 2626; **06**, 2118; **07**, 2309; **09**, 2352; **10**, 2677; **11**, 2983; **12**, 1321, 3505.

Misc. repairs to Abraham Lincoln House. Work of replacing old boiler at Ford's Theater Building. **06**, 2119; **07**, 2309; **08**, 2381.

MISC. 55. D. C.—BUILDINGS—ARMY WAR COLLEGE.

APPROPRIATIONS.

June 30, 1902, \$400,000, **03**, 2932.

Apr. 23, 1904, 300,000, **04**, 4194.

Total, 700,000

CONTRACTS.

Various contracts. **03**, 2933; **04**, 4195; **05**, 2829; **06**, 2269.

ENGINEERS.

Chief of Engineers. **R.**, **03**, 675; **04**, 740; **05**, 748; **06**, 828; **07**, 859; **08**, 899; **09**, 946; **10**, 1057; **11**, 31.

In charge:

Capt. John S. Sewell. **R.**, **03**, 2931; **04**, 4183; **05**, 2825; **06**, 2259; **07**, 2473.

Lt. Col. W. C. Langfitt. **R.**, **08**, 2555.

OPERATIONS.

1902-03. Designs completed; northeast cornerstone laid; foundations at west end practically completed; sewer completed. **03**, 674, 2931.

1903-04. Foundations finished; main walls completed; about 40% terrace work completed. **04**, 740, 4193.

Technical details giving various methods used in construction. **04**, 3866.

1904-05. Terrace of building 80% complete building itself up to second-floor level. **05**, 74 2827.

1905-06. Terrace of War College Building 95% completed; building itself 85% complete. **06**, 829, 2267.

1906-07. Work entirely finished, and accounts settled up. **07**, 859, 2473.

MAPS, PHOTOS., ETC.

Plan showing layout of buildings and ground method of reinforcing an inadequate concrete. **04**, 3869.

Photographs: View of experimental pile at point; view of experimental pile exposed on one side; view showing method of building brick wall on concrete foundation; view of concrete piles in trench. **04**, 3869. Exterior view, main entrance to War College and Engineer post grounds. **04**, 4190.

Sketch, plan showing layout of buildings and grounds. **06**, 2268.

MISC. 56. D. C. — EXECUTIVE MANSION (WHITE HOUSE).

(For details prior to 1901, see Misc. 65 on p. 2072 of this index.)

1900-01. Usual care and repairs. Old water-supply, waste, and soil pipes replaced by new ones. Private dining room repapered, redecorated, and repainted; also main corridor, and other apartments, north and south porticos repainted. Automatic fire-alarm system placed in attic; new carpets, furniture, and furnishings purchased. Plans, with est. of cost, \$1,136,960, for extending mansion prepared in accordance with congressional action. Conservatory repaired and repainted; repairs to greenhouses and stable. **01**, 675, 3690, 3728.

Inventory of public property in the Executive Mansion. **01**, 3736.

Address of Col. T. A. Bingham, relative to extending Executive Mansion. **01**, 3754.

1901-02. Misc. repairs, etc. Remodeling mansion and building separate office building for the President. **02**, 596, 2720.

Inventory of public property. **02**, 2754.

Notes on the chrysanthemum by Geo. H. Brown, landscape gardener. **02**, 2761.

1902-03. Executive Mansion remodeled, redecorated, and refurbished, an addition to it built; the conservatory and greenhouses formerly attached to the mansion torn down, and five of the greenhouses reerected at the propagating gardens. Separate office building erected; extensive improvements to grounds. **03**, 658, 2519.

Inventory of public property. **03**, 2582.

1903-04. Exterior Executive Mansion and interior President's Office building painted; imp. and repairs in mansion and imp. about grounds; extensive imp. and repairs about the President's stables. Additional greenhouse built. **04**, 730.

Inventory of public property. **04**, 3970.

1904-05. Misc. repairs; 3 additional greenhouses built. **05**, 738, 2622.

Inventory of public property. **05**, 2674.

1905-06. Misc. painting, imp. in electric wiring, 2 additional greenhouses constr., and 2 new cold frames constr. **06**, 820, 2113.

Inventory of public property. **06**, 2164.

1906-07. Extensive repairs and betterments. Work commenced for repainting entire exterior; additional fire protection installed, new pavement laid, etc. **07**, 841, 2300.

Inventory of public property. **07**, 2358.

1907-08. Considerable painting; new water-tight covering placed upon roof of east terrace; repairs at President's stables and to greenhouses, boilers, and heating pipes. **08**, 885, 2377.

Inventory of public property. **08**, 2430.

1908-09. Misc. repairs in and about mansion; furniture cared for; repairs to Executive Office building, President's stable, and to greenhouse structures and their heating apparatus. **09**, 929, 2332.

Inventory of public property. **09**, 2378.

1909-10. Misc. repairs; considerable painting. Additional accommodations to President's Office by erection of addition to original building; old building remodeled. **10**, 1041, 2654.

1910-11. Misc. repairs; painting; furniture regularly cared for; silver closet built; lightning rods taken down; new system of protection from lightning installed; partition built in President's Offices; other misc. work. **11**, 1103, 2961.

1911-12. Misc. repairs and painting; President's stable torn down; accommodations provided in stables of Quartermaster's Department; frame building in rear of stables moved to propagating gardens; repairs to greenhouse structures. **12**, 1319, 3483.

MISC. 57. D. C.—“FLATS”—ANACOSTIA RIVER, D. C.

The Anacostia R. rises in Prince George County, Md., and, flowing 20 m. in a southwesterly direction, joins the Potomac R. in the District of Columbia.

The portion included in this proj. extends from Anacostia Br., District of Columbia, upstream 5 m. to the District line. It is subject to a mean tidal oscillation of 3' and a max. rise during freshet to about 12' above m. l. w.

The chan. has not been imp. by the United States.

A report on ex. of the Anacostia R. by S. T. Abert in 1875 states that “in 1835 vessels carrying

100 hogsheads of tobacco, or about 60 tons, were able to load at Bladensburg,” but no record of the exact depth at that time is available. In 1862 the min. chan. d. was 18' at m. l. w. at Anacostia Br., 12' at the Philadelphia, Baltimore & Washington br., and 3' at Benning Br. In 1891 the min. chan. d. was 15' at m. l. w. at Anacostia Br., 12' at the Philadelphia, Baltimore & Washington R. R. br., 8' at Benning Br., and 3' at the District line. The “present” min. chan. ds. are about the same, except near the District line, where the min. d. is now about 2' at m. l. w.

The channel is narrow and winding, and between

the chan. and the banks are extensive flats and marshes which are alternately exposed and flooded by tidal action.

In summer the flats are covered with a rank growth of aquatic plants, which prevent a rapid cleansing movement of the tide and causes deposits of mud and filth. The meadows, which are above ordinary h. w. level, are flooded at varying intervals, whenever the water is raised by flood or easterly winds above normal level, and every depression retains a stagnant pool, a condition most favorable for the development of malaria.

The acts making app. for this work approv. Mar. 3, 1911, and June 26, 1912, have provided that the money—

“be expended under the supervision of the Chief

of Engineers, United States Army, upon plan to be prepared under the direction of, and to approved by, a board of engineers to consist the Engineer Commissioner of the District of Columbia; the officer in charge of public buildings and grounds, and the engineer officer in charge the improvement of the Potomac River; said sum to be available for the preparation of plans, the prosecution of the work, the employment of personal service, and for such other purposes as may in the judgment of said board be necessary carry out the purposes of this appropriation.”

Necessary surveys made; proposed to expend available funds in dr. and constr. of R. walls the vicinity of Pennsylvania Ave. Br. and the line of Massachusetts Ave. extended.

References to examination or survey reports and maps or plans not in project documents.

| Section covered. | Congressional documents. | | | | Annual report of Chief of Engineers. | |
|--|--------------------------|-----|-------------------|------------|--------------------------------------|------|
| | House or Senate. | No. | Congress. | Session. | Year. | Page |
| Bladensburg to navy yard ¹ | House... | 94 | Forty-fourth.... | First..... | 1876 | 3 |
| Do. ¹ | | | | | | |
| Bladensburg to mouth ² | House... | 30 | Fifty-second.... | First..... | 1892 | 10 |
| Do. ¹ | | | | | | |
| Bridge in line with Massachusetts Avenue. ² | House... | 140 | Fifty-fifth..... | Second.... | | |
| Bladensburg to mouth ² | do.... | 87 | do..... | Third..... | 1899 | 14 |
| Do. ¹ | | | | | | |
| District of Columbia line to Philadelphia, Baltimore & Washington R. R. Branch. ² | Senate... | 166 | Fifty-seventh.... | First..... | | |
| Report as to title to riparian lands ² | House... | 194 | Fifth-ninth..... | do..... | | |
| Do. ¹ | Senate... | 402 | Sixty-first..... | Second.... | | |
| Do. ² | do.... | 19 | Sixty-second.... | First..... | | |

¹ No maps.

² Contains maps.

The board of officers constituted by the act approv. Mar. 2, 1911, consisted of Lt. Col. W. O. Langfitt, Corps of Engineers, U. S. Army, in charge of the imp. of the Potomac R.; Lt. Col. W. V. Judson, Corps of Engineers, U. S. Army, Engineer Commissioner of the District of Columbia; and Col. Spencer Cosby, U. S. Army, in charge of public buildings and grounds. The board recom. a complete proj. for the work, conforming in general with the scheme of development outlined in the report of the Park Commission (R. of Senate Committee on the District of Columbia, S. No. 166, 57th, 1st) and approv. by the Commission of Fine Arts.

The general features of the proposed proj. are: (a) The constr. of a dam, with lock and necessary appurtenances, on the line of Massachusetts Ave., to maintain the pool above at a normal elevation of about 8' above m. l. w. (b) The constr. of river walls between Anacostia Br. and the dam, with top of walls at elevation of 8' above m. l. w. (c) Dr. section of R. between Anacostia Br. and the

dam. (d) The constr. of low walls or gravel beach around the basin from the dam to the District of Columbia line. (e) Dr. section of R. between the dam and the District of Columbia line. (f) The depth of dr. to be such that the excavation and fill will approx. balance. (g) That draw spans be required in Pennsylvania Ave., Pennsylvania Baltimore & Washington R. R., and Benning Brs., available width to be 100', as in the present Anacostia Br. (h) That the H. lines above Anacostia Br. be abolished and the bulkhead line just below Anacostia Br. be modified as indicated on map.

Est. cost of the reclamation, \$2,046,100.

The operations during 1912 included a comprehensive study of the situation, including topographical and hydrographic surveys, investigation of stream flow and sedimentation, flood conditions and sewage pollution.

Plans were in progress for beginning work on constr. with Government plant.

The total amount expended on the existing proj. to June 30, 1912, was \$10,115.56.

12, 1342, 1343.

The District of Columbia app. act of July 1, 1902, app. \$5,000, to be expended under the direction of the Sec. of War for making a survey and outline map of land owned by the U. S. within what is known as the flats of the Anacostia R. from its mouth to the boundary line of the District of Columbia, and au. and directed the Attorney General to report upon the nature of title to lands embraced within said flats. Survey made, and R. thereon by Lt. Col. Chas. J. Allen, Corps of Engineers, dated Feb. 17, 1903, with maps, transmitted to the Attorney General with a view

to ex. and report pursuant to the law. 03, 36; 04, 19; 05, 20. H. D. No. 194, 59th, 1st. 06, 18.

APPROPRIATIONS.

| | |
|----------------|--------------------|
| July 1, 1902, | \$5,000, 03, 36. |
| Mar. 2, 1911, | 100,000, 12, 3564. |
| June 26, 1912, | 100,000, 12, 3564. |
| Total, | 205,000 |

ENGINEERS.

Chief of Engineers. R., 03, 36; 04, 19; 05, 20; 06, 18; 12, 1342.

Boards. See above.

In charge. Lt. Col. W. C. Langfitt. R., 12, 3563.

MISC. 58. D. C.—LOTS, SALE OF—INTERSECTION OF K AND SIXTEENTH STREETS.

ENGINEERS.

Chief of Engineers. R., 81, 335.

Act Mar. 3, 1881, an. sale of lots. Appraisement

made by 3 residents of Washington, D. C. Sales made to Messrs. Cook, Dickson, King, Boynton, et al. Total received, \$7,452. 81, 335, 336.

MISC. 59. D. C.—MEMORIALS — M'MILLAN MEMORIAL FOUNTAIN.

The sundry civil act approv. June 25, 1910, for the fiscal year 1911, contained the following item:

"For the preparation of the site, approaches, walks, foundation, and piping for the fountain to be erected in McMillan Park, in the District of Columbia, by the James McMillan Memorial Association of Michigan, \$15,000."

By arrangement with the Commissioners of the District of Columbia the work provided for was performed under the officer in charge of the Washington Aqueduct, the site for the fountain being under control of the latter officer.

The work was completed during 1910-11, except the constr. of the granite work, under contract for \$8,400, and which was finished in 1912.

No work done in 1911-12 on the ground toward the erection of the fountain by the James McMillan Memorial Association of Michigan; expected to be done during the following year.

APPROPRIATIONS.

See above.

ENGINEERS.

Chief of Engineers. R., 11, 1102; 12, 1318.

In charge. Lt. Col. W. C. Langfitt. R., 11, 2956; 12, 3467.

Assistants:

Capt. W. T. Hannum. 11, 1094; 12, 1311.

1st Lt. J. J. Bain. 12, 1311.

¹ App. by D. of C.

MISC. 60. D. C. — MONUMENTS — WASHINGTON MONUMENT (1901-1912).

(For prior details, see Misc. 65 on p. 2072 of this index.)

1900-01. Usual care; addition to boiler house constr.; new electric elevator installed. Work of stiffening tie-rods of iron columns within which elevator car runs completed, and the 70-volt lamps in shaft replaced with lamps of 110 volts. **01**, 3696, 3728.

1901-02. Usual care required for mainten. Painting ironwork in the interior, running new electric-light wires, and replacing 70-volt lamps with lamps of 110 volts. **02**, 597, 2723.

1902-03. Misc. work of painting, carpentry, plumbing, etc. **03**, 658, 2527.

1903-04. Struck by lightning; slight damage to motor room. **04**, 3910.

1904-05. New hoisting cables, new counter-weight cables, new controller cable installed; two new 80-horsepower boilers purchased and placed. Reception room constr. on lower floor; iron folding gates and revolving door placed at entrance. **05**, 738, 2628.

1905-06. Interior ironwork painted. **06**, 820, 2120.

1906-07. 2 steel arms put in for equalizing the unequal expansion of the cables of the elevator and usual care extended to shaft and machinery connected therewith. **07**, 841, 2310.

1907-08. New cast-iron sheaves placed at top for cables; new governor gears and shaft put in place on cable drum of elevator. Misc. repair made about the shaft, the power house, and lodge house. **08**, 886, 2383.

1908-09. New cable placed; wooden sheathing replaced with tile; engines in power house overhauled and repaired. **09**, 930, 2347.

1909-10. Woodwork in motor room repaired and necessary painting done. Painting also done at lodge house and minor repairs to machinery in power house. **10**, 2672.

1910-11. Terrazo floor laid in waiting room at lodge house, wainscoting constr. around room changes made in heating pipes, plumbing remodeled, etc. **11**, 1104, 2880.

1911-12. Iron and woodwork in shaft painted and new sash made and painted for windows at top. **12**, 1321.

MISC. 61. D. C.—PARKS, PUBLIC RESERVATIONS, ETC (1901-1912).

(See Misc. 65 on p. 2072 of this index.)

1900-01. Total area of parks, 407.21 acres. **01**, 3701.

At the propagating gardens necessary repairs made to greenhouse structures, additional propagating house constr., frame work of one of the greenhouses rebuilt, new office building erected, and grounds around it improved; some old iron fencing erected, part of Fifteenth St. roadway graded, etc. About 984,000 plants propagated for stock and park decoration. **01**, 675, 3715, 3730.

Usual care extended to improved parks and park places. 20 of the small unimproved reservations, containing 2.91 acres, brought to the first stage of improvement, and 3 of the small improved reservations further improved. Marking sts. placed at corners of 70 reservations, and Truxtun Circle highly improved. New entrance constr. to one of the main roadways in the monument grounds. Asphalt pavements in parks extended by constr. of 2,410 sq. y. of asphalt footwalk, 240 sq. y. of asphalt roadway and 455 sq. y. asphalt footwalk repaired and resurfaced. **01**, 676, 3723. 56' cobblestone gutter constr., and 438' drainpipe and 1,092' water pipe laid. **06**, 675, 3700.

Damages to Executive Mansion grounds by fire to inaugural stands. Recom. that refusal be made to allow erection in future or committees

be required by law to give bonds and guaranty **01**, 3704. Data relating to principal city park in the U. S. **01**, 3711. Occupancy of reservation by committee on inaugural ceremonies. **01**, 3715 Plan for improving section s. of Pennsylvania Ave. and n. of B St. S.W. and for a suitable connection between Potomac and Zoological Parks Printed in Doc. No. 135, H. R., 56th, 2d. s. **01** 3719, 3729.

1901-02. Repairs to greenhouses; plant house constr.; greenhouses remodeled and rebuilt; 784,000 plants propagated; 22,000 c. y. earth received and spread in propagating gardens. Asphalt pavements in parks extended by constr. of 1,401 sq. y. footwalk; 1,663 sq. y. repaired and resurfaced 561' iron drainpipe and 1,959' water pipe laid 148' st. curb laid; cobblestone gutter, cinder foot walk, board footwalk constr., posts and fence painted. **02**, 597, 2726.

1902-03. Mainten. and care of parks and improved places; part of Potomac Park extensively improved by grading; constr. a macadam roadway, etc. In various parks curb set, fountains erected, asphalt pavements extended, footwalk asphalt roadway repaired and resurfaced. At propagating gardens necessary repairs made; over

1,000,000 plants propagated. **03**, 659, 2531. Recom. for increased schedule of pay for park watchmen. **03**, 2536. 36th national encampment of the G. A. R. permits granted. **03**, 2549. Notes on public playgrounds, etc., by Geo. H. Brown, landscape gardener. **03**, 2666. Notes on Codium by Geo. H. Brown. **03**, 2669.

1903-04. Misc. work of mainten. (as described in former years); reservations relinquished to eliminate grade crossings and provide for constr. of a union railroad station; list given. **04**, 3913. Coping constr., sod laid, trees and shrubs planted, baseball diamond laid off, band concerts held, work on Potomac Park in progress, asphalt pavement constr., etc. **04**, 3924. Over 1,000,000 propagated. **04**, 3943. Notes on historic trees of Washington. **04**, 4046; **05**, 738, 2631; **06**, 820, 2122; **07**, 841, 2312.

1904-05. Use of Monument Grounds by American Railway Appliance Exhibition. **05**, 2654. Description of rare tropical plants. **05**, 2756. List of trees and shrubs in some of the public parks. **05**, 2757.

1905-06. Report on "The City Parks and Park Places" by Geo. H. Brown, landscape gardener. **06**, 2238.

1906-07. Constr. of macadam roadway along the n. and w. sides of tidal reservoir in Potomac Park. **07**, 2328.

1907-09. Additional spaces transferred, reservations imp., work of imp. E. Potomac Park completed, cement coping constr., gravel roadway in President's Park resurfaced, Garfield Park remodeled, asphalt walk repaired, etc. **08**, 886, 2385; **09**, 930, 2335. At propagating gardens, various greenhouse structures repaired; 690,000 plants propagated. **09**, 930, 2349.

1909-12. Usual care and mainten. work; macadam driveway along North B St. completed; work for imp. interior portion Potomac Park accomplished; coping constr.; walks laid; gravel road resurfaced. **10**, 1041, 2658. Over 680,000 plants propagated. **10**, 2676; **11**, 1103, 2965; **12**, 1320, 3486. Over 670,000 plants propagated. **12**, 1321, 3503.

MISC. 62. D. C.—PARKS—LIGHTING (1900-1912).

(See Misc. 65 on p. 2072 of this index.)

1900-01. Lights in parks and grounds maintained in good condition, minor repairs made, and old lanterns replaced. **01**, 3722; **03**, 2567; **04**, 3953; **05**, 2659; **06**, 2147; **08**, 2409; **09**, 2352; **11**,

2973. New improved system of lighting parks adopted and installation nearly completed. **12**, 1320.

MISC. 63. D. C.—PARKS—POTOMAC PARK (1908-1912).

1908-09. Mainten. of imp. portions, grading, macadam roadway, cinder footwalk, drainpipe laid, etc. **09**, 2355; **10**, 2669. Monument grounds;

misc. work of filling fishponds, roadway constr., cinder paths laid, etc. **10**, 2673; **11**, 2978; **12**, 3501.

MISC. 64. D. C.—FISHWAYS AT GREAT FALLS.

APPROPRIATIONS.

1882, \$50,000, **83**, 339, 2092; **87**, 2565.
1888, 25,000, **88**, 312, 2766.
1892, 15,000, **93**, 4310.
Total, 90,000

CONTRACTS.

J. E. Lyons, fishway constr. **85**, 2500.
1891. T. Hathaway, constr. of fishways, \$31,908. **91**, 3906.

ENGINEERS.

Chief of Engineers. **R.**, **83**, 339; **84**, 344; **85**, 374; **86**, 368; **87**, 335; **88**, 312; **89**, 380; **90**, 348; **91**, 443; **92**, 417; **93**, 479; **94**, 435; **95**, 489.

In charge:

Maj. G. J. Lydecker, 1883-89. **R.**, **83**, 2092; **84**, 2311; **85**, 2499; **86**, 2061; **87**, 2564; **88**, 2766.
Col. J. M. Wilson, 1889-90. **R.**, **89**, 2825.

Lt. Col. G. H. Elliot, 1890-92. **R.**, **90**, 3532; **91**, 3905; (Col.) **92**, 3382; **93**, 4310; **94**, 3224.

Maj. J. G. D. Knight. **R.**, **95**, 4114.

Assistant. Capt. T. W. Symons. **R.**, **84**, 2312; **85**, 2500; **86**, 2063.

OPERATIONS.

1885-86. Work upon fishways commenced under contract, but abandoned after destruction of unfinished portion by flood. **86**, 2061.

1886-87. Reconstr. of dam. **87**, 2564.

1891-92. Fishways in process of constr. **92**, 3382.

PROJECT.

By Maj. Lydecker, 1883, for erection of fishways at Great Falls of the Potomac R.; est., \$34,160.19; **85**, 2499; **87**, 2565.

SURVEYS.

Maps. **84**, 2321, 2336.

MISC. 65. D. C.—PUBLIC BUILDINGS AND GROUNDS.

(See Misc. 43-84 on p. 2039-2040 of this index.)

NOTE.—In addition to care, etc., of public grounds and buildings, the office was charged at 1900 with—

Care and repair of the Government telegraph lines connecting the Capitol with the various departments and the Government Printing Office.

Repair and imp. of the Government Printing Office.

Repair of the building on Tenth St. NW., where Abraham Lincoln died.

Constr. of the statue of Gen. J. A. Logan.

Care of such matters connected with the erection of the statue of Gen. Sherman as properly devolved upon the War Department.

Care of the monument at Wakefield, Va., the birthplace of Washington.

Care of the iron-pile dock erected under the supervision of the office in 1894, under the direction of the Department of State, at the mouth of Bridge Creek, Va.

The erection in the National Military Park at Gettysburg, Pa., of the memorial tablet to Abraham Lincoln.

Preservation, care, and safety of buildings occupied by the War Department in the District, except State, War, and Navy Department Building.

Care of the banks of the Potomac R. from the n. line of the Arsenal grounds to the s. curb line of N St.

The work, since June 15, 1900, of continuing plans for extending the Executive Mansion.

The work, since June 20, 1900, of making an ex. and reporting plans for the treatment of that section of the District situated s. of Pennsylvania Ave. and n. of B St. SW., and for a suitable connection between the Potomac and Zoological Parks.

At 1912 the various duties assigned to the officer in charge of public buildings and grounds were as follows:

Mainten., care, and repair of the Executive Mansion, grounds, and greenhouses. (See Misc. 56.)

Imp., policing, care, and mainten. of various parks and reservations in the District of Columbia. (See Misc. 61.)

Imp., care, and mainten. of the portion of Potomac Park w. of the R. R. embankment.

Care and mainten. of the Washington National Monument. (See Misc. 60.)

Care and mainten. of the propagating gardens.

Care of the building No. 516 Tenth St. NW., where Abraham Lincoln died. (See Misc. 54.)

The preservation, care, and safety of buildings occupied by the War Department in the District of Columbia, except State, War, and Navy Department Building.

Care and repair of the Government telegraph line connecting the Capitol with the various departments and Government Printing Office. (See Misc. 72.)

Care and mainten. of the highway bridge across the Potomac R., D. C. (See Misc. 43-50.)

Furnishing and planting trees, shrubs, etc., the grounds of the Library of Congress, of Capitol, and of executive departments.

The immediate charge of the banks of the Potomac R. from the n. line of the arsenal (of Washington Barracks) grounds to the s. curb line N St. SW. (See Misc. 61-63, 66-67, 84.)

Care of the monument at Wakefield, Va., birthplace of Washington, and the iron-pile dock at the mouth of Bridge Creek, Va.

The duties of executive and disbursing officer of the following commissions:

Grant Memorial Commission.

Barry Statue Commission.

John Paul Jones Statue Commission.

Columbus Memorial Commission.

Lincoln Memorial Commission.

In charge of the monument at Fredericksburg, Va., to the memory of Gen. Hugh Mercer.

Member of the commission created by the pub. buildings act approved May 30, 1908, to cause plans and ests. to be prepared for a suitable armory for the National Guard of the District of Columbia.

Secretary, executive and disbursing officer of the Commission of Fine Arts, created by act approved May 17, 1910.

Member of board of engineers to prepare and approve plans for the reclamation and development of the Anacostia R. and Flats. (See Misc. 5.)

Military aide to the President.

ENGINEERS.

Chief of Engineers. **R.**, 67, 52; 68, 74; 65; 70, 84; 71, 100; 72, 98; 73, 109; 74, 120; 75, 126; 76, 116; 77, 124; 78, 139; 79, 183; 80, 2; 81, 334; 82, 324; 83, 339; 84, 344; 85, 374; 86, 368; 87, 336; 88, 312; 89, 381; 90, 349; 91, 4; 92, 418; 93, 480; 94, 435; 95, 491; 96, 437; 97, 542; 98, 546; 99, 632; 00, 710; 01, 675; 02, 5; 03, 658; 04, 730; 05, 738; 06, 820; 07, 841; 08, 885; 09, 929; 10, 1041; 11, 1103; 12, 1319.

In charge:

Maj. N. Michler (Bvt. Brig. Gen.). **R.**, 67, 51 532 (public park and site of Presidential Mansion 544 (foreign paving); 68, 889, 913 (survey, Potomac R. in District of Columbia); 69, 493, 498 (Washington Canal, Tiber Creek); 517 (probable dam to Georgetown or Virginia chan. from repair R. R. br.); 70, 517, 530 (ex. of Potomac); 71, 97

Maj. O. E. Babcock. **R.**, 71, 967; 72, 1010, 10 (description of grounds); (Col.) 73, 1151; 74, 385; 75, ii, 800; 76, ii, 675; 77, ii, 1061.

Lt. Col. T. L. Casey. **R.**, 77, ii, 1072; 78, 1345; 79, ii, 1877; 80, 2339.

Col. A. F. Rockwell. **R.**, 80, 2339; (Col.) 8 2711; 82, 2733; 83, 2093; 84, 2339.

Lt. Col. J. M. Wilson. **R.**, 85, 2503; 86, 207 87, 2569; 88, 2769; 89, 2827.

Col. O. H. Ernst. **R.**, 90, 3535; 91, 3907; 92, 3385.

Col. J. M. Wilson. **R.**, 93, 4313; 94, 3265 (including list of U. S. reservations in Washington 95, 4129; 96, 3975.

Col. T. A. Bingham. R., 97, 4025; 98, 3661 (erection of Government Printing Office; including records of Washington Monument, changes in ironwork); 99, 3811; 00, 5227; 01, 3689; 02, 2717; 03, 2517.

Col. A. M. Miller. R., 04, 2899.

Col. C. S. Bromwell. R., 05, 2619; 06, 2112; 07, 2300; 08, 2376.

Col. Spencer Cosby. R., 09, 2323; 10, 2653; 11, 2959; 12, 3481.

Assistant. Lt. J. S. Sewell. R., 96, 4004.

MAPS, PLATES, ETC.

Map of the city of Washington, D. C., showing reservations, etc. 84, 2371.

River front, Washington, D. C. 86, 2098.

Maps of the various parks in Washington, D. C. 86, 2098.

Reservations. 87, 2612; 94, 3314; 00, 5237, 5242; 02, 2728.

Tunnel, water supply, city of Washington. 88, 2766.

National road to Mount Vernon. 90, 3580.

Various reservations. 94, 3272. President's Park. 94, 3274.

Capitol spring water piping. 96, 3994.

Washington Monument. 98, 3666. Views from. 98, 3668. Power-house layout. 98, 3668.

President's Park, view. 98, 3727.

Fountains, at night. 98, 3732; 99, 3824. Study for. 00, 5241.

Ground plan, Executive Mansion. 99, 3814.

White House Conservatory, west "L." 99, 3814.

Blizzard, 1899, White House Grounds. 99, 3814.

Washington Monument—Tie rods strengthened; as Monument looked before 1878; "present view." 99, 3819.

Copings. 99, 3826.

Propagating gardens. 99, 3834.

Monument Grounds. 99, 3834.

Washington Circle. 99, 3834.

McPherson Square. 99, 3834.

Subfoundation, Sherman Statue. 99, 3840.

Wharves and harbor lines. 99, 3844.

White House. 00, 5228, 5230, 5232.

Uniform of park watchmen. 00, 5244.

Easter Monday egg rolling, White House. 00, 5244.

Guide to trees and shrubs, White House. 00, 5249.

Bronze vase, Lafayette Square. 00, 5252.

Toolhouse, President's Park. 00, 5252.

Map of the city of Washington, showing U. S. reservations. 01, 3700; 02, 3728.

Photograph, new office at propagating gardens, 1901. 01, 3716.

Sketch, proposed development of propagating gardens, greenhouses, and nursery. 01, 3718.

Sketches, the Mall, as proposed by Pierre L'Enfant. 01, 3718.

Sketch study for embellishment and use of Potomac Park. 01, 3718.

Sketch, Grant Memorial site. 01, 3758.

Photographs, propagating gardens, looking w. on C St. between storehouse and shops; new storehouse, Fifteenth St. side, garden side. 02, 2736. Old carpenter shop; old blacksmith shop; old plumber's and paint shop; new shops. 02, 2739.

Sketch, plan for imp. Monument Park. 02, 2738.

Photograph, Rochambeau Statue. 02, 2741.

Photograph, varieties of codiaums of propagating gardens. 02, 2519.

Photographs, exterior and interior of Executive Mansion. 02, 2522.

Sketch, White House, Executive Office and Grounds. 03, 2526.

Photographs, old canal lock, entrance to Potomac Park, main entrance to Potomac Park, old canal lock house, Seventeenth and B Sts., new roadway, Potomac Park. 03, 2554.

Photographs of following statues: Gen. Andrew Jackson, center of Lafayette Park; Gen. Washington, Washington Circle; Gen. John A. Rawlings, Pennsylvania Ave.; Gen. Winfield Scott, Scott Circle; Abraham Lincoln, in front of U. S. Courthouse; Abraham Lincoln, Lincoln Park; Maj. Jas. B. McPherson, McPherson Square; Gen. Nathanael Greene, Stanton Park; Maj. Gen. Geo. H. Thomas, Thomas Circle; Admiral Farragut, Farragut Square; Prof. Joseph Henry, Smithsonian grounds; Admiral Du Pont, Du Pont Circle; President Garfield, Maryland Ave. and First St. NW.; Gen. Lafayette and compatriots, Lafayette Park; Gen. Winfield Scott Hancock, Hancock Place; L. J. M. Daguerre, Smithsonian grounds; Dr. Samuel D. Gross, Smithsonian grounds; Daniel Webster, Massachusetts Ave. between Sixteenth and Seventeenth Sts. NW.; Gen. John A. Logan, Iowa Circle; Dr. Samuel Hahneman, Massachusetts Ave.; Albert Pike, Indiana Ave.; Rochambeau, southwest corner of Lafayette Park; Gen. Ulysses S. Grant (model).

Sketch, section 1, Arsenal Grounds to N St. 03, 2570.

Photograph, tree planted by President Roosevelt, e. entrance White House Grounds; tree planted by Mrs. Roosevelt, e. entrance White House Grounds. 04, 3901. China cabinet, and display of White House china. 04, 3904. Colonial gardens, White House Grounds, e. side, also w. side. 04, 3908.

Sketch, park coping concrete. 04, 3918.

Photographs, Sherman Statue. 04, 3948.

Sketch, plan of Sherman Statue and grounds. 04, 3948.

Photographs, new plants in gardens. 05, 2621. Potomac Park driveway. 05, 2646. Statue representing "Victory," antique decorative urn. 05, 2654. Sherman Plaza. 05, 2655.

Sketch, general plan of White House, Executive Office, and Grounds, showing the location of the shrubs and trees, of various parks and circles. 05, 2772.

Photographs, view of Potomac Park from highway embankment, of Potomac Park nursery, of new riverside drive. **06**, 2136.

Sketch, Potomac Park, development and utilization. **06**, 2137.

Photographs, Mercer monument and grounds, Fredericksburg, Va. **06**, 2146.

Photograph, view of Potomac Park Basin drive. **07**, 2328.

Photographs, views of McClellan Statue, as completed; of statue (veiled) and stands; of statue unveiled. **07**, 2338.

Sketch, showing waterside drives. **08**, 2400.

Photograph, view of riverside drive looking se. to inlet, of riverside drive looking nw. to N. B St., of Riverside Drive Circle, looking se., of old sewer canal. **08**, 2400.

Sketch, W. Potomac Park, N. B St. extended, and the inlet br. **09**, 2356.

Photograph, view of the new inlet br., Potomac R. side. **09**, 2357.

Photographs, the Sheridan Statue, Sheridan Circle, unveiling ceremonies. **09**, 2360. The Longfellow Monument. **09**, 2364. The Stephenson Monument; the John Witherspoon Monument. **09**, 2366.

Photographs, view of the Executive Office Building, of the President's Office. **10**, 2656. Wading pool and children's playground, Garfield Park. **10**, 2662. Inlet br., tidal basin, Potomac Park. **10**, 2670. View of Pulaski Monument, and Kosciuszko Monument. **10**, 2689.

Photograph, landscape imp. at Thomas Circle. **11**, 2969. Revised landscape setting of Webster Statue. **11**, 2970. New entrance, Lincoln Park. **11**, 2972.

Sketch, Reservation 126, playground and park treatment. **11**, 2972.

Photographs, Von Steuben Monument, and unveiling of monument. **11**, 2990.

Photographs, fountain and terrace at W. Twenty-second St. **12**, 3490.

Photographs, Neighborhood Park at Mount Pleasant. **12**, 3492. John Paul Jones Monument. **12**, 3514. Columbus Memorial, Union Station Plaza. **12**, 3515.

OPERATIONS.

Each an. report gives these in detail.

See "Special Reports" below.

SPECIAL REPORTS.

Public park and site of Presidential Mansion. R., Maj. N. Micheler. **67**, 532.

Remarks on the vegetation of the District of Columbia. Dr. Arthur Schott, Georgetown. **67**, 538.

Public park for the Capital. Speech by Hon. B. Gratz Brown. **67**, 542.

Public pavements, suggestions for. Gen. M. C. Meigs. **67**, 544 (with plates).

List of trees and shrubs. G. H. Brown, public gardener. **86**, 2099.

Public reservations. **87**, 2593; **94**, 3272, 3295; **01**, 3701.

List of deciduous trees and shrubs. **90**, 3556. Evergreen trees and shrubs. **90**, 3561.

National Road to Mount Vernon. Lt. Col. P. C. Hains. **90**, 3563.

List of buildings, etc., in charge of Superintendent of Public Buildings and Grounds. **94**, 3268, and in subsequent reports.

Old records of city of Washington, and reservations occupied in violation of law. **96**, 3997, and subsequent years.

New building, Government Printing Office. 1st Lt. J. S. Sewell. **96**, 4004.

Regulation for protection of the national park grounds in the District of Columbia. **97**; 4061; **98**, 3661.

Washington Monument statistical records—levels—plummet—bench mark—record of plumb-line. **98**, 3669. Changes in iron framework. **98**, 3716; **00**, 5236. Levels. **01**, 3698; **02**, 2725.

Parks of Washington, in relation to parks of other cities. **99**, 3824; **00**, 5238.

Future of parks in Washington. **99**, 3824.

U. S. wharf property, Washington, D. C. **99**, 3843, and subsequent years.

List of trees and shrubs, Executive Mansion. H. Pfister, head gardener. **00**, 5245.

Legal status, Office Public Buildings and Grounds. **00**, 5273.

List of records of city of Washington. **00**, 5281.

List of trees, shrubs, etc., public grounds. G. H. Brown. **00**, 5286.

Extension of White House. **01**, 3693.

Washington Monument—electric plant. **01**, 3698.

Principal parks of U. S.—data. **01**, 3710.

Inventory, White House contents. **01**, 3736; **02**, 2754; **03**, 2582; **04**, 3970; **05**, 2674; **06**, 2164; **07**, 2358; **08**, 2430; **09**, 2378; new method, **10**, 2655.

Address, Col. T. A. Bingham, centennial exercises, East Room, White House, Dec. 2, 1900. **01**, 3754.

Program, competition for Grant Statue or Memorial. **01**, 3756.

Program, competition, McClellan Statue. **01**, 3758.

Special index to annual report. Begins with **01**, 3759.

Remodeling White House. **02**, 2721.

Office building for the President. **02**, 2722.

Washington Monument—distribution of weights. **02**, 2725. Data relative to. **02**, 2726; **03**, 3911; **04**, 3911; **05**, 2630; **06**, 2121; **07**, 2311; **08**, 2384; **09**, 2348; **10**, 2672; **11**, 2981; **12**, 3503.

Notes on the chrysanthemum. G. H. Brown. **02**, 2760.

Potomac Park (portion) transferred to Office of Public Buildings and Grounds. **03**, 2552.

List of statues. **03**, 2559; **04**, 3946.

Notes on public playgrounds. G. H. Brown. **03**, 2666.

Notes on codiaeumns. G. H. Brown. 03, 2669.
Reservations relinquished to provide for Union
Railroad Station, and transferred for various pur-
poses. 04, 3913; 05, 2632.

Notes on historic trees of Washington, D. C.
04, 4046.

Band concerts begun. 05, 2648.

Reservations occupied by inaugural committee.
05, 2652.

Historic statues presented by inaugural com-
mittee. 05, 2653.

Sherman Plaza. 05, 2655.

Description, rare tropical plants, propagating
gardens. 05, 2756.

Trees and shrubs, by their various names, in
D. C. public parks. 05, 2757.

City parks, and park places, D. C. G. H. Brown.
06, 2238.

Extraordinary repairs, White House. 07, 2308.
Roadway, Potomac Park. 07, 2327.

Building for offices of the President. 10, 2657.

Commission of Fine Arts. 10, 2687.

Columbus Memorial au. act Mar. 4, 1907. 12,
3514.

Lincoln Memorial au. act Feb. 9, 1911. 12, 3515.

MISC. 66. D. C. — RESERVATIONS, OCCUPANCY OF (1900-1912).

(See Misc. 67 on p. 2075 of this index.)

1900-01. 158,624 sq. f. given to Baltimore &
Potomac R. R.; 66,156 sq. f. given to Baltimore &

Ohio R. R. 01, 3726. Reservations occupied for
inaugural purposes. 09, 2369.

MISC. 67. D. C.—RESERVATIONS OCCUPIED IN VIOLA- TION OF LAW.

1900-12. List of names of persons occupying
such reservations. 01, 3725; 02, 2745; 03, 2570

04, 3957; 05, 2661; 06, 2151; 07, 2344; 08, 2416;
09, 2367; 10, 2690; 11, 2996; 12, 3518.

MISC. 68. D. C. — ROADS — FROM AQUEDUCT BRIDGE TO MOUNT VERNON.

NOTE.—This relates to a proposed national
boulevard connecting Arlington with Mount
Vernon. Several reports with plans and ests.
have been submitted since 1886. The Chief of
Engineers earnestly recom. congressional action.

Act Feb. 23, 1889, au. Sec. of War to have sur-
veys made, and est. prepared. 89, 385, 2867;
00, 43.

APPROPRIATION.

1889, \$10,000, 89, 2867.

ENGINEERS.

Chief of Engineers. R., 89, 385; 90, 350; 99,
42; 00, 43.

In charge. Lt. Col. C. P. Hains. R., 89, 2867;
90, 3563.

Assistant. B. F. Mackall. R., 90, 3571.

MISC. 69. D. C. — ROADS — CONDUIT ROAD, RECONSTRUCTION.

NOTE.—The Conduit Road is approx. 1½ m. l. from Foxhall Road to Great Falls, and is a necessary feature of the operation and mainten. of the conduit (water-supply system, D. C.), especially while awaiting the constr. of public roads on either side.

Its advantages were early appreciated, the officer in charge reporting in 1868 that it should be macadamized as soon as practicable.

Between 1870-1875, \$46,000 were app. for this purpose, and 9.4 m. surfaced.

Since the latter date but \$4,000 have been especially app. for the road, the last of which was \$2,000 in 1900.

The small amounts spared from the regular app. have been wholly and totally inadequate for mainten. alone.

By act of Congress approv. June 26, 1912, an

app. of \$15,000 was made for beginning the surfacing and imp. of the Conduit Road from Foxhall Road to Great Falls during the fiscal year 1913. Est. that about \$30,000 additional needed to complete this work. 11, 1096; 12, 1314.

APPROPRIATIONS.

See above.

ENGINEERS.

Chief of Engineers. R., 11, 1096; 12, 1314.

In charge. Lt. Col. W. C. Langfitt. R., 11, 1094, 2942; 12, 3463.

Assistants:

Capt. W. T. Hannum. 11, 1094; 12, 1311.

1st Lt. J. J. Bain. 12, 1311.

MISC. 70. D. C.—STATUES (1900-1912).

(See Misc. 65 on p. 2072 of this index.)

1900-01. There are 21 statues in national public grounds in charge of this office. Statues of Gen. Logan and Albert Pike completed; former unveiled. Granite coping set in position about two-thirds of the way around the site of Gen. Sherman, and statue work continued. Lettering on statue of Daniel Webster regilded. Congress app. \$10,000 for statue to Gen. U. S. Grant; designs solicited. Congress app. \$50,000 for site and statue of late Maj. Gen. Geo. B. McClellan. 01, 3720. Program of competition for Grant Statue or Memorial, Washington, D. C. 01, 3756. Of equestrian statue of late Maj. Gen. George B. McClellan. 01, 3758.

1901-02. Statue of Rochambeau and pedestal for same erected. 02, 597, 2740.

1902-03. Table of statues in public grounds. 03, 2560; 04, 3946. Details of work on various statues. 03, 2563.

1903-04. Sherman Statue completed and unveiled. 04, 3948. Contract for Grant Statue entered. 04, 3949. Details of work on other statues given. 04, 3949.

1904-05. Historic statues presented by inaugural committee. 05, 2653. Work of imp. at "Sherman Plaza" completed. 05, 2655. Working model for McClellan Statue approv.; contract for erection of monument to Gen. Hugh Mercer entered into; other work on statues and memorials. 05, 2656.

1905-06. Models of some of the bronzework of Grant Memorial completed, approv., and site selected. Model of McClellan Statue completed and approv.; bronze casting of same completed and accepted. Sculptor given another opportunity to

submit model for Pulaski Statue. Artist selects for statue of Baron von Steuben. Monument to Gen. Hugh Mercer, at Fredericksburg, Va., completed and grounds of site imp. 06, 820, 2144.

1906-07. Statue of Gen. McClellan completed erected, and unveiled; the full-size models of the bronze lions for the Grant Memorial completed a model of the Pulaski Statue approv.; contract entered into for the Von Steuben Statue. Model selected for the statue of Kosciuszko and a site selected for the statue of Longfellow. 07, 842, 2337.

1907-08. Foundation for Grant Statue nearly completed; contract entered into for Sheridan Statue and Pulaski Statue; progress made with models for Von Steuben Statue; full-size model for Kosciuszko Statue completed; site and sculpto selected for John Paul Jones Statue; site selected for statue of Commodore Barry; and other miscellaneous work on statues and memorials. 08, 886, 2410.

1908-09. The statues of Gen. Philip H. Sheridan, Henry Wadsworth Longfellow, and John Witherspoon, and the Stephenson Grand Army Memorial were erected and completed, and all but the latter unveiled. The architectural portion and some of the bronze sculpture of the Grant Memorial were finished. Site selected for the statue of Commodore John Barry, and models were submitted in a competition for that statue a new site was selected and contract entered into for the statue of John Paul Jones, and progress was made on the models for the Pulaski and the Von Steuben Statues. 09, 930, 2359.

1909-10. Statues of Gen. Count Pulaski and Gen. Thaddeus Kosciuszko erected, completed, and unveiled; full-size model of artillery group for

memorial to Gen. U. S. Grant completed and approv., and will now be cast in bronze; full-size model of artillery group for memorial to Gen. von Steuben completed, cast in bronze, received in Washington and stored; other misc. work. **10**, 1042, 2682.

1910-11. Statue of Gen. Baron von Steuben erected, completed, and unveiled; full-size model of artillery group for memorial to Gen. U. S. Grant sent to foundry to be cast in bronze; sculptor selected for Commodore John Barry Statue; plaster

models statue of John Paul Jones and bas relief for pedestal completed by sculptor and approv.; scale model for Columbus Statue approv. **11**, 1105, 2989.

1911-12. Monument to John Paul Jones erected, completed, and unveiled; also memorial to Christopher Columbus. Group for Grant Memorial cast in bronze and placed in position upon pedestal; contract entered into for constr. and erection of Commodore Barry Statue. **12**, 1321, 3510.

MISC. 71. D. C.—TELEGRAPH AND TELEPHONE WIRES—PUTTING UNDERGROUND.

ENGINEERS.

Chief of Engineers. **R.**, **88**, 313.

In charge. Lt. Col. J. M. Wilson. **R.** (Sen. Ex. D. 153, 50th, 1st), **88**, 313, 2794.

PLANS.

R. on comprehensive system of underground wires for telegraph and telephone service to con-

nect the several departments and bureaus of the U. S. in Washington called for by Senate resolution, Mar. 26, 1888, together with an est. of the cost. **88**, 313. For **R.**, see above. Est., \$69,054.61. **88**, 2799.

MISC. 72. D. C.—TELEGRAPH AND TELEPHONES—PRIVATE DEPARTMENTAL CONNECTIONS.

ENGINEERS.

Chief of Engineers. **R.**, **98**, 547; **99**, 633. (See also Misc. 71.)

In charge. Col. T. A. Bingham. **R.**, **98**, 3743; **99**, 3842; **00**, 5262. (See also Misc. 71.)

PROJECT.

Under an allotment of \$7,000, Apr. 9, 1898, from app. for "National defense" (war), act Mar. 9, 1898, telephone circuits were constr. and completed between the White House and the executive departments, with some minor exceptions completed later. **98**, 547.

1900-05. Electric storage battery, in duplicate, purchased to replace the old-style gravity battery hitherto used. The desirability of replacing the "present" overhead system of wires with underground conduits and cables submitted for action of Congress and printed in H. D. No. 135, 56th, 2d; est., \$30,000. **01**, 3724; **02**, 2743; **03**, 2568; **04**, 3954; **05**, 2659.

1905-06. Overhead cables of departmental telegraph line removed from roof of Treasury Department Building and brought into building through an underground conduit; other misc. work done. **06**, 821, 2148; **07**, 2414; **09**, 2353; **10**, 2677; **11**, 2985.

MISC. 73. D. C. — WATER SUPPLY — WASHINGTON AQUEDUCT (1850-1912).

Apps. for mainten. and operation of the Washington Aqueduct are applied to the imp., mainten., and repair of those parts of the water-supply system which are under the supervision of the Chief of Engineers. These are—

The masonry dam across the Potomac at Great Falls.

The works there for regulating the supply to the conduit.

The Conduit Road from Great Falls to Washington, a distance of about 14 m.

The conduit from Great Falls to the Georgetown Reservoir, a distance of about 12 m.

The 3 reservoirs for supplying the city.

The tunnel, about 4 m. l., connecting the Georgetown and McMillan Park Reservoirs.

The 2 brs. for carrying the mains across Rock Creek.

And other auxiliary works.

A description of these works may be found in the Annual Report of the Chief of Engineers, 1903, pages 2485-2487.

The original proj. for constr. of the Washington Aqueduct was dated Feb. 12, 1853, and published as Senate Ex. D. No. 48, 32d, 2d. The proj. provided for supplying the city of Washington with water taken from the Potomac R. at Great Falls, Md., about 14 m. above the city and 16½ m. from the present filtration plant, and with water from Little Falls Branch. Work was begun in 1853, and in 1859 water from Little Falls Branch was supplied to the city through the conduit. The first Potomac water was supplied to the city in December, 1863.

The water from Little Falls Branch became polluted, and works for excluding it were completed in 1895. The dam at Great Falls was raised during 1896 and the capacity of the system increased to its "present" extreme limit of 90,000,000 gallons per day, or, making allowances for sudden increases in consumption, to a safe limit of 65,000,000 gallons. For a discussion of the capacity of the system, see Annual Reports of the Chief of Engineers for 1897, pages 3991-4014; for 1906, pages 2093-2095; and for 1909, pages 2310-2311.

As explained in the report of the officer in charge of the Washington Aqueduct for the fiscal year ending June 30, 1911, the usual app. of \$33,000 is not sufficient to provide for the proper maintain. of the aqueduct and its accessories, and the amount is increased, in ests. submitted, to \$38,000, thus providing \$5,000 for maintaining the Conduit Road in good condition when once placed in such condition; the character and amount of traffic, especially of automobiles, has caused its rapid deterioration.

Br. No. 6 across Rock Creek is no longer an integral part of the aqueduct system but is maintained solely for the benefit of the city. As this br. is entirely too narrow for the traffic passing over it and needs to be widened, its formal transfer to the city recom.

Prior to August, 1905, the mains leading to the city from the Georgetown (distributing) Reservoir were used for a gravity supply to a part of the city of Washington, and they were maintained by the U. S. On Aug. 21, 1905, as the filtration plant had been so far completed that a portion of it could be put into operation, the gates connecting the Georgetown Reservoir with the mains referred to were closed, and the entire flow of water for the section which they supplied was sent through the tunnel to the filtration plant and thence to those mains for distribution. They accordingly became an essential part of the city distribution system, and, by mutual agreement, they have since been operated and maintained by the city water department. Their formal transfer to the city recom. 12, 1312, 1313.

APPROPRIATIONS.¹

| | |
|--|-----------|
| Sept. 30, 1850..... | \$500 |
| Aug. 31, 1852..... | 5,000 |
| Mar. 3, 1853..... | 100,000 |
| Mar. 3, 1855..... | 250,000 |
| Aug. 18, 1856..... | 250,000 |
| Mar. 3, 1857..... | 1,000,000 |
| June 12, 1858..... | 800,000 |
| June 25, 1860..... | 500,000 |
| July 4, 1864..... | 150,000 |
| July 28, 1866..... | 142,584 |
| Dec. 20, 1866..... | 12,000 |
| Mar. 2, 1867..... | 20,000 |
| July 20, 1868..... | 10,000 |
| July 25, 1868..... | 52,500 |
| Mar. 3, 1869..... | 25,000 |
| July 15, 1870..... | 120,822 |
| Mar. 3, 1871..... | 114,196 |
| June 10, 1872..... | 70,555 |
| Jan. 23, 1873..... | 14,000 |
| Mar. 3, 1873..... | 43,600 |
| June 23, 1874..... | 36,400 |
| Mar. 3, 1875..... | 26,000 |
| July 31, 1876..... | 22,000 |
| Mar. 3, 1877..... | 15,000 |
| June 20, 1878..... | 15,000 |
| July 1, 1879..... | 20,000 |
| June 4, 1880..... | 20,000 |
| Mar. 3, 1881..... | 20,000 |
| July 1, 1882..... | 20,000 |
| July 15, 1882..... | 1,485,279 |
| Mar. 3, 1883..... | 20,000 |
| July 5, 1884..... | 20,000 |
| July 7, 1884..... | 87,500 |
| Feb. 25, 1885..... | 87,500 |
| Mar. 3, 1885..... | 20,000 |
| Mar. 26, 1886..... | 5,000 |
| July 9, 1886..... | 20,000 |
| Aug. 4, 1886..... | 555,000 |
| Mar. 3, 1887..... | 20,000 |
| Mar. 30, 1888..... | 355,000 |
| July 18, 1888..... | 20,000 |
| Mar. 2, 1889..... | 595,000 |
| Aug. 6, 1890..... | 25,500 |
| Sept. 30, 1890..... | 48,396 |
| Mar. 3, 1891..... | 20,000 |
| July 14, 1892..... | 20,000 |
| Mar. 3, 1893..... | 80,000 |
| Aug. 7, 1894..... | 82,500 |
| Aug. 18, 1894..... | 4,000 |
| Mar. 2, 1895..... | 71,500 |
| June 11, 1896..... | 25,000 |
| Mar. 3, 1897..... | 26,000 |
| June 30, 1898..... | 322,210 |
| Mar. 3, 1899..... | 230,000 |
| June 6, 1900..... | 176,034 |
| Total..... | 8,296,577 |
| Received from sale of land, etc., prior to 1880; reverted to app..... | 15,651 |
| | 8,312,229 |
| Reverted to Treasury..... | 38,048 |
| Net amount expended..... | 8,274,181 |

¹ Taken from 12, 3461.

APPROPRIATIONS—Continued.

Appropriations, 1901-11, inclusive.

| | |
|-----------------------------------|--------------|
| Mar. 1, 1901..... | \$184,222.97 |
| July 1, 1902..... | 102,490.00 |
| Mar. 3, 1903..... | 33,000.00 |
| Apr. 27, 1904..... | 33,000.00 |
| Mar. 3, 1905..... | 33,000.00 |
| June 27, 1906..... | 33,000.00 |
| Mar. 2, 1907..... | 102,000.00 |
| May 26, 1908..... | 43,000.00 |
| May 26, 1908..... | 16,000.00 |
| Mar. 3, 1909..... | 33,000.00 |
| May 18, 1910..... | 69,500.00 |
| Mar. 2, 1911..... | 131,000.00 |
| Total..... | 803,212.97 |
| Reverted to Treasury.. | \$12,194.48 |
| Outstanding liabilities, | |
| June 30, 1912..... | 7,778.24 |
| | 19,972.72 |
| Net amount expended, 1901-12..... | 783,240.25 |
| Net amount expended, 1850-1900. | 8,274,181.04 |
| Total net expended..... | 9,057,421.29 |
| (a) For constr..... | 7,876,324.44 |
| For operation, mainten., and | |
| repairs..... | 1,181,096.85 |
| (b) Paid by the U. S..... | 6,433,862.93 |
| Paid by D. C..... | 2,623,558.36 |

ENGINEERS.

Chief of Engineers. **R.**, 67, 52; **68**, 74; **69**, 65; **70**, 84; **71**, 99; **72**, 98; **73**, 109; **74**, 120; **75**, 126; **76**, 116; **77**, 124; **78**, 139; **79**, 184; **80**, 243; **81**, 334; **82**, 324; **83**, 338; **84**, 342; **85**, 372; **86**, 365; **87**, 333; **88**, 310; **89**, 378; **90**, 345; **91**, 436; **92**, 413; **93**, 475; **94**, 432; **95**, 485; **96**, 430, 3932; **97**, 537; **98**, 542; **99**, 629; **00**, 705; **01**, 671; **02**, 593; **03**, 654; **04**, 726; **05**, 734; **06**, 815; **07**, 836; **08**, 879; **09**, 923; **10**, 1035; **11**, 1094; **12**, 1311.

Boards:

Commission of experts on aqueduct tunnel. **R.**, 96, 3932. (Maj. W. L. Marshall, Capt. J. L. Lusk, and Capt. D. D. Gaillard, Corps of Engineers; A. Fteley and D. Fitzgerald, civil engs.) Reports of others on the subject: Col. G. H. Elliot (retired). 96, 3944. Gen. M. C. Meigs. 96, 3949. Maj. J. G. D. Knight. 96, 3950. T. B. Main and A. J. Sparrow. 96, 3942.

In charge:

Under War Department—

Capt. M. C. Meigs, 1852-60.

Capt. H. W. Benham, 1860.

Lt. J. St. Clair Morton, 1860-61.

Gen. M. C. Meigs, 1861-62.

Under Department of the Interior—

W. R. Hutton, 1862-63.

S. Seymour, 1863-65.

T. B. Samo, 1865-67.

Under War Department—

Maj. N. Michler (Bvt. Brig. Gen.). **R.**, 67, 548; **68**, 904; **69**, 502, 515 (history of imp.); **70**, 522; **71**, 974.

Maj. G. H. Elliot. **R.**, 71, 948.

Maj. O. E. Babcock. **R.**, 72, 1019; (Col.) **73**, 1162; **74**, ii, 397; **75**, ii, 814; **76**, ii, 691; **77**, ii, 1061, 1071, 1093 (letters of Gen. M. C. Meigs concerning criticism of Rock Creek Br., and of Boards of Engineers, and of Lt. Col. Casey).

Lt. Col. T. L. Casey. **R.**, 77, ii, 1089; **78**, ii, 1350; **79**, ii, 1885; **80**, 2344, 2357 (imp. of water supply; letter to Senate); **81**, 2703; **82**, 2729.

Maj. G. J. Lydecker. **R.**, 83, 2077; **84**, 2299; **85**, 2453; **86**, 2013; **87**, 2527; **88**, 2749.

Lt. Col. J. M. Wilson. **R.**, 89, 2809.

Lt. Col. G. H. Elliot. **R.**, 90, 3501; **91**, 3875; **92**, 3349; (Col.) **93**, 4275; **94**, 3193; **95**, 4119 (list of mains laid in the District).

Maj. J. G. D. Knight. **R.**, 95, 4101.

Capt. D. D. Gaillard. **R.**, 96, 3905; **97**, 3991; **98**, 3642 (ex. of aqueduct tunnel).

Col. T. A. Bingham. **R.**, 98, 3625.

Lt. Col. A. M. Miller. **R.**, 99, 3781; **00**, 5193; **01**, 3651; **02**, 2691; **03**, 2485; (Col.) **04**, 3883.

Lt. Col. S. S. Leach. **R.**, 05, 2609.

Capt. Spencer Cosby. **R.**, 06, 2087; **07**, 2283; (Maj.) **08**, 2533.

Maj. J. J. Morrow. **R.**, 09, 2305.

Capt. W. T. Hannum. **R.**, 10, 2627.

Lt. Col. W. C. Langfitt. **R.**, 11, 2935; **12**, 3457.

Assistants:

T. T. Samo. **R.**, 68, 907; **69**, 503; **70**, 524; **71**, 955; **80**, 2350.

Capt. T. W. Symons. **R.**, 85, 2456.

LEGISLATION.

Laws relating to the aqueduct. **71**, 956.

MISCELLANEOUS.

Each an. report, principally in later years, covers the condition of the reservoirs, conduits, brs., and mains, the consumption and waste of water, the condition of the water during the year, and the daily gauge pressures.

PROJECTS.

Risk of interrupting supply of water by accident to conduit (50 years old) and recom. for constr. of another. **05**, 735.

WATER SUPPLY.

1900-01. Extravagant use of water a serious menace to supply of water with its "present" capacity (76,000,000 gallons), and at the rate of increase the ultimate limit would be reached in about 12 years. Tables given, showing consumption by day, month, etc. **01**, 3651-3665; **02**, 2696-2705; **03**, 2490-2495; **04**, 3886-3889; **05**, 2610; **07**, 2283; **08**, 2354; **09**, 2313; **10**, 2632.

¹ Reapp. from unexpended balance of app. of \$90,000, act of Congress Mar. 2, 1907. Expended under Washington Aqueduct for parking grounds, McMillan Park Reservoir.

1901-02. Est. daily per capita consumption and waste, 205 gallons; 100 gallons is ample for all domestic, business, and public uses. 02, 593, 2697.

1902-03. Per capita consumption, 212 gallons. 03, 655. 235 gallons. 04, 3887. 207 gallons. 06, 2092. 179 gallons. 09, 2313.

1905-06. R. by Mr. Allen Hazen, consulting engr. on capacity of plant. Use of water, and restrictive measures to prevent waste. 06, 2093.

1907-08. Recom. in regard to metering Federal buildings and institutions to stop waste of water. 08, 1879.

Table showing loss of head and elevation water will assume for varying rates of flow. 09, 2310.

Table, tons of suspended matter entering system. 09, 2312; 11, 2939; 12, 3460.

R. by Lt. Hannum on condition of conduit. 09, 2308.

Consumption and waste of water: Tables showing the average consumption of water per 24 hours, by years from 1874 to 1906 and by months from July, 1899, to Jan., 1903, will be found in the Annual Report of the Chief of Engineers for 1906, page 2092, and by months for the period Jan., 1903, to June, 1910, in the Annual Report of the Chief of Engineers for 1910, page 2632. The following table covers the fiscal years 1910, 1911, and 1912, and the accompanying diagram gives a graphic comparison with the consumption for previous years since 1899:

Table showing average consumption of water for hours.

[In million gallons.]

| | Fiscal years. | | |
|-------------------------------------|---------------|-------|------|
| | 1910 | 1911 | 1912 |
| July..... | 64.05 | 64.22 | 66. |
| Aug..... | 61.42 | 62.82 | 63. |
| Sept..... | 60.32 | 62.59 | 60. |
| Oct..... | 59.18 | 61.05 | 59. |
| Nov..... | 55.25 | 57.91 | 56. |
| Dec..... | 56.77 | 62.77 | 53. |
| Jan..... | 62.49 | 60.67 | 71. |
| Feb..... | 60.28 | 57.18 | 70. |
| Mar..... | 56.04 | 53.99 | 60. |
| Apr..... | 58.32 | 55.76 | 57. |
| May..... | 57.76 | 63.04 | 61. |
| June..... | 58.37 | 62.18 | 61. |
| Average..... | 59.19 | 60.38 | 61. |
| Average per capita consumption..... | 173 | 173 | 175 |

Per capita consumption for 1912 is based on population of 354,019, which is that assumed by the health department, D. C.

The max. daily amount of water pumped to the filters during the year was 92,720,000 gallons.

Plate showing consumption and waste. 06, 2093; 07, 2286; 08, 2356; 09, 2313; 10, 2632; 11, 2940; 12, 3460.

MISC. 74. D. C. — WATER SUPPLY — WASHINGTON AQUEDUCT—LINING OF TUNNEL.

NOTE.—The total l. of unlined tunnel of the aqueduct through r. is 4,364', and there were places in 1912 where the r. was disintegrating and falling from the sides and roofs. "Those places should be lined both for the sake of the stability of the aqueduct and to remove the danger to the lives of the employees engaged in cleaning and inspection."

By act of Congress approv. Mar. 2, 1911, the sum of \$8,000 was app. for the purpose of commencing the work.

Est. of \$12,000 submitted in 1912 for its continuance during the fiscal year 1914.

The actual work of lining can be done only when conditions permit the draining of the aqueduct. 12, 1313, 3462.

APPROPRIATIONS.

See above.

ENGINEERS.

Chief of Engineers. R., 11, 1095; 12, 1313.

In charge. Lt. Col. W. C. Langfitt. R., 11, 2941; 12, 3462.

Assistants:

Capt. W. T. Hannum. 11, 1094; 12, 1311.
1st Lt. J. J. Bain. 12, 1311.

OPERATIONS.

1911-12. During the fiscal year a concret wastewear was built and a sluice gate installed. About 140 c. y. of r. blasted from bottom of the tunnel, and 161 linear f. of 15-inch drain tile was laid, surrounded by concrete; 186 linear f. of the invert of the concrete lining and 45 linear f. of arch was built. Besides the work done in the tunnel, a landing was built to receive materials at the side of the Chesapeake & Ohio Canal, a derrick was erected, a concrete mixer was purchased and installed, a collapsible steel form for use in building the lining was purchased, and considerable sand and gravel are now on hand to continue the work in 1913. 12, 1313, 3462.

MISC. 75. D. C. — WATER SUPPLY — FILTRATION PLANT (INCLUDING OPERATION AND MAINTENANCE), 1900-1912.

(See Misc. 73-83 on p. 2040 of this index.)

APPROPRIATIONS.

The following data is from 12, 3480:

| | |
|--------------------|--------------|
| June 6, 1900..... | \$200,000.00 |
| Mar. 1, 1901..... | 500,000.00 |
| July 1, 1902..... | 600,250.00 |
| Mar. 3, 1903..... | 600,000.00 |
| Apr. 27, 1904..... | 1,568,155.00 |
| June 27, 1906..... | 80,000.00 |
| Mar. 2, 1907..... | 90,000.00 |
| May 26, 1908..... | 82,000.00 |
| Mar. 3, 1909..... | 82,000.00 |
| May 18, 1910..... | 82,000.00 |
| Mar. 2, 1911..... | 91,000.00 |

Total..... 3,975,405.00

Reverted to Treasury.. \$44,166.63

Reapp. under head of parking..... 16,000.00

Outstanding liabilities,

June 30, 1912..... 12,341.62

62,508.25

Net amount ex-

pended..... 3,912,896.75

(a) For constr..... 3,378,845.99

For mainten. and operation. 534,050.76

(b) Paid by U. S..... 1,956,448.375

Paid by D. C..... 1,956,448.375

CONTRACTS.

Abstract of contracts in force. 03, 2510; 05, 2618; 06, 2101; 07, 2290.

1907. Ward W. Griffith, coal, \$3.75 t. 08, 2372.

1909. Merchants Coal Co., bituminous coal. 10, 2646.

ENGINEERS.

Chief of Engineers. R., 86, 365; 98, 545; 00, 709; 01, 674; 02, 596; 03, 657; 04, 728; 05, 736; 06, 819, 2096; 07, 838; 08, 882; 09, 927; 10, 1036; 11, 1098; 12, 1316.

In charge:

Maj. G. J. Lydecker. R., 86, 2021.

Col. G. H. Elliot. R., 94, 3203; 98, 3650.

Lt. Col. A. M. Miller. R., 00, 5224; 01, 3680; 02, 2712; 03, 2505; 04, 3890.

Lt. Col. S. S. Leach. R., 05, 2609.

Capt. Spencer Cosby. R. 06, 2096, 2101; (maj.), 07, 2289, 2291; 08, 2361, 2362.

Maj. J. J. Morrow. R., 09, 2316, 2317.

Capt. W. T. Hannum. 10, 2634.

Lt. Col. W. C. Langfitt. 11, 2946; 12, 3468.

Board.

Convened by order Sec. of War. R. on proper site for filtration beds for water supply. Recom. site at est. cost \$2,402,042.54. Lt. Col. A. M. Miller. Capt. L. H. Beach, Capt. D. D. Gaillard, 1st Lt. G. M. Hoffman. 01, 3683.

Assistants:

Capt. T. W. Symons. R., 86, 2021.

Capt. D. D. Gaillard. R., 98, 3640.

MAPS.

Sketch of Washington Aqueduct filtration plant. 04, 3890.

OPERATIONS.

1900-01. Preparation of drawing, erection of plant, other preliminary work. 01, 3682.

1901-02. Excavations for reservoir made and 274 l. f. east wall built; drawings for gatehouse made; excavation of intake foundation; survey of land; other misc. work. 02, 596. Amount and cost of work. 02, 2715.

1902-03. Various contracts let; excavation work begun; survey party laying out lines; temporary office established; amount and cost of work. 03, 2505.

1903-04. Filtration gatehouse completed; Michigan Ave. extension completed; installation and delivery of boilers, pumps, meters, sluice gates, and valves; cement; 18,917.1 c. y. concrete placed. 04, 3889.

1904-05. Pumping station completed; controller house completed; work on shelter house; various contract work done; 95,008 c. y. filter sand and 23,011 c. y. gravel placed. 05, 736, 2614.

1905-06. Office and laboratory, regulator houses, and shelter house completed; 5,000 sq. y. sod laid; 3,000' gravel road built; 7,000' cobblest. gutters laid; other misc. work done under contract. 06, 2096. Force organized for operation and mainten.; daily determinations for alkalinity and hardness made; other misc. work. Summary of total costs for operation; cost per million gallons filtered. 06, 2108; 07, 2291; 08, 2362; 09, 2317; 10, 2640.

1906-07. Only minor work done. Plant practically completed. 07, 2289.

See 1905-6.

1907-08. Machine shop erected; addl. filter unit built; gratings for covering wells in regulator houses completed. 08, 2361.

See 1905-6.

1908-09. Experimental filter plant for rate studies built. 09, 2316.

See 1905-6.

SPECIAL REPORTS.

R. by Lt. Col. Miller on treatment of Potomac R. water prior to filtration. Tables showing (1) record of filter A, (2) condition of water at Great Falls; various ests. for installing plant. 03, 2511-2515.

Remarks by Mr. Allen Hazen regarding use of a coagulant. 06, 2099.

¹ Unexpended balance of app. of \$90,000, act of Congress Mar. 2, 1907, reapp. for parking grounds, McMillan Park Reservoir, and expended under head of "Washington Aqueduct."

FABLES.

Turbidities. **06**, 2104; **07**, 2291; **08**, 2362; **09**, 317; **10**, 2635; **11**, 2947; **12**, 3468.

Bacteria per c. e. **06**, 2106; **07**, 2292; **09**, 2319; **10**, 2636; **11**, 2948; **12**, 3470.

Summary of results of tests for bacillus coli. **06**, 2106; **07**, 2292; **08**, 2362; **09**, 2320; **10**, 2637; **12**, 3472.

Summary of sanitary chemical analyses of weekly samples. **06**, 2109.

Tables showing rate of deaths from typhoid fever. **06**, 2110; **07**, 2294.

Experimental studies on rates of filtration. **09**, 325; **10**, 2643; **11**, 2950; **12**, 3468.

PROJECTS.

Act Mar. 1, 1901, Congress decided that the slow-sand system should be adopted; all plans were adapted to this system, and an addl. purchase of land was made, being enough to serve for a slow-sand filtration-plant with a capacity of 75,000,000 gallons per diem. **01**, 3682.

Mr. Allen Hazen employed as consulting engineer. **02**, 596.

Est. for remodeling Georgetown Reservoir, and constr. works to provide for the pre. treatment of Potomac water by means of a coagulant, \$90,000. **08**, 883.

MISC. 76. D. C.—WATER SUPPLY—48-INCH MAIN.

NOTE.—Act Mar. 2, 1889, au. a 48" main from distributing reservoir above Georgetown, e. to Rock Creek at M St., thence along M St. to New Hampshire Ave., etc., to connect with an existing 8" main from the "new" reservoir at R and Fourth Sts.; all to be done under the direction of he Chief of Engineers.

Plans, etc., begun at once. Contracts let.

In addition to line specified by Congress, a 30" main laid from New Jersey Ave. and B to E. Capitol rd Eleventh Sts.

Completed, 1891. **89**, 379, 2920; **92**, 416.

APPROPRIATION.

Mar. 2, 1889, \$575,000.

ENGINEERS.

Chief of Engineers. **R.**, 89, 378; **90**, 346; **91**, 441; **92**, 416.

In charge:

Lt. Col. J. M. Wilson. **R.**, 89, 2828.

Lt. Col. G. H. Elliot. **R.**, 90/ 3522; **91**, 3897; **92**, 3380.

MISC. 77. D. C.—WATER SUPPLY—INCREASING.

(See Misc. 73-83 on p. 2040 of this index.)

APPROPRIATIONS.

| | |
|----------------|--|
| July 15, 1882, | \$1,485,279.30 |
| July 7, 1884, | 87,500.00 |
| Mar. 3, 1885, | 87,500.00 |
| Mar. 26, 1886, | 5,000.00 |
| Aug. 4, 1886, | 555,000.00 |
| Mar. 30, 1888, | 355,000.00, 88 , 311. |
| Mar. 2, 1895, | ¹ 125,000.00, 95 , 487. |
| Mar. 3, 1897, | 200,000.00 |
| June 30, 1898, | 594,421.00 |
| June 6, 1900, | 139,034.34 |
| 1901, | 162,222.97, 01 , 3671. |
| 1902, | 69,490.00, 03 , 656, 2501. |
| 1908, | ² 10,000.00, 09 , 925; 12 , 1314. |
| 1911, | ³ 3,000.00, 12 , 1314. |
| Total, | 3,878,447.61 |

CONTRACTS.

Bricks; st.; cement; pumping plant; gates, valves, etc. **01**, 3671.

Pumping plant and roof. **02**, 2708.

Fence around reservoir. **03**, 2501.

ENGINEERS.

Chief of Engineers. **R.**, 83, 338; **84**, 343; **85**, 373; **86**, 366; **87**, 334; **88**, 310; **89**, 378; **90**, 348; **91**, 442; **92**, 416; **93**, 478; **94**, 434; **95**, 487; **96**, 433; **97**, 540; **98**, 545; **99**, 629; **00**, 707; **01**, 673; **02**, 594; **03**, 656; **04**, 727; **09**, 925; **10**, 1039; **11**, 1097; **12**, 1314.

Boards:

Convened by S. O. 107, July 15, 1885, to consider proj. of Maj. Lydecker for diversion of 3 small streams across the reservoir site. **R.**, 85, 2497. (Col. T. L. Casey, Lt. Col. W. P. Craighill, Maj. G. J. Lydecker.)

Board for consideration of a tunnel for aqueduct extension. **R.**, 87, 2546. (Col. J. C. Duane, Lt. Col. H. L. Abbot, Lt. Col. C. B. Comstock, Lt. Col. W. McFarland.)

Commission of Experts on tunnel constr. **R.**, 96, 3932. (Maj. W. L. Marshall; Capt. J. L. Lusk; A. Fteley, C. E.; D. Fitzgerald, C. E.; Capt. D. D. Gaillard.)

¹ Raising dam at Great Falls. ² Pre. survey, etc. **10**, 1039. ³ Ex. of availability of Patuxent R., Md.

In charge:

Maj. G. J. Lydecker. **R.**, 83, 2080; 84, 2301; 85, 2469; 86, 2043; 87, 2535; 88, 2755.

Lt. Col. J. M. Wilson. **R.**, 89, 2317.

Lt. Col. G. H. Elliot. **R.**, 90, 3531; (Col.) 91; 3904; 92, 3380; 93, 4309; 94, 3222.

Maj. J. G. D. Knight. **R.**, 95, 4111; 96, 3950 (on feasibility and propriety of completing the tunnel conduit), 3944 (views on abandonment of incomplete aqueduct tunnel).

Capt. D. D. Gaillard. **R.**, 96, 3925; 96, 3029 (testing tunnel conduit, and on feasibility and propriety of completing the conduit); 97, 4018.

Capt. T. A. Bingham. **R.**, 98, 3658.

Lt. Col. A. M. Miller. **R.**, 99, 3797; 00, 5203, 01, 3666; 02, 2706; 03, 2499; (Col.) 04, 3889.

Maj. J. J. Morrow. **R.** (H. D. 347, 61st, 2d), 10, 2649. (Suggests Patuxent R. as source of supply.)

Capt. W. T. Hannum. **R.**, 10, 1039.

Lt. Col. W. C. Langfitt. **R.**, 11, 2935; 12, 1314.

Assistants:

Capt. T. W. Symons. **R.**, 85, 2478.

Lt. C. McD. Townsend. **R.**, 87, 2557; 88, 2764, 89, 2820.

T. B. Main and A. J. Sparrow. **R.**, 96, 2942 (ex. of tunnel).

Gen. M. C. Meigs. **R.** (views on proposed abandonment of aqueduct tunnel), 96, 3949.

R. S. Smead. **R.**, 00, 5217 (tunnel).

Lt. G. M. Hoffman. **R.**, 00, 5221 (reservoir air shafts).

Capt. Hoxie. **R.**, 85, 2085 (ex., extension of aqueduct).

Lt. G. M. Hoffman. **R.**, 01, 3671.

R. C. Smead. **R.**, 01, 3674.

OPERATIONS.

1900-01. The tunnel completed from w. shaft to Howard University Reservoir. **01**, 674, 3666. Amount and cost of work. **01**, 3676.

1901-02. On Jan. 8, 1902, all connections bet. the tunnel, the reservoirs, and the city mains opened and new works placed in service. Details of work and cost. **02**, 2706, 2711.

1902-03. Work increasing water supply entirely completed, except the building of an iron fence around the reservoir. **03**, 2500. Details of work and cost. **03**, 2502, 2505.

1903-04. Entirely completed. **04**, 3889.

1909-12. See Engineers and Appropriations. An addl. increase needed. **09**, 925; **10**, 1039; **11**, 097; **12**, 1314.

SURVEYS.

Act May 26, 1908, app. \$20,000 (see Appropriations) for pre. investigations and surveys for increasing the water supply. Result, with recom. of Maj. J. J. Morrow, submitted through Chief of Engineers, July 8, 1909. Reference made in the report to using Patuxent R. (Unless there be prompt installation of meters in the D. C. a new aqueduct will be necessary. Believed for the best interests of the U. S. to determine as soon as practicable the adaptability of the Patuxent R. as a source of supply.) **10**, 1039, and H. D. 347, 61st, 2d.

MISC. 78. D. C. — WATER SUPPLY — INVESTIGATION OF FILTRATION METHODS.

NOTE.—Acts June 30, 1898, and Mar. 3, 1899, called for detailed ests. of the cost of filtering the water supply of Washington, D. C.

Data relating to filtration in U. S. and foreign countries collected.

Two experimental filters erected, to test merits of English or slow system and American rapid system of filtration.

Various experiments conducted relating to turbidities, bacteriology, etc. **99**, 631, 3809.

Better results obtained from the American system of filtration. Report submitted Mar. 28, 1900. S. D. 259, 56th, 1st. **00**, 709.

APPROPRIATIONS.

| | | |
|--------|---------|---------------------|
| 1898, | \$3,000 | 99, 3809; 00, 5224. |
| 1899, | 5,000 | |
| Total, | 8,000 | |

ENGINEERS.

Chief of Engineers. **R.**, 99, 631; 00, 709.

In charge. Capt. A. M. Miller. **R.** (Lt. Col.), 99, 3809; 00, 5224.

OPERATIONS.

See note above.

MISC. 79. D. C. — WATER SUPPLY — METERING WATER SUPPLY OF UNITED STATES BUILDINGS AND GROUNDS.

The necessity for the prompt installation of meters is explained in the report on "Increasing the water supply of the D. C.," H.-D. 347, 61st, 2d. The finding in this report that a new aqueduct was not necessary was based on the assumption, among others, that metering of all services in the D. C. would be immediately provided for.

... "a study of the consumption of water in the D. C. in its relation to air temperatures has led the officer in charge to conclude that the necessity for the general and complete installation of meters is still very urgent, not only to remove the necessity of an expend. of \$5,000,000 or \$6,000,000 for the constr. of a new aqueduct, but also to remove the possibility of the consumption of water exceeding the max. capacity of the aqueduct, which is still likely to happen in the case of the recurrence of a

period of cold weather similar to that of the winter of 1904-5."

By act of Congress approv. May 18, 1910, the sum of \$7,000 was app. to begin the work of metering the U. S. buildings, reservations, and grounds during the fiscal year 1911. This provided for "The purchase, installation, and mainten. of water meters to be placed on water services of the Government Printing Office, the U. S. navy yard, and the Municipal Building of the D. C., said meters to be purchased, installed, maintained, and remain under the observation and control of the officer in charge of the Washington Aqueduct."

The work provided for by the above act was completed.

10, 1038; 11, 1098; 12, 1315.

MISC. 80. D. C. — WATER SUPPLY — PRELIMINARY TREATMENT PLANT.

The necessity for this work is discussed in the Annual Report of the Chief of Engineers for 1908, pages 2365 to 2372.

By act of Congress, approv. May 18, 1910, provision was made for the constr. of works for applying a coagulant to the water supply and for the purchase of a coagulant.

The building for storing the coagulant was erected, the pumps, piping, dissolving tanks, heating plant, and other necessary apparatus for

applying the coagulant were installed and a supply of sulphate of alumina was purchased. Coagulant was applied to the water on 10.4 days in January and 3.7 in February. 08, 2365, 2372; 10, 1037.

1911. The operation of this plant is now provided for in the same item of the D. C. app. act as for the operation and mainten. of the filtration plant.

11, 1100.

MISC. 81. D. C.—RESERVOIRS—DALECARLIA RECEIVING RESERVOIR.

(See Misc. 73-83 on p. 2040 of this index.)

NOTE.—This reservoir, completed in 1859, partly in Montgomery Co., Md., and partly in the D. C., was constr. for the storage of Potomac water from Great Falls. It became contaminated by the water flowing into it from its watershed of about 4,000 acres.

The object of the imp., begun in 1893, was the diversion from the reservoir of the contaminating water, entering the reservoir by 3 streams, East Creek, Mill Creek, and Little Falls Branch.

The proj. for the imp. provided for the erection of dams across the valleys of all these streams, and diverting the damned waters through a shaft finally and tunnel to the Potomac. Est., \$150,000.

Map of watershed and plans of the works. 93, 4308-4309.

Work was begun July, 1893. 95, 489.

The work was completed under Col. Elliot, Nov. 15, 1895, with the exception of the acquirement of a small piece of land, about $\frac{1}{2}$ acre.

The works as completed consist of 4,869' of open paved chans., 4 earthen dams aggregating 629', a shaft 51' d., and 2 tunnels with an aggregate l. of 1,400'.

Water was turned into the reservoir July 27, 1895. 96, 437, 3971.

APPROPRIATIONS.

1893, \$60,000, **93**, 478, 4303.
1894, 52,500, **95**, 490, 4128.
1895, 37,500, **95**, 490, 4128.
1907, 30,000 (dr.), **08**, 880.
16,000 (dr.), **08**, 880.
20,000 (riprapping), **08**, 881.

Total, 216,000

CONTRACTS.

1907. Wetherill Bros. Machine Co., dr., \$26,400.
08, 880, 2359.

DREDGE.

Description. **08**, 2359.

ENGINEERS.

Chief of Engineers. **R.**, **95**, 489; **96**, 436.
(See also Misc. 73-83 on p. 2040 of this index.)

In charge:

Col. G. H. Elliot. **R.**, **95**, 4121.
Maj. C. E. L. B. Davis, 1895.
Capt. D. D. Gaillard. **R.**, **96**, 3971.
(See also Misc. 73-83 on p. 2040 of this index.)

OPERATIONS.

1907-08. 46,380 c. y. dr. **08**, 881. Riprap-
ping of by conduit completed, 1907. **08**, 881.
About 3,806 c. y. r. quarried, and 6,886 l. f. of shore
line graded, etc. **08**, 881.

1908-09. 64,210 c. y. dr. **09**, 925. 2,234 c. y.
st. quarried, and 4,230 l. f. slope paved for width
of 18'. **09**, 926.

RIGHT OF WAY.

2 R. R. (extension of Baltimore & Ohio R. R.),
under au. of Congress, laid extensions through
grounds. **93**, 4288; **09**, 926; **10**, 1039; **11**, 1097.

MISC. 82. D. C. — WATER SUPPLY — REMODELING GEORGETOWN RESERVOIR.

The necessity for the work was discussed in the
Annual Report of the Chief of Engineers for 1908,
pages 2365 to 2372.

By act of Congress, approv. Mar. 2, 1911, the sum
of \$50,000 was app. for remodeling the Georgetown
Reservoir in order to continue the works for pre-
treatment of the water supply. By act June 26,
1912, \$58,000 was app. for completing this work.

"The sediment in the raw water will, by pre-

treatment of the water, be precipitated and settle
out in the Georgetown Reservoir."

During the year 1911-12 contracts were made
with William F. Cush for excavation, building
dam and concrete stop plank opening, and with
R. E. Boisseau for constr. concrete drains, and con-
siderable work was done by hired labor.

11, 1101; **12**, 1317.

MISC. 83. D. C. — RESERVOIRS — PARKING GROUNDS, M'MILLAN PARK RESERVOIR.

This reservoir, situated near the Soldiers' Home, has
a capacity of 300,000,000 gallons. The park
has an area of 118 acres. Plans were drawn by
Olmsted Bros. for attractively parking this whole
area.

The act of Congress providing for the expenses
of the government of the D. C., approv. May 26,
1908, au. the expend. of not exceeding \$6,000 for
parking the grounds at the Washington City
Reservoir, the funds to be available until the
close of the fiscal year 1909. The work performed
during that year is described at page 2327 of the
Annual Report of the Chief of Engineers for 1909.

The sum of \$2,000 app. by act May 18, 1910, for
continuing the proj., was expended on that part
of the park s. of the reservoir. 700 c. y. of soil
were purchased, 424 sq. y. concrete sidewalk were
laid, and 249 trees were set out.

The sum of \$2,000 app. by act Mar. 2, 1911, for

continuing the proj., was also expended on the
area s. of the reservoir. The area was covered
with soil and seeded to grass, and 559 sq. y. of
sidewalk, 265 l. f. of tile drains, and 484 l. f. of con-
crete gutters were laid, and 1 flight of concrete
steps was constr.

By act of Congress, approv. June 26, 1912, \$2,000
was app. for continuing the parking in the fiscal
year 1913.

In order to complete this work it will be necessary
to do several thousand yards of grading on the n.
and w. sides of the reservoir, to lay 13,950 sq. y. of
concrete sidewalk, place 9,460 sq. y. of macadam
surface on the roads, purchase 14,125 c. y. of soil
for preparing the ground for planting shrubs and
trees, purchase and set out 1,208 trees and 18,400
shrubs, and make other minor changes.

08, 882; **09**, 929; **10**, 1038; **11**, 1101; **12**, 1317.

MISC. 84. D. C.—WHARVES, ETC.—U. S. WHARF PROPERTY, WASHINGTON, D. C. (1900-1913).

(See Misc. 65 on p. 2072 of this index.)

1900-01. Act of Congress approv. Mar. 3, 1899, placed "wharf property and certain public spaces" in the D. C. under control and jurisdiction of the Chief of Engineers. Legal steps taken to secure possession of occupied wharf property. **01**, 3727; **02**, 2746.

App. made to pay owners for their wharf structures, etc.; leases approv. **03**, 2571.

Sea wall should be rebuilt. **04**, 3958; **05**, 2662; **06**, 2152.

Various leases in force for use of wharf. **07**, 2345; **08**, 2417; **09**, 2368; **10**, 2680; **11**, 2987; **12**, 3509.

MISC. 85. EXPLORATIONS AND RECONNOISSANCES (1867-1900).

(See Misc. 85-96 on p. 2040 of this index.)

ENGINEERS.

Chief of Engineers. **R.**, **67**, 53; **68**, 76; **69**, 67; **70**, 87; **71**, 103; **72**, 100; **73**, 114; **74**, 123; **75**, 131; **76**, 120; **77**, 128; **78**, 146; **79**, 188; **80**, 246;

81, 339; **82**, 327; **83**, 342; **84**, 347; **85**, 376; **86**, 372; **87**, 344; **88**, 316; **89**, 386; **90**, 354; **91**, 449; **92**, 242; **93**, 488; **94**, 443; **95**, 497; **96**, 442; **97**, 547; **98**, 552; **99**, 639; **00**, 718.

MISC. 86. EXPLORATIONS, RECONNOISSANCES, AND WORK IN THE FIELD (1901-1912).

(See Misc. 85-96 on p. 2040 of this index.)

ENGINEERS.

Chief of Engineers. **01**, 683; **02**, 605; **03**, 668.

In charge:

Department of the Columbia—

Lt. Col. W. P. Richards, 7th U. S. Infantry.

01, 683, 3799.

Maj. W. C. Langfitt. **03**, 668, 2915.

Department of the East—

Capt. C. A. F. Flagler. **01**, 683, 3062.

Capt. F. R. Shunk. **02**, 606.

Lt. Col. W. R. Livermore. **03**, 668, 2902.

Manila, P. I.—

Lt. Lytle Brown. **01**, 683.

Lt. C. E. L. B. Davis. **02**, 606, 3050; **03**, 668, 2903.

Department of California—

Lt. Jas. F. McKinley, 11th U. S. Cavalry. **01**, 684.

Lt. Col. David P. Heap. **02**, 606, 3050; **03**, 668, 2899.

Department of the Missouri.

Maj. Smith S. Leach. **02**, 606, 3060; **03**, 668, 2914.

Department of Texas—

Capt. C. S. Riche. **02**, 606, 3061.

Department of Colorado—

Lt. Hugh A. Drum. **03**, 668, 2916.

Lt. Burton J. Mitchell, 12th U. S. Infantry. **02**, 606, 3063.

OPERATIONS.

Engr. officers and acting engr. officers on staffs of commanding generals of military divisions and departments engaged in building and repairing roads and brs., surveys in the field, making and distributing maps, and other duties incidental to work of engs. in the field. **01**, 683, 3799; **02**, 605, 3049; **03**, 667, 2899.

MISC. 87. EXPLORATIONS, ETC. — FORTIETH PARALLEL—GEOLOGICAL EXPLORATIONS.

ENGINEERS.

Chief of Engineers. **R.**, **67**, 54, 866; **68**, 76; **69**, 68; **70**, 87; **71**, 103; **72**, 101; **73**, 113; **74**, 122; **75**, 129; **76**, 119; **77**, 127; **78**, 141; **79**, 186; **80**, 245; **81**, 338.

In charge:

Clarence King, geologist. **R.**, **71**, 1027, 1030; **73**, 1203; **74**, ii, 477; **75**, ii, 919; **76**, iii, 217; **77**, ii, 1207; **78**, iii, 1419.

Ex. of so-called diamond fields. **73**, 1208.

MISC. 88. IRRIGATION — [(a) CALIFORNIA; (b) ARID LANDS—RECLAMATION].

(a) Irrigation—Joaquin, Tulare, and Sacramento Valleys, Cal.

ENGINEERS.

Chief of Engineers. R., 73, 115; 74, 126.

Commission:

Lt. Col. Alexander; Maj. Mendell; Prof. Davidson of the Coast Survey. H. Ex. D. 290, 43d, 1st.

(b) Arid Lands—Fund for Reclamation of.

NOTE.—Act June 17, 1902, set apart as a fund for the reclamation of arid lands the moneys received from the sale of public lands in certain of the States and Territories.

Total amount accumulated in the fund to January, 1911, est. at almost \$70,000,000. On June 30, 1910, the net investment in reclamation works amounted to \$53,781,302.88, in addition to about \$336,000 for secondary proj., townsitc development, Indian irrigation, and general expenses.

Reclamation act requires return to the reclamation fund of the est. cost of constr.; entrymen, etc., receiving water from such proj., required to contribute their proportion. Total cash returns to June 30, 1910, \$902,822.25; from water-right operation and mainten., \$249,637.19. An addl. revenue of \$2,086,173.73 derived from sale of town lots, water, power, etc.

June 30, 1910, U. S. prepared to supply water to 876,684 acres of land. Area of lands included in the proj. "now" (1910) under constr. over 3,100,000 acres.

The additions to the reclamation fund from the sales of public land found insufficient for the completion of the 30 primary proj. with such expedition as the necessities of settlers, etc., called for. President Taft recom. issuance of certificates of indebtedness against the reclamation fund.

Act June 25, 1910, which au. issuance of not exceeding \$20,000,000 of certificates of indebtedness, made the app. subject to the conditions that it should be expended upon existing proj., etc., and that no part of the same should be expended until after the proj. had been ex. and reported upon by a Board of Army Engineer Officers, and approv. by the President.

Exs. made by the BE., and recoms. made as to the allotments of the proceeds of the certificates to be issued.

The BE., in addition, recom. allotments of that part of the reclamation fund derived from the sale of public lands to supplement the \$20,000,000 loan, and to carry on worthy proj. not participating in the distribution of the loan.

BE. derived its facts from officers of the Reclamation Service, etc., settlers, landowners, and others. Feasibility of proj. considered from engineering and economic view.

BE. pointed out the importance of legislation au. sale of surplus water, and modifications of conditions for payments on certain proj. "which will otherwise fail of returning their cost to the reclamation fund."

Report of the BE. approv. by the President.

ENGINEERS.

Board:

Lt. Col. J. Biddle, Lt. Col. W. C. Langfitt, Maj. Wm. W. Harts, Maj. C. W. Kutz, Maj. H. Burgess. R., H. D. 1262, 61st, 3d.

Contents: Letter of transmittal, etc. Salt R. proj., Ariz. Yuma proj., Ariz.-Cal. Orland proj., Cal. Grand Valley proj., Colo. Uncompahgre proj., Colo. Minidoka proj., Idaho. Boise proj., Idaho. Garden City proj., Kans. Huntley proj., Mont. Milk R. proj., Mont. Sun R. proj., Mont. Lower Yellowstone proj., Mont. and N. Dak. North Platte proj., Wyo.-Neb. Truckee-Carson proj., Nev. Carlsbad proj., N. Mex. Hondo proj., N. Mex. Rio Grande proj., N. Mex.-Tex. Missouri R. pumping units, N. Dak. Umatilla proj., Ore. Klamath proj., Ore.-Cal. Belle Fourche proj., S. Dak. Strawberry Valley proj., Utah. Okanogan proj., Wash. Yakima proj., Wash. Shoshone proj., Wyo.

MISC. 89. EXPLORATIONS, ETC. — LAVA BEDS (MODOC CAMPAIGN), OREG.—RECONNOISSANCE.

ENGINEERS.

Chief of Engineers. R., 73, 114.

In charge: Capt. G. J. Lydecker. R., 73, 1219.

MISC. 90. MAUMEE VALLEY — HISTORIC GROUNDS, LOCATIONS, AND MILITARY WORKS (Examination of).

ENGINEERS.

Chief of Engineers. **R.**, 89, 386.

In charge: Col. O. M. Poe. **R.**, 89, 2869.

MISC. 91. MILITARY MAPS, GEOLOGICAL MAPS, ETC.

The operations of the Corps of Engineers require quite frequently the preparation of maps, plans, sketches, etc. A large number of these are printed as a part of the reports of the Chief of Engineers. (See pp. 21 of this index.) Each abstract throughout this index cites references to the maps, etc., relating to the work referred to in the abstract.

Various maps, etc., have been prepared by the department, but have not been published as a part of the reports. For example, see "Surveys—Northern and Northwest Lakes—Charts," on p. 2120-2124 of this index. The references below relate to other instances:

Maps—Military, geographical, and lake survey—

ENGINEERS.

Chief of Engineers. **R.**, 66, ii, 20; 68, 77; 39, 69; 76, iii, 117, 564; 77, 125; 78, 140; 79, 184; 30, 244; 81, 337; 82, 325.

Maps—Military and geographical—

ENGINEERS.

Chief of Engineers. **R.**, 83, 341; 84, 345; 85, 175; 86, 371; 88, 316; 89, 385.

Maps—Military and other maps—

ENGINEERS.

Chief of Engineers. **R.**, 90, 353; 91, 449; 92, 122; 93, 488; 94, 443.

Maps—Campaigns and battlefields—

ENGINEERS.

Chief of Engineers. **R.**, 66, ii, 23; 67, 54; 68, 3; 69, 69; 70, 88; 71, 104; 72, 102; 73, 112; 74, 21; 75, 128; 77, 125; 78, 140; 79, 185; 90, 354.

In charge:

Maj. N. Michler (Bvt. Brig. Gen.). **R.**, 68, 1199 649.; 69,

Maj. G. L. Gillespie (Bvt. Lt. Col.). **R.**, 73, 1202; 74, ii, 476.

Lt. Col. G. K. Warren. **R.**, 79, iii, 1973.

Explorations—Reports and maps, certain omissions—

ENGINEERS.

Chief of Engineers. **R.**, 72, 102; 75, 131.

In charge:

Col. J. H. Simpson. **R.**, 72, 1173.

Maj. G. K. Warren (Bvt. Maj. Gen.). **R.**, 75, 1240.

Maps—Inclusive of war maps—

Paragraph 393 of the Army Regulations requires that the commanding officer of each post where there are fixed batteries bearing upon a chan. will call upon the Engineer Department for accurate charts showing the soundings to the extent of the ranges of the guns. Ests. for this work submitted an. Amount usually required, \$5,000. **01**, 685; **02**, 611; **03**, 673; **04**, 739; **05**, 747; **06**, 828; **07**, 858; **08**, 898; **09**, 945; **10**, 1056.

Atlas of the Battlefield of Antietam, prepared under direction of Antietam Battlefield Board. **05**, 747.

Map of battlefield of San Juan, near Santiago Cuba, printed. **06**, 828.

Maps of Manchurian campaign of Russo-Japanese War, and of the Civil War printed. **08**, 898.

In view of the urgent necessity of printing certain important military maps being prepared in addition to the prosecution of the work ordinarily accomplished under this app., the est. submitted for the fiscal year ending June 30, 1913, increased to \$10,000. **11**; 30; 12, 28.

MISC. 92. EXPLORATIONS — ONE HUNDREDTH MERIDIAN.

Territory s. of Central Pacific R. R., embracing parts of e. Nevada and Arizona.

(Topographical and geographical surveys and explorations w. of the one hundredth meridian.)

List of publications. **78**, iii, 1656.

ENGINEERS.

Chief of Engineers. **R.**, **71**, 101, 103; **73**, 113; **74**, 122; **75**, 130; **76**, 120; **77**, 120, 127; **78**, 142; **79**, 186; **80**, 245; **81**, 338; **82**, 326; **83**, 341; **84**, 346; **85**, 376.

In charge:

Lt. G. M. Wheeler. **R.**, **73**, 1211, 1217; **74**, ii, 480, 589 (plan of publication of the report); **75**, ii, 921; **76**, iii, 219; **77**, ii, 1209; **78**, iii, 1421; (Capt.) 1977; **80**, iii, 2459; **84**, 2375.

Lt. M. M. Macomb, 4th Inf. **R.**, **81**, 2805; **82**, 2821; **83**, 2379.

Assistants:

Lt. R. L. Hoxie. **R.**, **74**, ii, 481; **75**, ii, 957.

Lt. W. L. Marshall. **R.**, **74**, ii, 483; **75**, ii, 957, 967 (meteorology and hypsometry); **76**, iii, 300, 370 (meteorology and hypsometry).

Acting Asst. Surg. H. C. Yarrow, U. S. Army. **R.**, **74**, ii, 583 (natural history); **75**, ii, 1059; **76**, iii, 532 (ethnological research); **78**, iii, 1623 (fishes), 1628 (reptiles and batrachians).

Prof. E. D. Cope. **R.**, **74**, ii, 591 (geology—paleontology); **75**, ii, 921, 981, 1086.

Lt. P. M. Price. **R.**, **75**, ii, 960.

Lt. R. Birnie, jr., 13th Inf. **R.**, **75**, ii, 961, 1098 (ruins); **76**, iii, 350; **77**, 1262; **78**, iii, 1544; **79**, iii, 2215.

Lt. S. E. Blunt, Ord. Corps. **R.**, **75**, ii, 963.

Lt. C. W. Whipple, 3d Art. **R.**, **75**, ii, 964; **76**, iii, 367.

Dr. O. Leow. **R.**, **75**, ii, 1017 (geology and mineralogy); **76**, iii, 393 (geology and mineralogy); **75**, ii, 1049 (agricultural researches); **76**, iii, 434 (agricultural researches), 422; **75**, ii, 1094 (ruins); **76**, iii, 372 (meteorological conditions, Mohave Desert), 393 (geology—mineralogy); **76**, iii, 403 (alkaline lakes, springs, etc.), 434 (physical and agricultural features of Mohave Desert); **76**, iii, 541 (ethnology); **76**, iii, 442 (vegetation of Mohave Desert), 548 (effects of dry climate).

Dr. J. T. Rothrock, acting assistant surgeon, U. S. Army. **R.**, **75**, ii, 1037 (natural history and botany); **76**, iii, 422 (natural history and botany).

H. W. Henshaw. **R.**, **75**, ii, 1069, 1073 (ornithology); **76**, iii, 444 (ornithology), 525 (mammals); **77**, ii, 1303 (mammals); **77**, iii, 525 (mammals); **78**, iii, 1607 (mammals), 1609 (fishes), 1623, 1628 (reptiles and batrachians); **79**, iii, 2260 (reptiles and batrachians).

C. E. Aiken. **R.**, **75**, ii, 1070 (zoology).

A. S. Gatchet. **R.**, **75**, ii, 1100 (Indian languages); **76**, iii, 550.

Lt. E. Bergland. **R.**, **76**, iii, 329; **77**, ii, 1250; **78**, iii, 1525.

Lt. W. L. Carpenter, 9th Inf. **R.**, **76**, iii, 346; **76**, iii, 521 (insect fauna).

Lt. C. C. Morrison, 6th Cav. **R.**, **76**, iii, 356 **77**, ii, 1273; **78**, iii, 1553.

Prof. J. Morcou. **R.**, **76**, iii, 378 (geology); **78**, iii, 1648 (discoveries of California).

A. R. Conkling. **R.**, **76**, iii, 419 (geology); **77**, ii, 1285, 1295, 1298 (geology); **78**, iii, 1589, 1606 (geology).

S. H. Scudder. **R.**, **76**, iii, 493 (orthoptera).

J. L. Le Conte, M. D. **R.**, **76**, iii, 516 (coleoptera).

Lt. S. E. Tillman. **R.**, **77**, ii, 1253; **78**, iii, 1529; **79**, iii, 2187.

Lt. T. W. Symons. **R.**, **77**, ii, 1257; **78**, iii, 1535; **79**, iii, 2192.

Lt. M. M. Macomb, 4th Art. **R.**, **77**, ii, 1278; **78**, iii, 1561; **79**, iii, 2231.

J. A. Church. **R.**, **77**, ii, 1284 (Comstock Lode); **78**, iii, 1567.

P. R. Uhler. **R.**, **77**, ii, 1322 (hemiptera).

Lt. W. Young. **R.**, **78**, iii, 1542; **79**, iii, 2206; **79**, iii, 2213 (survey of Great Salt Lake).

Prof. D. S. Jordan. **R.**, **78**, iii, 1609 (fishes).

Lt. E. Griffin. **R.**, **79**, iii, 2201.

Lt. H. H. Ludlow, 3d Art. **R.**, **79**, iii, 2239.

Prof. T. H. Safford, Ph. D. **R.**, **79**, iii, 2242 (astronomy).

J. H. Clark. **R.**, **79**, iii, 2243 (astronomy).

M. Rock. **R.**, **79**, iii, 2246 (astronomy).

Prof. J. J. Stevenson. **R.**, **79**, iii, 2249, 2259 (geological report).

MISC. 93. STONES, BUILDING—EXPERIMENTAL TESTS.

ENGINEERS.

Chief of Engineers. **R.**, **74**, 126.

In charge. Lt. Col. Q. A. Gillmore (Bvt. Maj. Gen.). **R.**, **75**, ii, 819.

MISC. 94. MINING—SUTRO TUNNEL.

NOTE.—Act Apr. 4, 1871, the President au. and requested to appoint a board of 3, 2 members to be of the Corps of Engineers, and 1 a civil or mining engineer, to ex. and report on the Sutro Tunnel, Nev., au. by act July 25, 1866, "with special reference to the importance, feasibility, cost, and me required to constr. the same; the value of the bullion extracted from the mines on the Comstock lode; their present and probable future reduction; also, the geological and practical value of said tunnel as an exploring work, and its general

bearing upon our mining and other national interests in ascertaining the practicability of deep mining."

ENGINEERS.

Chief of Engineers. R., 71, 105; 72, 102.

Commission. R., 72, 1126. (Lt. Col. H. G. Wright (Bvt. Maj. Gen.); Lt. Col. J. C. Foster (Bvt. Maj. Gen.); W. Newcomb, civil and mining engineer; secretary, Capt. W. R. King.)

MISC. 95. EXPLORATIONS — UINTAH MOUNTAINS, UTAH.

ENGINEERS.

Chief of Engineers. R., 72, 101.

In charge. Capt. W. A. Jones. R., 72, 1108.

MISC. 96. EXPLORATIONS—RAYMOND EXPLORATION, YUKON RIVER, ALASKA.

ENGINEERS.

Chief of Engineers. R., 71, 103.

In charge. Capt. C. W. Raymond, 1871. Ex. D. 12, 42d, 1st.

NOTE.—This is believed to be the first exploration of the upper reaches of the Yukon.

MISC. 97. FORTIFICATIONS.

(See p. 1793 of this index.)

MISC. 98. FORTIFICATIONS—ISTHMIAN CANAL.

The constr. of these works was under the Isthmian Canal Commission, but plans for the various

defensive works were prepared by the Chief of Engineers. 12, 23.

MISC. 99. LAWS AFFECTING THE CORPS OF ENGINEERS.

NOTE.—Since 1873 the an. reports of the Chief of Engineers reprint all the laws passed in the preceding fiscal year which have a bearing on rivers and harbors, etc. See also page 2329 of this index.

Complete copies of the laws relating to rivers and harbors only are printed in several volumes, covering the laws from Aug. 11, 1790, to Mar. 4, 1913, as H. D. 1491, 62d, 3d.

1873, 121; 75, 139; 76, 129; 77, 143; 78, 163; 79, 209; 80, 265; 81, 367; 82, 353; 83, 367; 84, 371; 85, 401; 86, 395; 87, 371; 88, 2821; 89, 413; 90, 3607; 91, 477; 92, 3463; 93, 519; 94, 3455; 95, 4259; 96, 4079; 97, 4137 (compilation of laws for protection of navigable waters); 4151, 4197; 98, 3789; 99, 3903; 00, 5457; 01, 3837; 02, 3079; 03, 2943; 04, 4223, 4314; 05, 2847; 06, 2281; 07, 2477; 08, 2563; 09, 2527; 10, 2751; 11, 3051; 12, 3569.

MISC. 100. MONUMENTS—FORT RECOVERY, OHIO.

APPROPRIATION.

1910, \$25,000, 11, 1121.

CONTRACT.

1912. Van Amringe Granite Co., Boston, Mass.
12, 1346.

ENGINEERS.

Chief of Engineers. R., 11, 1121; 12, 1345.

In charge. Maj. J. C. Oakes. 11, 1121; 12,
1345.

PROJECTS.

1911. Preparatory work; designs to be submitted August, 1911: 11, 1121.

1912. The design of monument selected is the Egyptian obelisk; it will be 101' 4" in h. above grade and will have at the base of the shaft and in a standing position a granite statue of a frontiersman 9' in h. The exterior walls of the shaft will be of granite blocks and the backing of reinforced concrete, with a circular shaft in the center.

During the year the foundation and the lower 18 courses of the shaft were completed. 12, 1345.

MISC. 101. MONUMENTS—FREDERICK THE GREAT.

APPROPRIATION.

1904, \$8,000, 04, 4199.

ENGINEERS.

Chief of Engineers. R., 04, 742; 05, 749.

In charge. Capt. J. S. Sewell. R., 04, 4199;
05, 2835.

PROJECTS AND OPERATIONS.

1904. The work was au. by the sundry civil
act Apr. 28, 1904.

* * * * *
"To defray the expenses incident to the erection and dedication, upon War College grounds, Washington Barracks, of the statue of Frederick the Great, the gift to the United States of His Imperial Majesty the Emperor of Germany, to be immediately available, eight thousand dollars."

Contract awarded for the granite pedestal; contractors had selected rough blocks for the work by the close of the fiscal year. Some study given subject of a suitable order of exercises for the dedication of the statue. 04, 4199.

1905. Pedestal purchased and placed in position, the statue placed thereon, unveiling ceremonies on Nov. 19, 1904.

Pedestal stands on the line of front steps leading up to the terrace in front of the War College. It occupies one of six granite bases provided for similar purposes.

All the work in connection with the statue proper has been completed, except that an inscription stating the date of dedication remains to be placed on the s. side of the base of the pedestal. 05, 2835.

MISC. 102. MONUMENTS—TO GENs. FRANCIS NASH AND WM. LEE DAVIDSON.

CONTRACTS.

1905. James F. Nowlan, monuments, \$8,750.
05, 2837. Henry Bonnard Bronze Co., New York,
4 bronze tablets, \$500. 05, 2837.

ENGINEERS.

Chief of Engineers. R., 03, 676; 04, 742; 05,
750; 06, 830.

In charge:

Capt. E. E. Winslow. R., 03, 2939.

Capt. R. P. Johnston. R., 04, 4201; 05, 2837;
06, 2273.

PROJECTS.

Congress au. \$5,000 by joint resolution, Jan. 30,
1903, for each monument. 03, 676.

Sites in Guilford battle grounds, near Greensboro, N. C., selected by governor of North Carolina. approv. by Sec. of War. 03, 2939.

Resolution of Continental Congress, Nov. 4, 1777. Resolved, That his excellency Governor Caswell of North Carolina be requested to erect a monument of the value of \$500, at the expense of the U. S., in honor of the memory of "Brig. Gen. Francis Nash, who fell in the Battle of Germantown, on the 4th day of October, 1777, bravely contending for the independence of his country."

Resolution of Continental Congress, Sept. 20, 1781. Resolved, That the governor and council of the State of North Carolina be desired to erect a monument, at the expense of the U. S., not exceeding the value of \$500, to the memory of the "late Brig. Gen. Davidson, who commanded the militia of the district of Salisbury, in the State of North Carolina, and was killed on the 1st day of February last, fighting gallantly in the defense of the liberty and independence of these States."

To carry those resolutions into effect, Congress, by joint resolution, approv. Jan. 30, 1903, app.

for each monument, the funds to be distributed under the direction of the Sec. of War.

monuments completed, 1906, and given the custody of the State of North Carolina, "cared for and preserved by the State."

monuments, which are practically identical sign, are simple monumental arches, with bronze inscription tablets on each monument, with no sculpture. These arches span a narrow roadway in the Guilford battle ground, which is the Atlantic & Yadkin R. R., a branch of the Southern R. R., at the battle-ground station, 6 m. from Greensboro, N. C. The road crosses the R. R. approx. at right angles, and the arches are on either side of the R. R. and about 100 yds. apart.

The arches are 33' 6" h., 28' 6" w., and 7' thick, and present a very massive, substantial appearance. The clear w. of archway is 12' 6" and the clear h. from the ground to the soffit of the keystone is 20' 4". The arches are of solid masonry, the exposed sts. being cut to the dimensions, but with quarry faces, and the interior core being of rubble. The outside arch sts. vary from 8" to 18" in thickness, so the core and shell are intimately bonded together. The granite has a uniform light-gray color (almost white) and is very even grained and almost entirely free from stains or flaws of any kind.

On the front face of each monument (that is, the face toward the R. R.) the surname of the hero to whom the monument is erected appears in raised letters on the heavy belt st. immediately above the keystone.

On each inscription tablet are of cast bronze, each being 2' 6" in w. by 3' 6" in h. These tablets

are placed on the front faces of the columns supporting the arch, and are at such height from the ground as to be conveniently and easily read.

The inscriptions read as follows:

Inscriptions on tablets on Davidson Monument:

Tablet No. 1—Brigadier General William Lee Davidson. Born 1746. Killed in the battle of Cowan's Ford, N. C., February 1st, 1781. Major, April 15, 1776. Lieut. Colonel, Oct. 4, 1777. Brigadier General, Aug. 31, 1780. "On Fame's eternal camping ground."

Tablet No. 2—"To the memory of the late Brigadier General Davidson, who commanded the militia of the District of Salisbury, in the State of North Carolina, and was killed on the 1st day of February last, fighting gallantly in defence of the liberty and independence of the States." (Extract from Resolution of Congress September 20, 1781.)

Inscriptions on tablets on Nash Monument:

Tablet No. 1—Brigadier General Francis Nash. Born 1742. Fatally wounded in battle of Germantown, Pa., October 4, 1777. Member of Provincial Congress of North Carolina, 1775. Lieutenant Colonel, September 1, 1775. Colonel, April 10, 1776. Brigadier General, February 5, 1777. "Ever since the dawn of the Revolution I have stood for the cause of Liberty and my country."

Tablet No. 2—"In honor of the memory of Brigadier General Francis Nash, who fell in the battle of Germantown, on the 4th day of October, 1777, bravely contending for the independence of his country." (Extract from Resolution of Continental Congress November 4, 1777.)

06, 2273.

SC. 103. MONUMENTS—GUILFORD COURTHOUSE.

APPROPRIATION.

1911, \$30,000, 11, 1122.

TRACTS.

Projects.

ENGINEERS.

Chief of Engineers. R., 11, 1122; 12, 1348.

CHARGE:

1st. E. I. Brown. 11, 1122.

2nd. L. H. Rand. 12, 1348.

3rd. H. W. Stickle. 12, 1348.

OBJECTS.

1st. Feb. 13, 1911, authorized erection of a monument on the battle field of Guilford Courthouse, Guilford

County, N. C., to commemorate the battle fought there on Mar. 15, 1781, by the American forces, commanded by Maj. Gen. Nathanael Greene, and in memory of Maj. Gen. Nathanael Greene, and the officers and sailors of the Continental Army who participated in the Battle of Guilford Courthouse. The funds to be expended under the direction of Sec. of War.

Operations during 1910-11 consisted in the preparation of a program of competition, the selection of a location for the monument, and the acceptance of a deed to the site selected. 11, 1122.

Of the various models, selection made of No. 5; award made to the designer, Mr. Packer; price, \$27,500. 12, 1348.

MISC. 104. MONUMENTS—KINGS MOUNTAIN, S. C.

APPROPRIATION.

1906, \$30,000, 07, 861.

CONTRACT.

1908. Southern Marble & Granite Co., monumental constr., \$25,000 (supplemental contract, \$21,000). 09, 2521.

ENGINEERS.

Chief of Engineers. R., 07, 861; 08, 903; 09, 950; 10, 1060.

In charge:

Capt. G. P. Howell. 07, 861.

Capt. E. P. Stuart. R., 08, 2561.

Capt. E. I. Brown. R., 09, 2521.

Capt. E. N. Adams. R., 10, 2745.

PROJECTS AND OPERATIONS.

1907. Act June 16, 1906, au. erection of a monument on Kings Mountain battle ground to commemorate the victory of the War of the American Revolution, Oct. 7, 1780. Title to the land determined by the Attorney General of the U. S., to rest with the Kings Mountain Centennial Association of S. C. 07, 861.

1908. Recom. and approv. that McKim, Mead & White, architects, New York City, be employed to prepare designs and specifications for

this monument. The type of monument decided upon an obelisk bearing 4 tablets, for inscriptions, within an inclosure.

Bids opened Apr. 23, 1908, for the constr. of this monument, and contract was awarded to The Southern Marble & Granite Co., Spartanburg, S. C., to construct a monument 115' 3" h., of granite from the quarry of The North Carolina Granite Corp., Mount Airy, N. C., for the sum of \$25,000.

At the close of the fiscal year the plan of the monument had been approv., the inscriptions for the bronze tablets had received the approval of the Sec. of War, and everything was in readiness for the constr. of the monument; the contractor had built storage sheds and office on the site, and ground had been broken for the excavation for the foundation on June 23. 08, 2561.

1910. Owing to the greater d. required to secure a suitable footing for the foundation, it became necessary to reduce the size of the monument originally contemplated. Supplemental contract was therefore made for the constr. of a monument 83' 6" h., with lightning conductor installed, for the sum of \$21,000. Under this contract the monument completed, with the exception of the sculptured work, setting of the bronze tablets, and erection of inclosure. During the year this work was completed and final payment under the contract was made. 10, 2745.

MISC. 105. MONUMENTS—MONTEREY, CAL.

APPROPRIATION.

1907, \$10,000, 09, 2523.

ENGINEERS.

Chief of Engineers. R., 08, 903; 09, 951; 10, 1061.

In charge. Lt. Col. J. Biddle. 08, 903; R., 09, 2523; 10, 2749.

PROJECTS AND OPERATIONS.

During the War with Mexico, on July 7, 1846, Commodore Sloat, in accordance with instructions from our Government, landed a force of sailors and marines at Monterey and took possession of California in the name of the U. S. In 1886 an organization composed of Mexican War veterans, California pioneers, Army and Navy officers, and others prominent in the affairs of the State, was formed for the purpose of erecting a monument to Commodore Sloat, the organization being known as the Sloat Monument Association.

A site was procured on the military reservation of the Presidio of Monterey, on the slope of a hill

overlooking the B. of Monterey. Upon this site, which is unobstructed by trees or adjacent buildings, a suitable foundation was laid and a base, or platform, for the proposed monument was constr., faced with sts. which were contributed by various counties of the State, military, and civic organizations. The base is 24' sq. and 6' h.

The U. S., act Mar. 4, 1907, app. \$10,000 for the erection of a monument to Commodore John Drake Sloat, U. S. Navy, at Monterey, Cal. A portion of this sum, not to exceed \$1,000, to be devoted to procuring a suitable design and other pre. expenses, leaving about \$9,000 for the actual work, act of Mar. 28, 1908.

The amount expended on base unknown.

With the aid of the San Francisco Art Institute and the Sloat Monument Association, a design made; approv. by Sec. of War June 29, 1909.

Competitive designs obtained by offering 3 prizes of \$250, \$150, and \$100, respectively.

08, 903; 09, 951, 2523.

1910. Monument completed June 2, 1910, and dedicated June 14, 1910. 10, 2749.

ISC. 106. MONUMENTS—NEW ORLEANS, LA.**PROPRIATION.**

1907, \$25,000, 07, 862.

CONTRACT.

908. M. P. Doullert, building work (3 contracts). 08, 2560.

ENGINEERS.

Chief of Engineers. R., 07, 862; 08, 902; 09,

in charge:

Capt. J. F. McIndoe. 07, 862; R., 08, 2559.

1st Lt. W. Willing. 09, 949.

1st Col. L. H. Beach. R., 09, 2519.

OBJECTS AND OPERATIONS.

Act Mar. 4, 1907, Congress au. completion of a monument to memory of the soldiers who fell in the Battle of New Orleans in the War of 1812. Design of the monument approv. by Sec. of War July 17, 1907; work of constr. and disbursement of funds assigned to Engineer Department. The site of the structure is at Chalmette, La. 07, 862.

The Chalmette monument was originally designed by Newton Richards, whose plans were accepted by the Jackson Monument Association May, 1855. This design consisted of a plain shaft 142' h., resting on 5 steps, each 2' h. and rising about 2' 6" above the natural surface of the ground; the shaft to be 16' 8" sq. at the base and 12' 6" at the top; the base of the shaft to have the 4 faces corniced projections surmounted by sculptured emblems, one of these to serve as entrance to a spiral stairway leading to a chamber at the top; the stair to be lighted by small

openings at regular intervals; both shaft and base to be faced with marble.

A contract for the erection of the monument was awarded in June, 1855, but the work was not completed.

At the time Congress made the above app. no work had been done for over 50 years, it is said. The shaft was 56' 10" h., measuring from the top of the mound of earth about 12' 6" above the natural surface and about 185' in diameter which had been placed around the monument to protect the brick foundation. The base was 16' 8" sq. outside and 10' 8" diameter inside; the top was 14' 11" sq. outside and 9' 11" diameter inside.

Under proj. approv. July 6, 1907, it was proposed to remove the mound of earth covering the base of the existing monument, to extend the shaft on the original lines 24' 2½", and to place thereon a pyramid 9' h., making the top of the monument when completed approx. 100' above the natural level of the ground. The entire shaft and base are to be covered with marble. A spiral stairway, with iron steps supported by a central brick pier and the brick lining of shaft, leads to an observation chamber 9' 6" sq. in top of monument. There is to be a bronze door at the entrance to the monument, bronze handrails on both sides of stairway, bronze grilles in the windows of observation chamber, and a bronze historical tablet on the wall of observation chamber. 08, 902.

The monument was completed by the contractor in December, 1908, and in March, 1909, transferred to the custody of the United [States] Daughters of 1776 and 1812, as required by the act of Mar. 4, 1907, under au. of a letter from the Sec. of War dated Mar. 5, 1909. 09, 949.

ISC. 107. MONUMENTS—POINT PLEASANT.**CONTRACT.**

See Projects, etc.)

ENGINEERS.

Chief of Engineers. R., 09, 952; 10, 1061.

in charge:

Capt. F. W. Altstaetter. 09, 2525; 10, 2747.

OBJECT AND OPERATION.

The public building act May 30, 1908, app. the sum of \$10,000 to aid in the erection and completion of a memorial structure at Pt. Pleasant, W. Va., to commemorate a battle of the Revolution fought at that point.

909. The site and plans having been approv.

by the Sec. of War for the erection of a granite monument in Tu-endi-wei Park, Pt. Pleasant, W. Va., contract entered into bet. the U. S., the trustees of the Pt. Pleasant battle monument, and the Van Amringe Granite Co., of Boston, for the erection of a monument at a cost of \$15,000, \$10,000 of which, less cost of supervision, is to be paid by the Government. 09, 952, 2525.

1910. The lower courses, shaft, bronze tablets, and the "Frontiersman" statue were placed. On July 22, a storm wrecked the cribbing used in erecting the monument, but no damage was done to the permanent work. The monument was accepted on the part of the Government Nov. 26, it having been unveiled by the people of Pt. Pleasant on Oct. 9. 10, 2747.

MISC. 108. MONUMENTS—TO SERGEANT FLOYD.**ENGINEERS.**

Chief of Engineers. R., 99, 641; 00, 722; 01, 687.

In charge. Capt. H. M. Chittenden. R., 00, 5455; 01, 3827.

Deficiency act Mar. 3, 1899, app. \$5,000 for erection, in cooperation with Floyd Memorial Association, of a monument near Sioux City, Iowa, over the remains of Sergt. Charles Floyd, of the Lewis and Clark Expedition. This sum expended in conjunction with other sums app. by Iowa, county of Woodbury, Iowa; city of Sioux City, Iowa; and contributions from various other sources, the total amounting to nearly \$20,000. Work conducted entirely under supervision of the U. S. Engineer office in Sioux City.

At the close of 1900 the foundation for the monument had been completed, a contract had been let on the part of the State of Iowa for the st. in the shaft, and advertisements were out for the erection of the monument, this part of the work to be done from the U. S. app.

The monument was formally dedicated May 30, 1900.

The foundation is a solid monolith of concrete, approx. of the form of a frustum of a pyramid, with 484 sq. f. bearing surface. It weighs 278 t.

The style of the shaft is that of the Egyptian obelisk. The base is 9.42' sq. and the h. is 100.174'. The material is cut st. from the Kettle R. sandst. quarries of Minnesota. The cut st. comprises the greater part of the volume of the shaft, there being a small core composed of concrete. Upon the e. and w. faces of the shaft are 2 large bronze tablets² with suitable inscriptions. The monument is protected from defacement by a steel picket fence 7½' h. A concrete pavement in the form of a terrace and roadway extends around the monument to the circumference of a circle of nearly 50' radius. The grounds in the immediate vicinity have been graded, and a roadway has been constructed from the monument to the nearest public highway.

The monument and 1 acre of ground around it are now the property of the Floyd Memorial Association. 01, 687.

Calculation for constr. of obelisk. Constr. of foundation. Securing dimension st. Proportions of Bunker Hill, Bennington, and Washington Obelisks. 01, 3827.

MISC. 109. MONUMENTS—BRIG. GEN. SHIELDS.**APPROPRIATION.**

1910, \$3,000, 10, 1062.

CONTRACTS.

(See Projects.)

ENGINEER.

Chief of Engineers. R., 10, 1062; 11, 1120.

In charge. Maj. E. H. Schulz. 10, 1062; 11, 1120.

PROJECTS.

Act June 25, 1910, au. monument over grave of Brig. Gen. James Shields, St. Marys Cemetery, Carrollton, Mo. 10, 1062.

Award was made to Jerome Connor, sculptor, of Washington, D. C., \$2,925. Monument completed and accepted Nov. 12, 1910. Unveiled on this date with appropriate ceremonies in the presence of the widow and son of Gen. Shields. There were also present distinguished citizens of

Carrollton, the State of Missouri, and the Nation, including Hon. H. S. Hadley, governor of Missouri; Hon. W. W. Rucker, Member of Congress from the second district of Missouri; Jerome Connor, the sculptor and contractor, of Washington, D. C.; and others. National troops from Fort Leavenworth and Missouri State troops were in attendance.

The monument was erected on the Shields lot in St. Marys Cemetery, Carrollton, Mo. It rests on a concrete foundation: 6' 8" by 7' 6" by 6' d. The pedestal is 8' 6" h., of 3 pieces of Missouri granite, with all the exposed surfaces highly polished, and weighs between 15 and 16 t. The first base is 6' 8" by 7' 6" by 1', the second 4' 8" by 3' 10" by 1' 8", and the third 4' 2" by 3' 4" by 6' 10". On this is placed the bust, 4' 6" in height. It is of American standard bronze and weighs 800 pounds. Total height, 14'.

On the face of the monument, n. side, is engraved: "General James Shields, born in County Tyrone, Ireland, May 10, 1810, and died in Ottumwa, Iowa,

¹ NOTE.—The records of the expedition spell Clark's name sometimes with a final "e" and sometimes without. A facsimile of a document signed by Clark shows that he spelled his name without a final "e."

² Tablet on west face of monument:

"Floyd. This shaft marks the burial place of Sergeant Charles Floyd, a member of the Lewis and Clark Expedition. He died in his country's service and was buried near this spot August 20, 1804. Graves of such men are pilgrim shrines; shrines to no class or creed confined. Erected A. D. 1900, by the Floyd Memorial Association, aided by the United States and the State of Iowa."

Tablet on other faces of monument:

"In commemoration of the Louisiana purchase, made during the administration of Thomas Jefferson, third President of the United States, April 30, 1803. Of its successful exploration by the heroic members of the Lewis and Clark Expedition. Of the valor of the American soldier and of the enterprise, courage, and fortitude of the American pioneer to whom these great States west of the Mississippi River owe their secure foundation."

June 1, 1879. Soldier, jurist, statesman. Erected by the United States under an act of the Congress approved March 15, 1910."

Underneath was placed the bronze coat of arms of the U. S. On the right side the words "Winchester, Port Republic"; on the left side "Cerro

Gordo, Chapultepec"; and on the rear of the pedestal is another bronze ornament, consisting of a palm leaf with the seals of the States which he represented in the U. S. Senate, with the inscription, "United States Senator from Illinois, Minnesota, and Missouri." 11, 1120.

MISC. 110. MONUMENTS—MEMORIAL ARCH AT VALLEY FORGE.

APPROPRIATION.

1911, \$100,000, 11, 1121.

CONTRACTS.

1911. Paul P. Cret, architect, \$5,460. 12, 1346.

1912. H. L. Brown, erection, \$91,000. 12, 1347.

ENGINEERS.

Chief of Engineers. R., 11, 1121; 12, 1346.

PROJECTS.

Act June 25, 1910, an. erection, upon site of the encampment during the winter of 1777-78, of a memorial arch within the Valley Forge Park. The said act also provided that the amount an. should be expended by the Valley Forge Park Commission under the direction of the Sec. of War; no app. made.

Act Mar. 4, 1911, made app. and provided that the money should be expended under the direction of the Sec. of War.

In 1910 resolution adopted by Valley Forge Park Commission approving the perspective drawings, plans, and specifications submitted by Mr. Paul P. Cret, architect, and directing their submission to the Sec. of War, who gave his approval Mar. 27, 1911. Location originally decided upon at a point near the intersection of the Old Gulph Road and the Outer Boulevard; approved by Sec. of War.

During 1910-11 topographical survey of site made and test borings made to determine character of soil and d. to which foundation of arch should be carried.

At the close of the year modified drawings and specifications for the constr. of the arch were in course of preparation.

A contract was entered into with Mr. Paul P. Cret, under date of May 20, 1911, covering his services as architect for the constr. of the arch. 11, 1121.

1912. Excavation work in progress; models and decorative work in progress; detailed drawings made. 12, 1347.

MISC. 111. PARKS, NATIONAL—CRATER LAKE.

APPROPRIATION.

(See Project.)

1910, \$10,000, 11, 1118, 3036.

ENGINEERS.

Chief of Engineers. R., 11, 1118; 12, 1340.

In charge. Maj. J. J. Morrow. R., 11, 3035; 12, 3561.

PROJECT.

A complete description of Crater Lake Park is found in Professional Paper No. 3, Department of the Interior, U. S. Geological Sur., entitled "The Geology and Petrography of Crater Lake National Park," by J. S. Diller and H. B. Patton; Government Printing Office, 1902.

The sundry civil act approved Aug. 24, 1912, provided an app. of \$50,000 for expend. under the direction of the Sec. of War for the constr. of a wagon road and the necessary brs. through Crater Lake National Park, together with a system of tanks and water-supply pipes to provide for

sprinkling in accordance with the recoms. contained in the R. published in H. D. 328, 62d, 2d, referred to below. 12, 1341.

OPERATIONS.

1911. A sur. of the nature of a pre. R. R. sur. was made covering the road from the entrance to the park on the approach from Klamath Falls up to the crater rim at the present location of the lodge of the Crater Lake Co., and a sur. of the proposed road encircling the lake was completed with the exception of a short piece over the cliff near Andersons Spring. Measurement of discharge of all convenient springs was completed. Nearly 50 m. of pre. lines were run and platted. 11, 3035.

1912. During the fiscal year one party, constituted as each of the parties of the preceding season, was sent into the park in July, 1911, under the direction of Junior Engr. W. G. Carroll, and finished the work uncompleted during the preceding season, namely, 6 m. of the 36 m. of road encircling the lake, the 5 m. of road to the Pinnacles, and the

4 m. of road to the s. boundary of the park. This work comprised about 1 month of field work. After the return of the field party, in the office, all transit lines were computed and platted, the location was profiled, ests. were completed, and final R. submitted Nov. 21, 1911. This R. is printed in full with map and profiles in H. D. 328, 62d, 2d. The total est. cost of the system of roads and trails is

\$642,000, with an addl. \$65,000 for a system of tanks and sprinkling, and an an. est. after completion for mainten. of \$20,000. 12, 3561.

SURVEYS.

Act June 25, 1900, an. sur., locating and preparing plans and est. for roads and trails in Crater Lake National Park, Oreg. 11, 1118.

MISC. 112. NATIONAL PARKS — YELLOWSTONE NATIONAL PARK—OFFICE, YELLOWSTONE PARK, WYO.

APPROPRIATIONS.

| | Administration and protection. | Roads and bridges. | Total. |
|---|--------------------------------|--------------------|--------------|
| Mar. 3, 1893..... | \$16,429.97 | \$23,570.03 | \$40,000.00 |
| July 7, 1894..... | 16,999.98 | 23,000.02 | 40,000.00 |
| Mar. 3, 1895..... | 16,790.63 | 23,209.37 | 40,000.00 |
| July 15, 1896..... | 934.25 | | 934.25 |
| Aug. 4, 1896..... | | 20,000.00 | 20,000.00 |
| Mar. 3, 1897..... | | 20,000.00 | 20,000.00 |
| Oct. 2, 1898..... | | 25,000.00 | 25,000.00 |
| Mar. 2, 1899..... | | 50,000.00 | 50,000.00 |
| Aug. 30, 1899..... | | 75,000.00 | 75,000.00 |
| Mar. 3, 1891..... | | 75,000.00 | 75,000.00 |
| Aug. 5, 1892..... | | 45,000.00 | 45,000.00 |
| Mar. 3, 1893..... | | 30,000.00 | 30,000.00 |
| Aug. 18, 1894..... | | | 30,000.00 |
| Mar. 2, 1895..... | 10,565.24 | | 30,000.00 |
| June 8, 1896..... | | 89,434.76 | 5,000.00 |
| June 11, 1896..... | | | 35,000.00 |
| June 4, 1897..... | 6,736.74 | 28,263.26 | 35,000.00 |
| July 7, 1898..... | 11,356.57 | 28,643.43 | 40,000.00 |
| Mar. 3, 1899..... | 5,534.64 | 34,465.36 | 40,000.00 |
| June 6, 1900..... | 5,000.00 | 55,000.00 | 60,000.00 |
| Mar. 3, 1901..... | 5,000.00 | 113,000.00 | 118,000.00 |
| June 28, 1902..... | 5,000.00 | 250,000.00 | 255,000.00 |
| Mar. 3, 1903..... | 5,000.00 | 250,000.00 | 255,000.00 |
| Apr. 28, 1904..... | 7,500.00 | 250,000.00 | 257,500.00 |
| Mar. 3, 1905..... | 7,500.00 | 133,000.00 | 140,500.00 |
| June 30, 1906..... | 7,500.00 | 55,000.00 | 62,500.00 |
| Mar. 4, 1907..... | 8,000.00 | 75,000.00 | 83,000.00 |
| May 27, 1908..... | 10,500.00 | 65,000.00 | 75,500.00 |
| Mar. 4, 1909..... | 8,000.00 | 65,000.00 | 73,000.00 |
| June 25, 1910..... | 8,500.00 | 75,000.00 | 83,500.00 |
| Mar. 4, 1911..... | 8,500.00 | 70,000.00 | 78,500.00 |
| Receipts from sales..... | 171,348.02 | 2,046,586.23 | 2,217,934.25 |
| | | 551.15 | 551.15 |
| Received from other sources (see money statement, 1903, p. 2892)..... | 171,348.02 | 2,047,137.38 | 2,218,485.40 |
| Received from other sources (see money statement, 1904, p. 4178)..... | | 210.00 | 210.00 |
| Received from other sources (see money statement, 1905, p. 2812)..... | | 117.80 | 117.80 |
| | | 523.15 | 523.15 |
| Total..... | 171,348.02 | 2,047,988.33 | 2,219,336.35 |
| Less amount reverted to Treasury, July, 1904, app. 1901-2..... | | 621.22 | 621.22 |
| Grand total..... | 171,348.02 | 2,047,367.11 | 2,218,715.13 |

12, 1338.

30462°—H. Doc. 740, 63-2—vol 2—20

CONTRACTS.

1901. C. B. Scott, teams. **01**, 3783.

1903. American Br. Co., constr. material, over 500,000 pounds, 3.35¢ to 4¢ lb. Paul McCormick, teams. **03**, 2893; **04**, 4178.

ENGINEERS.

Chief of Engineers. **R.**, **87**, 342; **88**, 314; **89**, 382; **90**, 352; **91**, 477; **92**, 422; **93**, 486; **94**, 441; **99**, 637; **00**, 716; **01**, 682; **02**, 604; **03**, 666; **04**, 787; **05**, 744; **06**, 825; **07**, 856; **08**, 896; **09**, 942; **10**, 1053; **11**, 1114; **12**, 1334.

In charge:

Capt. C. B. Sears. **R.**, **87**, 3133.

Maj. C. J. Allen. **R.**, **88**, 2803; **89**, 2857.

Maj. W. A. Jones. **R.**, **90**, 3591; **91**, 3931; **92**, 3433; **93**, 4391; **94**, 3439.

Capt. H. M. Chittenden. **R.**, **99**, 3863; **00**, 5403; **01**, 3777; **02**, 3033, 3042; **03**, 2444, 2885; (Maj.) **04**, 4171; **05**, 2809.

1st Lt. E. D. Peek, 1906-8. **R.**, **06**, 2253; **07**, 2461; (Capt.) **08**, 2543.

1st Lt. A. Williams, 1908-9.

1st Lt. W. Willing, 1909-11. **R.**, **09**, 2509; (Capt.) **10**, 2735.

Capt. C. H. Knight, 1911. **R.**, **11**, 3029; **12**, 3555.

Assistants:

Lt. W. E. Craighill. **R.**, **89**, 2862; **90**, 3595; **91**, 3939.

Lt. H. M. Chittenden. **R.**, **92**, 3439; **93**, 4396.

A. E. Burns. **R.**, **00**, 5420; **01**, 3795, 3796.

C. E. Sherman. **R.**, **00**, 5417; **01**, 3789.

C. A. Hunt. **R.** (Bridges), **94**, 3447.

S. F. Crecelius. **R.**, **01**, 3793; **02**, 3046.

E. D. Vincent. **R.**, **02**, 3045.

PROJECTS.

The Yellowstone National Park was set apart from the public domain and placed under the control of the Sec. of Interior, act Mar. 1, 1872.

Sundry civil act Mar. 3, 1883, au. constr. and imp. of suitable roads and brs. under the supervision of an Engineer officer to be detailed by the Sec. of War; officer detailed 1883.

This was the beginning of systematic road constr. in the park. Previous work consisted of opening rough trails, temporary in character.

Subsequent to sundry civil act Aug. 4, 1886, expend. for imp. transferred to charge of Engineer Department.

Has since been in charge of Engineer Department, with exception of period August, 1894, to March, 1899. **12**, 1334.

By Capt. C. B. Sears, 1887, comprehensive system of substantial roads, which, with the change of the act of Mar. 3, 1891, is the basis of the system in force 1912.

Sundry civil act June 6, 1900, au. that road extension and imp. be made in harmony with general plan to be approv. by Chief of Engineers. Plan pprov. Aug. 27, 1900; modified by au. Sec. of

War, July 22, 1901; further modified by approv. of Chief of Engineers, July 2, 1902.

Sundry civil act June 28, 1902, recognized this proj., and provided for its completion; practically finished during June 30, 1906.

The road system comprises a belt line or main circuit, which reaches all of the important centers of interest, with side roads, bridle trails, and 4 approaches leading from the park boundary to different points on the belt line—in all, about 350 m. of road, and about 125 brs.

Existing proj., 1912, provides that the belt line and the approach from the n. entrance be thoroughly metaled with crushed r., gravel, or other good material; that iron pipe, tile, or other good material be used for culverts; that steel and concrete be used for brs.; and that roads on the main tourist route be sprinkled. Roads into the park, except from the n., are constr. and maintained as earth roads. **92**, 3450; **00**, 5441; **01**, 3786; **12**, 1335.

1901. "Est. total cost of the proj., exclusive of an. mainten. and repairs and of macadamization, is \$870,000. Of this sum \$472,000, in round numbers, has been expended, about \$88,000 (\$113,000, act Mar. 3, 1901, less \$25,000 an. repairs) is available, and \$310,000 is required. The cost of an. mainten. and repairs has been about \$174,000.

"The result of the expend. thus far, after certain portions of the road are rebuilt, will be about 190 m. of road and 80 brs. constr. There remain to be built about 144 m. and 11 costly brs." **01**, 682.

Proposal of Chief of Engineers to macadamize belt line of roads approv. by Sec. of War (150 m.; est., \$2,000 per m.). **01**, 3797.

1903. Plan for parking grounds, Mammoth Hot Springs. Notes on planting. By W. H. Manning. **03**, 2894.

1905. Maj. Chittenden est. \$75,000 an. for mainten. **05**, 2813.

On account of the growing public interest in the park, and the consequent demand upon its roads, \$2,000,000 est. for enlargement and extension of the proj. **05**, 2816.

In 1905 Maj. Chittenden, in a memorandum, outlined the peculiar needs of the road system of the park. **05**, 2816.

Recom., also, that park be made a separate Engineer district. Objection to addl. roads, as not being at all needful or desirable. **05**, 2822.

Change in route of road from Tower Falls to Mammoth Hot Springs recom. on account of dangerous slides. Observatory on Mount Washburn also recom. **06**, 2257.

1910.¹ "The apps. for the 'past' 6 years have proven inadequate for mainten., and if steps are not taken to replace old worn-out brs. terrible accidents are liable to happen. The road surface, too, is in a poor and worn-out condition and in need of a more thorough treatment than can be given with the small apps. that have been made during the past few years." **10**, 1054; **11**, 1114.

¹Special request for separate allotment for road repairs. H. D. 772, 61st, 2d.

1911. Steps had been taken from 1909 looking toward gradual accumulation by the department of its own animals for work in park. 11, 3032.

1912. (See Operations, 1912.)

OPERATIONS.

1883-87. Résumé. 87, 3133.

1872-00. Résumé. 00, 5420.

1901. Work in Golden Gate Canyon, including reconstr. viaduct, completed; single-track road built from Golden Gate to Middle Gardiner Falls; material for brs. in Gardiner Canyon purchased and 1 abutment erected; 10 m. road opened up on the e. approach, and nearly the whole line located; extensive repairs over the whole system. 01, 682, 3777.

The new road has been extended about 3 m. down the Yancey Hill: the sur. and definite location have been carried to the Yellowstone R. and to Tower Falls, and the 2 brs. for the Yellowstone and Lamar Rs. have been contracted for.

In the lower Gardiner Canyon 1 br. abutment has been put in, the spring rise preventing any further work until after it subsides.

On the e. approach about 6 m. of road has been graded and the br. over the Yellowstone has been about half built.

On the s. approach extensive repairs have been carried over the road from the Thumb to near Lewis R. and material has been partly assembled for the Lewis R. br.

Under general repairs and completion the road to the middle Gardiner Falls has been extended entirely around Bunsen Peak. The entire circuit of the belt line was opened before June 1, something never before accomplished in the history of the park. The Natural Br. cut-off has been built about 2 m. The whole line of road from Mammoth Hot Springs to Golden Gate has been resurfaced. A very steep hill, called Soap Hill, just below Fort Yellowstone has been cut out, replacing a 15% grade with one of 8%. The very dusty road across a portion of the Norris Geyser Basin formation has been entirely resurfaced. The Gibbon R. branch of the w. approach has been extensively imp. About 1½ m. of formation road near the Fountain Hotel have been resurfaced, and also about 2 m. of road in the Spring Creek Canyon. Besides these more important repairs the entire system has been gone over several times by small parties. 01, 3784.

1902. In vicinity of Yanceys Road constr.; locating Mount Washington road; work in Gardiner Canyon, on East Road, South Road, Mammoth Hot Springs; general repairs and Road completion; sprinkling; Howard-Chief Joseph Trail located with aid of special party, some being participants in Nez Perce Indian campaign. 02, 3034.

Increasing water supply, Fort Yellowstone, under allotment by Quartermaster General of \$8,000 from app. for transportation of the Army. 02, 3042.

1903. Extensive work at Mammoth Hot Springs, including reconstr. of the roads, the building of a large amount of concrete sidewalk, the grading and irrigation of the grounds, the completion of the water-supply system, the installation of an electric-light plant, and the erection of several necessary buildings.

The reconstr. of the road between Gardiner and Mammoth Hot Springs, including the partial constr. of an entrance gate at the n. boundary, corner stone being laid by President Roosevelt.

The partial constr. of a road between Mammoth Hot Springs and the Middle Gardiner.

The reconstr. and surfacing of 7 m. of road between Mammoth Hot Springs and Norris.

The reconstr. of the road in the vicinity of Virginia Cascade and at Blanding Hill.

The reconstr. of 3 stretches of road in the Gibbon Canyon for the purpose of cutting out bad hills.

The completion of about 3 m. of road on the Natural Br. Cut-off.

The grading of a new crossing of Cascade Creek at the Grand Canyon, and the surfacing with r. of about ½ m. of road in that vicinity.

The constr. of about 10 m. of new road on the Mount Washburn division.

The opening of nearly 40 m. of new road on the e. approach.

The opening of 4 m. of road, s. approach, and the completion of about 6 m. more.

The purchase and partial erection of 9 new brs., including the Melan Arch Br. over the Yellowstone.

The purchase of 12 new sprinkling wagons and the installation of the plant between Gardiner and Norris.

Extensive repairs to the entire system. Owing to the lateness of the season and the excessive amount of freight hauling in the early spring, the roads suffered very heavily, and the cost of opening them up was much greater than usual.

A new station house and barn were built for the superintendent at the s. boundary.

03, 2885.

1904. Extensive work in the vicinity of Gardiner, including the preparation of a large field for alfalfa sowing for the use of the superintendent in protecting the game in the winter.

The resurfacing with gravel of the entire line of road between Gardiner and Mammoth Hot Springs. Completion of road between Mammoth Hot Springs and the Middle Gardiner Br.

Continuation of reconstr. of road between Mammoth Hot Springs and Norris, about 6 m.

Completion of about 3 m. of road on Natural Br. Cut-off.

Continuation of work on both sides of Mount Washburn, a total distance of about 6 m.

Opening of a road (July 10, 1903) to travel and the execution of a large amount of work on this road.

The erection of a steel-concrete arch br. over the Yellowstone above the Upper Falls.

The opening of a new road from this br. to Artist Pt.

The erection of a steel arch br. over Cascade Creek, near the Grand Canyon, and the completion of approaches thereto.

Erection of a steel br. over the Gibbon R., in Gibbon Canyon.

Erection of the new Baronett Br. (steel) near Yanceys.

Extension of sprinkling system so as to cover about 55 m.

Heavy repair and mainten. work extending to every part of the system.

Erection of a new station house and barn at Gardiner for the use of the superintendent.

And many other less important items of work throughout the park.

04, 4171.

1905. The erection of a 5-span steel arch br. over the Middle Gardiner R. near Mammoth Hot Springs, being the largest br. in the park.

The erection of a steel truss br. over Nez Perce Creek near the Fountain Hotel, and of another over the Firehole R. above Excelsior Geyser.

The erection of a steel arch br. over Tower Creek near the falls, and of 4 wooden brs. over Trout and Antelope Creeks in Hayden Valley and over the Big and Little Blacktail Creeks on the road between Mammoth Hot Springs and Tower Falls.

The reconstr. of wooden brs. over Gibbon R. near Norris, the Firehole R., on the old freight road near the Fountain Hotel, and over the same stream above the Upper Geyser Basin.

The erection of a large wooden br. over the Lamar R. on the road to Cooke City, and also one over Grinnell Creek on the East Road.

The erection of a curved viaduct on the road e. of Sylvan Pass for the purpose of carrying the road over itself and by means of a loop diminishing the gradient to the adopted limit.

Extensive resurfacing and reconstr. of the roads on the main circuit from near Apollinaris Spring to Norris and thence to the lower end of Gibbon Canyon, and from the Fountain Hotel to the Upper Geyser Basin, and thence to the Continental Divide; also considerable work of a similar character on the road along the Yellowstone R. between the lake and Grand Canyon.

The completion of the road between the Thumb and Lake by way of Natural Br.

Extensive reconstr. and resurfacing of the road between Norris and the Grand Canyon, including the cutting down of several of the hills and the complete realignment down the long hill next to the Grand Canyon.

The opening and completion of the road across Mount Washburn, including both the low line through Dunraven Pass and the high line passing over the summit. On the low line there still remains about $\frac{1}{2}$ m. where further widening will be required.

The opening up of the entire line of road between Tower Falls and Mammoth Hot Springs, including the reconstr. and enlargement of the road from Crescent Hill Canyon to Tower Falls.

A general reconstr. of the Cooke City road from the Lamar R. crossing to Soda Butte.

The extensive enlargement of the road from the Canyon Hotel to Inspiration Pt. near the latter pt. and the completion of a new road from the new concrete-steel br. over the Yellowstone to Artist Pt. on the right bank of the Grand Canyon.

A considerable amount of imp. work on the w. approach, including widening of the road, resurfacing, and other work.

Extensive widening and enlargement of the East Road from Sylvan Pass to the Shoshone R.

General repairs and mainten. of the entire system.

The extension of the sprinkling system to include 100 m. of roadway.

The erection of 3 station houses and 11 officers' quarters at the station houses for the superintendent.

Considerable work in the imp. of the bridge trails for the use of the superintendent in patrolling the park.

Many other minor items of work pertaining to the imp. of the entire system.

05, 745.

1906. The irrigating ditches in the alfalfa field near the n. entrance of the park were kept in repair, and a new system of lateral ditches put in the field to imp. the distribution of water.

The mainten. of the lawns and shrubbery at Mammoth Hot Springs was continued throughout the season.

100 m. of the park roads were sprinkled up to Sept. 1.

A number of pumping tanks at various points on the circuit were converted into gravity tanks.

The reconstr. of the Cooke City road from the Lamar R. crossing to Soda Butte was partly completed.

The road from the concrete-steel br. across the Yellowstone R. down to Artists Pt. was widened and resurfaced.

The West Road was widened and surfaced, and mileposts put into the w. boundary.

The road between Upper Basin and De Lacy Creek was widened at a number of places and resurfaced.

The South Road between the Thumb and Jackson Lake was kept in repair.

The road over Mount Washburn was practically completed, except that there is a little over $\frac{1}{2}$ m. of road on the low line that will need further widening.

The wooden brs. over the Gibbon R. near Norris, the Firehole R. on the old freight road near the Fountain Hotel, and over the same stream above the Upper Geyser Basin, were reconstr.

A 150' wooden viaduct was built at the e. end of Sylvan Pass on the East Road.

A wooden br. was erected over Grinnell Creek, and other brs. on the East Road were repaired.

Guard rails were erected at different points of interest to protect the formation and also to protect the tourists.

The Hot Soda Spring, near Mammoth Hot Springs, and the Apollinaris Spring were cleaned

out and wells constr. around them in order to keep the surroundings free from mud.

General repair and mainten. of the entire system.

Many other minor items of work pertaining to the imp. of the entire system.

06, 826.

1907. General repair and mainten. of the entire system, including the Cooke City, East, West, and South Roads; the constr. of a road to the petrified tree stumps in the vicinity of Yanceys, and the excavation of the r. surrounding one of the stumps; repairs to brs.; the replacing of Sulphur Creek Br. by a culvert and fill; laying of tile culverts; constr. at a number of points of platforms for the loading and unloading of coaches; constr. of platforms and stairways in the canyon, of out-houses at several places, and of 3 houses on the Divide for working crews; the clearing of dead and falling timber from the roadside; 100 m. of road sprinkled, a number of pumping stations converted into gravity tanks, and hydraulic rams installed; repairs to sprinkling wagons, road graders, carts, and other vehicles; the purchase of a portable planer and the dressing of lumber; mainten. of trees, shrubs, vines, and lawns; the erection of a fence at Hymen Terrace, and of an iron fountain in front of the residence of the U. S. commissioner; care of the alfalfa field at Gardiner (since transferred to the charge of the superintendent of the park); the purchase of about 600 enameled-steel signs; the survey of a road to connect the canyon and Tower Falls, and a survey, in progress, for a road from the w. boundary of the park, at the crossing of the Gallatin R., to a point on the Norris Road about 7 m. from Mammoth Hot Springs.

07, 2461.

1908. General repair and mainten. of the entire system, including the Cooke City, East, West, and South Roads; repairs to brs.; the replacing of brs. at Alum Creek and Obsidian Creek by culverts and fills; laying of tile and iron culverts; the clearing of dead and fallen timber from the roadside; 85 m. of road sprinkled; a number of pumping stations converted into gravity tanks, and hydraulic rams installed; repairs to sprinkling wagons, road graders, carts, and other vehicles; mainten. of trees, shrubs, vines, and lawns; erection of about 500 enameled-steel signs; a survey for a road from the w. boundary of the park at the crossing of the Gallatin R. to a point on the Norris Road about 7 m. from Mammoth Hot Springs.

08, 2543.

1909. General repair and mainten. of the entire system, including the Cooke City, East, West, and South Roads; repairs to brs.; laying of tile and iron culverts; the clearing of dead and fallen timber from the roadside; 85 m. of road sprinkled; a number of pumping stations converted into gravity tanks, and hydraulic rams installed; repairs to sprinkling wagons, road graders, carts, and other vehicles; mainten. of trees, shrubs, vines, and lawns. There was expended during the fiscal year 1909, for mainten. and re-

pairs, \$80,672.91, and on the East and South Roads of the forest reserve, \$263.21. 09, 2509.

1910. General repair and mainten. of the entire system, including the Cooke City, East, West, and South Roads; repairs to brs.; laying of tile and iron culverts; the clearing of dead and fallen timber from the roadside; 85 m. of road sprinkled; a number of pumping stations converted into gravity tanks, and hydraulic rams installed; repairs to sprinkling wagons, road graders, carts, and other vehicles; mainten. of trees, shrubs, vines, and lawns. There was expended during the fiscal year 1910, for mainten. and repairs, \$47,845.45. 10, 2735.

1911. General repair and mainten. of the entire system, including the Cooke City, East, West, and South Roads; the constr. of 5 bridges, 4 steel and 1 wooden; repairs to brs.; the constr. of 487' of concrete retaining walls; laying of the tile and iron culverts; the clearing of dead and fallen timber from the roadside; 85 m. of road sprinkled; a number of pumping stations converted into gravity tanks, and hydraulic rams installed; repairs to sprinkling wagons, road graders, carts, and other vehicles; mainten. of trees, shrubs, vines, and lawns. There was expended during the fiscal year 1911, for mainten. and repairs, \$73,874.02, and for permanent work, \$15,000; a total expend. of \$88,874.02. 11, 3029.

1912. Act Mar. 4, 1911, app. \$70,000 for 1912, and provided that \$2,500 of it should be spent for mainten. of roads leading out of the park from e. and s. boundaries. On account of grave probability of accidents to tourists, app. applied to replacing by safe structures certain old brs., general repair and mainten. of entire system, including Cooke City, East, West, and South Roads, constr. of 3 steel brs., and a number of small wooden brs.; repairs to brs. and culverts; the clearing of dead and fallen timber from the roadside; the sprinkling of 100 m. of road; the conversion of a number of pumping stations into gravity tanks, and the installation of hydraulic rams; repairs to sprinkling wagons, road graders, carts, and other vehicles; and the mainten. of trees, shrubs, vines, and lawns. Sprinkling was continued as long as funds could be spared for the purpose and discontinued early in August, but only when the available balance remaining was reduced to an amount barely sufficient to pay the ordinary running expenses for the remainder of the fiscal year, and the cost of the new brs. contracted for and urgently needed. Immediately after sprinkling operations were stopped protests against such discontinuance were received from prominent persons, and the President called for a special report on the matter. The Engineer officer in local charge of the road work had already reported that the action was occasioned by lack of funds, and he stated, furthermore, that rains had left the road in poor condition and that the suspension of sprinkling and the limitations on other works, due to the lack of funds, was likely to result in serious damage before the end of the tourist season and to leave the roads

in poor shape to meet the winter storms. By oral direction of the Sec. of War a special est. was prepared for continuing the work of sprinkling and for contingencies likely to arise before the next app. became available. The amount named was \$12,000. The est. was submitted to Congress Aug. 19, 1911, and was published in H. D. No. 111, 62d, 1st, but no app. was made.

On Apr. 20, 1912, the acting superintendent of the park informed the Sec. of Interior that the main entrance road, between Fort Yellowstone at Mammoth Hot Springs and the R. R. station at Gardiner, Mont., would probably soon be closed, as the hillside was gradually slipping into the road; absolutely necessary to keep that road open for the full year, and that to have it closed then, when supplies for the summer were coming in for the park concessioners and for the military post, would be a calamity. He also stated that the dangerous part had been kept open during the autumn and winter by the labor of troops, but that an immense amount of earth must be removed before the road would be safe for travel.

On Apr. 30, 1912, the retaining wall and a portion of the road at the point in question slid into the river, leaving a passageway but 3' in w. As the Engineer officer in charge of the road work was without means for restoring wagon communication between Fort Yellowstone and Gardiner, the acting superintendent of the park sent a detachment of 40 men from the fort and widened the passageway to 6½'. A detachment was also employed throughout the month of May in repairing the retaining wall and keeping the road cleared of r. and dirt at the point where the slide occurred.

May 15, 1912, a special suppl. est. of \$20,000 for emergency repairs to roads in the park was submitted to Congress. This est. was published in H. D. No. 761, 62d, 2d, but no app. was made. In May the Interior Department allotted the sum of \$500 for opening the old wagon trail between Fort Yellowstone and Gardiner. The work was executed under the direction of the Engineer officer and completed on June 21.

No app. was made by Congress for the work during the fiscal year and there were no funds available in the hands of the Engineer officer for opening the roads for the tourist season of 1912. The expend. during the fiscal year for maintain. and repairs were \$36,524.62 and for permanent work \$22,713.88, a total expend. of \$59,238.50.

In response to a Senate resolution, dated Apr. 2, 1912, directing the Sec. of War—

"to submit to the Senate as early as possible an estimate of the cost of construction of new roads or changes in the present roads in the Yellowstone National Park in order to permit of the use of automobiles and motorcycles therein without interfering with the present mode of travel in vehicles drawn by horses or other animals—"

A R. on the subject prepared by Capt. Knight was sent to Congress with a letter of the Acting Sec. of War, dated June 26, 1912. It was printed in S. D. No. 871, 62d, 2d. The est. cost of constr. of new roads for the purpose was \$2,704,030 and for reconstr. of the existing road \$2,264,670. The an. cost of mainten. was placed at \$187,625 in case new roads are constr., and at \$112,886 if the existing roads are widened.¹ 12, 1337.

SPECIAL DATA.

- Aqueducts—concrete.² 03, 2476.
- Automobiles—dangerous in park. 03, 2468.
- Bridges²—Gardiners R. 02, 3034. Buffalo Fork, Otter Creek, Shoshone R., Gardiners R., Snake R., The Yellowstone, Cascade Creek. 03, 2457.
- Constr. details. 03, 2457, 2474. Steel-concrete, over Yellowstone.² 03, 2473.
- Camping parties. 03, 2467.
- Canyons—retaining walls. 03, 2454.
- Cliffs—overhanging.² 03, 2450.
- Climate—details. 03, 2449.
- Concrete arch viaduct—Golden Gate, Glen Creek Canyon.² 01, 3790.
- Concrete work—gates and viaducts; methods.¹ 03, 2470.
- Corduroy—advantageous only at point. 03, 2457.
- Cross slopes—right design. 03, 2459.
- Culverts—danger from there being so many needless ones. 03, 2458.
- Dams—concrete dams, building. 03, 2476.
- Building methods, Mammoth Hot Springs. 03, 2476.
- Ditches—for drainage, dangerous. 03, 2457.
- Water supply. 02, 3044.² Cross drains, objectionable. 03, 2459.
- Dust.³ 02, 3036.
- East Road—view and character. 01, 2781.
- Forest, tangent on.² 03, 2452.
- Fires.² 01, 3782; 02, 3042.
- Fords—elimination of. 03, 2458.
- Forests—details. 03, 2446.
- Fountains—concrete. 03, 2476.
- Gardiner Canyon—road.² 03, 2450.
- Gates—entrance.² 03, 2469.
- Irrigation—methods. 03, 2477. Fountain.¹ 02, 3044.
- Landmark—removal of, Golden Gate Rock. 03, 2471.
- Lumber—manufacture of. 03, 2459.
- Mileage system—extent. 01, 2784.
- Mount Washburn Road—view.² 03, 2452, 2454.
- Mountain systems—details. 03, 2446.
- Old Golden Gate viaduct—view.² 01, 3790.
- Park work—system and methods. 03, 2459.
- Camps for. 03, 2460.
- Railroads—electric lines impracticable. 03, 2468.

¹ Sundry civil act approv. Aug. 24, 1912, provided an app. of \$100,000 for the usual work of mainten. and repair of imps., including not to exceed \$4,500 and \$1,500 for the roads in the forest reserves leading out of the park from the e. and s. boundaries, respectively; and an additional app. of \$77,000 for widening and imp. surface of roads and for building brs. and culverts, from the belt-line road to the w. border, from the Thumb Station to the s. border, and from the Lake Hotel Station to the e. border, all within the park.

² Photographs.

Reservoirs—concrete.¹ **03**, 2476. Dams.¹ **02**, 3044.

Retaining walls—constr. details. **03**, 2457. Gibbons Falls.¹ **03**, 2456. Gardiners R.¹ **03**, 2456. Under cliff, Tower Falls. **03**, 2456.

Roads—restriction on freight haulage. **08**, 2549. Passenger traffic, methods. **03**, 2467. Freight haulage over. **03**, 2466. Cleaning done by chipmunks. **03**, 2466. Irregular trackage difficult to stop. **03**, 2466. Wide tires obligatory. **03**, 2465. Use of oil on. **03**, 2463. Sprinkling. **03**, 2462. Opening in spring. **03**, 2461. Mainten. and repair system. **03**, 2461. Securing proper surfaces. **03**, 2458. Constr. methods. **03**, 2456. Yellowstone Lake to e. boundary, description. **01**, 2793.

Road system—general description: Main circuit or belt lines—approaches—mileage—trails. **03**, 2444. Problem to locate.¹ **03**, 2450. Gradients. **03**, 2453. Rolling roads and their supposed advantages. **03**, 2454.

Seasons of drought. **01**, 3782. Shoshone or Stinkingwater R.—description. **01**, 2781.

Signposts—necessity for. **03**, 2459. Side hills—Mount Washburn Road. **03**, 2452. Snow—bad effect of on roads. **09**, 2510. Shovel-
ing the passes. **03**, 2460.¹ Effect of forests on melting of.¹ **03**, 2446, 2449. Drifts. **03**, 2456. Soil—character. **03**, 2448. Sprinkling—wagon.¹ **02**, 3044. Tower Cliffs—cliff and road.¹ **03**, 2450.

Viaduct—details, Golden Gate.¹ **03**, 2470. Winds—high. **01**, 2791.

SURVEYS.

The act of Mar. 4, 1907, app. \$1,000 for a sur. for a road from the point where the Gallatin R. crosses the w. boundary to a point on the Mammoth Hot Springs-Norris road.

The first sur. was begun on June 9, 1907, and completed July 2, 1907. This route, via the Gallatin R., Big Horn Pass, and then to Indian Creek on the Norris-Mammoth Hot Springs road, was deemed unfav., and on July 28, 1907, a second party left Bozeman and began a sur. via Gallatin R., Fan Creek, Snowshoe Pass, thence down the Gardiner and Glen Creek to Golden Gate. The second route, also, was not recom. The est. cost, distances, and recoms. are contained in a special R. submitted to the Chief of Engineers under date of Oct. 19, 1907 (H. D. 502, 60th, 1st), which also expresses the views of the superintendent of the park, who coincides with the Engineer officer in charge in not favoring any route from the Gallatin, principally for the reasons that the burden of maintaining the necessary existing roads and of properly guarding the park is now very great, and that the proposed new road would add materially to this burden without any corresponding benefit to the general public. **08**, 2546.

MAPS.

Tourist routes. **01**, 3798; **02**, 3048; **05**, 2822.

MISC. 113. RIVERS AND HARBORS²—UNIFORMITY RELATING TO APPROPRIATIONS.

R. dated Dec. 18, 1909, by a board of Engineers on ex. of certain Hs. on the Great Lakes and elsewhere in which the whole or a part of the H. is imp. at local expense, containing recoms. as to whether the imps. so made by local authorities should be undertaken or maintained by the General Government; also, as to uniform rules in making H. imps., required by the R. and H. act of Mar. 3, 1909, was duly submitted and reviewed by the BERH., pursuant to law. The R. was transmitted to Congress and printed in H. D. No. 1067, 61st, 3d, which contains discussions and recoms. in reference to the several questions called for by the above-mentioned act. **11**, 1073.

Act Mar. 3, 1909, au. ex. of the Hs. of the Great Lakes and elsewhere in which the whole or a part of the H. is imp. at local expense, with a view to determining whether the imps. so made by local authorities should be undertaken or maintained by the General Government and to establish uniform rules in making H. imps. R. by BE. (con-

stituted by S. O. 20, O. C. E., Apr. 30, 1909), on Dec. 18, 1909.

Members of the board—Col. D. W. Lockwood, Col. D. C. Kingman, Col. C. McD. Townsend, Lt. Col. J. Millis, Maj. Riche.

Recoms. of the board—

1. That advisability of U. S. undertaking any work be determined as by existing practice.
2. That the U. S. undertake constr. or mainten. at no locality where such work would benefit only private interests.
3. That U. S. work be confined to the general part of a H., etc., including break'rs, with their anchorage areas; entrance piers and js. and their contiguous chans.; and general chans. of approach. BE. recom. that imps. made by local authorities should not be undertaken or maintained by the U. S.

The above recoms. reviewed, in accordance with law, by the BERH. Concurrence in general

¹ Photographs.

² The duty of improving rivers, harbors, and other national waterways, according to the will of Congress, devolves upon the Chief of Engineers. The abstracts of the Rs. of the latter on this duty extend from p. 17 to p. 1791 of this index. (See also pp. 2041 of this index.)

(For a brief (and memorandum) relating to the riparian and water rights of the Federal Government, and of the various States, see S. D. 351, 61st, 2d.)

principles of the R. of the BE.; but recognized that there may be instances in which the interests of the general public will not require a rigid application of the principles stated in item 3, and that there be exceptional cases in which imps. made by local interests will fall within the class of

works deemed proper for the General Government to undertake or maintain, or that will so conform to an advantageous proj. for further imp. of the locality as to merit special consideration.—H. D. 1067, 61st, 3d.

MISC. 114. RIVERS AND HARBORS, ETC.—ASSISTANTS.

The Rs. of assistants to Engineer officers in charge of R. and H. works were printed in the Rs. of the Chief of Engineers up to or about 1905, after which date they were omitted generally from the Rs. on account of the growing volume of the Rs. After 1905 they are usually printed in the

congressional documents devoted to Rs. on Rs. and Hs. The important reports of assistants are referred to throughout this index, usually under the subhead of "Assistants." (See p. 21 of this index.)

MISC. 115. RIVERS AND HARBORS—BOARDS—BOARD OF ENGINEERS FOR RIVERS AND HARBORS.¹

Chief of Engineers. R., 03, 36; 04, 704; 05, 12; 06, 791; 07, 807; 08, 857; 09, 898; 10, 1008; 1, 1065; 12, 1279.

Section 3 of the R. and H. act of June 13, 1902, provides for the organization in the Office of the Chief of Engineers, by detail from time to time from the Corps of Engineers, of a board of 5 Engineer officers, whose duties shall be fixed by the Chief of Engineers, and to whom shall be referred for consideration and recom., in addition to any other duties assigned, so far as in the opinion of the Chief of Engineers may be necessary, all reports upon Rs. and survs. provided for by Congress and all proj. or changes in proj. for works of R. and H. np. theretofore or thereafter provided for, etc.

The board was constituted July 28, 1902, by the appointment of the following officers of the Corps of Engineers: Col. A. Mackenzie, Maj. H. F. Lodges, Maj. Edward Burr, Capt. C. H. McKinstry, and Capt. W. V. Judson.

On May 7, 1903, Col. Mackenzie was succeeded as senior member of the board by Lt. Col. Chas. J. Allen, Corps of Engineers.

Under the provisions of section 14 of the R. and H. act of June 13, 1902, all reports on pre. exs. and survs. provided for in that act referred to the board for ex. and review; in addition, the proj. or certain imps. presented to it for report, by resolution of the House Committee on Rs. and Hs., and by the Chief of Engineers. The reports rendered by the board from time to time presented to Congress at its regular sessions. 03, 36, 637.

The report of this board on a proposed work of np. is customarily printed as a part of the congressional document relating to the proposed work.

1903-04. Col. Chas. J. Allen, to Jan., 1904, senior member; Col. A. M. Miller, senior member, since Jan., 1904; Lt. Col. R. L. Hoxie; Maj. H. F. Lodges; Maj. E. Burr; Maj. H. C. Newcomer; Capt. C. H. McKinstry; Capt. W. V. Judson.

Detailed information relative to reports reviewed by board. 04, 3671.

1904-05. Col. A. M. Miller, senior member; Lt. Col. D. W. Lockwood; Lt. Col. R. L. Hoxie; Maj. S. W. Roessler; Maj. E. Burr; Maj. H. C. Newcomer; Capt. W. V. Judson; Capt. C. W. Kutz. Details. 05, 2569.

1905-06. Lt. Col. D. W. Lockwood; Lt. Col. R. L. Hoxie; Lt. Col. S. W. Roessler; Maj. W. C. Langfitt; Maj. E. Burr; Maj. C. McD. Townsend; Capt. C. W. Kutz. Details. 06, 2055.

1906-07. Col. D. W. Lockwood; Col. R. L. Hoxie; Maj. C. McD. Townsend; Maj. W. C. Langfitt; Maj. E. Winslow; Maj. C. Harding; Capt. C. W. Kutz; Capt. W. J. Barden. Details. 07, 2241.

1907-08. Col. D. W. Lockwood; Col. R. L. Hoxie; Lt. Col. S. S. Leach; Lt. Col. W. L. Fisk; Lt. Col. H. F. Hodges; Maj. E. E. Winslow; Maj. C. Harding; Capt. Wm. J. Barden. Details. 08, 2321.

1908-09. Col. D. W. Lockwood; Col. Jno. G. D. Knight; Col. R. L. Hoxie; Col. S. S. Leach; Lt. Col. W. C. Langfitt; Maj. H. C. Newcomer; Maj. E. E. Winslow; Maj. Spencer Cosby; Maj. Wm. J. Barden. Details. 09, 2277.

1909-10. Col. D. W. Lockwood; Col. Jno. G. D. Knight; Col. Wm. T. Rossell; Col. S. S. Leach; Lt. Col. W. C. Langfitt; Lt. Col. W. E. Craighill; Lt. Col. H. C. Newcomer; Maj. Herbert Deakayne; Maj. Wm. J. Barden. Details. 10, 2445.

1910-11. Col. Wm. T. Rossell; Col. Dan C. Kingman; Col. S. W. Roessler; Lt. Col. W. C. Langfitt; Lt. Col. H. Taylor; Lt. Col. H. C. Newcomer; Maj. H. Deakayne; Maj. W. J. Barden. Details. 11, 2657.

1911-12. Col. W. T. Rossell; Col. S. W. Roessler; Lt. Col. W. C. Langfitt; Lt. Col. H. Taylor; Lt. Col. H. C. Newcomer; Maj. Herbert Deakayne; Maj. W. J. Barden. Details. 12, 2879.

¹ Proposed national waterways commission.—S. D. 301, 61st, 1st.

OPERATIONS.

| Authority for investigation. | Number of investigations ordered. | Number completed during year ending June 30, 1912. | Total number completed prior to June 30, 1912. | Number remaining to be completed. |
|--|-----------------------------------|--|--|-----------------------------------|
| Act of June 13, 1902..... | 170 | ..... | 170 | ..... |
| Act of Mar. 3, 1915..... | 176 | ..... | 176 | ..... |
| Act of June 28, 1906..... | 1 | ..... | 1 | ..... |
| Act of Mar. 2, 1907..... | 200 | ..... | 200 | ..... |
| Act of May 28, 1908..... | 1 | ..... | 1 | ..... |
| Act of Mar. 3, 1909..... | 274 | 18 | 263 | 11 |
| Act of June 25, 1910..... | 187 | 64 | 169 | 13 |
| Act of Feb. 27, 1911..... | 90 | 67 | 69 | 21 |
| Resolutions of congressional committees..... | 102 | 5 | 97 | 5 |
| Concurrent resolution of Congress..... | 1 | 1 | 1 | ..... |
| Miscellaneous cases referred by the Chief of Engineers, U. S. Army..... | 41 | 6 | 40 | 1 |
| Total..... | 1,243 | 161 | 1,187 | 56 |

| Fiscal year. | Estimated cost of projects recommended by board. | Estimated cost of projects adopted by Congress. |
|--------------|--|---|
| 1904..... | \$904,117 | \$886,000 |
| 1905..... | 8,550,000 | 8,550,000 |
| 1906..... | ..... | ..... |
| 1907..... | 11,506,857 | 11,506,857 |
| 1908..... | 433,000 | 233,000 |
| 1909..... | 2,119,000 | 2,119,000 |
| 1910..... | 1,387,030 | 1,387,030 |
| 1911..... | 1,355,000 | ..... |
| 1912..... | 3,905,000 | ..... |
| Total..... | 30,160,004 | 24,681,887 |

MISC. 116. BRIDGES — DRAWBRIDGES — APPLICATION OF RULES AND REGULATIONS.

(See p. 2137 of this index.)

MISC. 117. BRIDGES—OBSTRUCTING NAVIGATION.

(See p. 2137 of this index.)

MISC. 118. BRIDGES OVER NAVIGABLE WATERS.

Various acts of Congress, general and specific, require the approval of the War Department for br. constr. or changes over U. S. navigable waterways, and for the operation of such brs.

Specific instances of such approval and over sight, reported upon by the Chief of Engineers, are indexed under the head of "Bridges." (See p. 2137 of this index.)

MISC. 119.**CANALS.**

Canals built or owned by the U. S. come within the embracing term of R. and H. works. Where privately built or owned canals affect other navigable waterways, they are, of course, subject to the regulatory powers of Congress.

(See the "Rivers and Harbors," p. 17 of this index. See also the "Finding List" at the back of this index for references to specific canals, including the Isthmian or "Panama Canal.")

(See also below.)

MISC. 120. CANALS — CHESAPEAKE AND DELAWARE BAYS (CANAL CONNECTING).

(See also pp. 313, 335 and 2116 of this index.)

By joint resolution of Congress approv. June 28, 1906, the President au. to appoint commission to ex. and appraise value of works and franchise of Chesapeake & Delaware Canal with reference to desirability of purchasing said canal by U. S.

Commission composed of Gen. Felix Agnus, Maj. C. A. F. Flagler, Chief of Engineers, and

Civil Engineer Frank Taylor Chambers, U. S. Navy. **06**, 798.

R. Jan. 1, 1907, submitted to Congress, printed in S. D. No. 215, 59th, 2d. Works, franchises, etc., of Chesapeake & Delaware Canal appraised at \$2,514,289.70. **07**, 228.

MISC. 121. CANALS—CHICAGO DRAINAGE CANAL.

In April, 1899, trustees of Sanitary District of Chicago requested permit from Sec. of War to connect drainage canal with West Fork of South Branch of Chicago R.; granted May 8, 1899.

The discharge from R. into drainage canal caused current which endangered navigation; order issued by Sec. of War, Apr. 9, 1901, reducing max. discharge to 200,000 c. f. per minute; subsequently

modified to permit an increase to 300,000 c. f. per minute bet. 4 p. m. and 12 midnight, daily.

Trustees of Sanitary District undertook enlargement of waterway of Chicago R.; with view to providing for full discharge required by State law without causing such current as to injure interests of navigation. **01**, 119; **02**, 580; **03**, 640.

MISC. 122. CANALS — LOCKS — BISHOP'S CANAL LOCK—EXAMINATION.**ENGINEERS.**

Chief of Engineers. **R.**, 69, 65.

Board. **R.**, 69, 529. Maj. W. P. Craighill (Bvt. Lt. Col.); and Capt. W. R. King (Bvt. Maj.).

BE. detailed Feb. 21, 1867, to ex. and report upon a model of an imp. canal and ship lock submitted by Mr. Martin Bishop, Ohio.

Novel arrangement, gates move up and down on horizontal axes, hoisting apparatus, weight of gate counterpoised, filling and emptying of chamber by wickets, movement of wickets affected by screw system." Object of inventor to have perfect lock when the gate is up, and an open chan. when

entirely submerged. New system would save weight and expense of operation.

Detailed comment by **BE.** Consideration of mechanical difficulties, of various systems of locking. Dimensions of existing lock systems of world.

Adaptation of the plan proposed to Washington Canal.

Detailed ests. of a canal lock, 8' lift, old plan, and by new plan; the first, \$72,722.50; and the second, \$53,210.55.

Names of some of the greatest navigable Rs. in the U. S.

69, 529-548.

MISC. 123. CANALS—RULES AND REGULATIONS FOR THE NAVIGATION OF CANALS AND SIMILAR WORKS OF NAVIGATION.

Section 4 of the R. and H. act of Aug. 18, 1894, as amended by section 11 of the R. and H. act of June 13, 1902, delegates to the Sec. of War the duty of prescribing such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are or that hereafter may be owned, operated, or maintained by the U. S., as in his judgment the public necessity may require; and he is also au. to prescribe regulations to govern the speed and movement of vessels and other water craft in any public navigable chan. which has been imp. under au. of Congress, whenever, in his judgment, such regulations are necessary to protect such imp. chans. from injury, or to prevent interference with the operations of the U. S. in imp. navigable waters, or injury to any plant that may be employed in such operations. Such rules and regulations have been estab. for the following-named works:

Ahnapee, Wis. 04, 710.
Apalachicola, Fla. 09, 911.
Appomattox R., Va. 04, 710.
Ashtabula, Ohio. 03, 641.
Baltimore, Md. 03, 641.
Bayou Plaquemine. 05, 718; 12, 1294.
Big Sandy R., W. Va. and Ky. 02, 580.
Black Warrior R., Ala. 02, 580; 04, 710.
Brunswick, Ga. 04, 710.
Buffalo Bayou, Tex. 09, 911.
Buffalo, N. Y. 03, 641.
Cape Charles City, Va. 04, 710.
Cape Fear R., N. C. 11, 1078; 12, 1294.
Cascades Canal, Columbia R., Ore. 02, 580.
Charlevoix, Mich. 04, 710; 05, 718.
Charlotte, N. Y. 03, 641.
Chesapeake B., York Spit Chan. 12, 1294.
Christiana R., Del. 10, 1019.
Cleveland, Ohio. 03, 641; 11, 1078.
Columbia R., Ore. (See Cascades, above.)
09, 911.
Conneaut, Ohio. 03, 641.
Cumberland R., Tenn. and Ky. 05, 718.
Darien, Ga. 04, 710.
Davis Isld. Dam, Ohio R. 02, 580.
Delaware R., Schooner Ledge. 05, 718.
Des Moines Rapids Canal, Mississippi R. 02, 580.
Detroit R., Mich. 07, 815.
Duluth-Superior H., Minn. and Wis. 02, 580;
09, 911; 10, 1019; 11, 1078.
Fairport, Ohio. 03, 641.
Fernandina, Fla. 04, 710.
Fox R., Wis. 02, 580.
Frankfort, Mich. 04, 710; 05, 718.
Galena R., Ill. 02, 580.
Galveston Chan., Tex. 10, 1019; 12, 1294.

Grand Haven, Mich. 04, 710; 05, 718.
Grand R. 12, 1294.
Green and Barren Rs., Ky. 02, 580.
Gulfport, Miss. 08, 866.
Hampton Roads, Va. 04, 710.
Hillsboro B., Fla. 05, 718; 09, 911.
Holland, Mich. 04, 710; 05, 718.
Huron, Ohio. 03, 641.
Illinois and Mississippi Canal, Rock R. 02, 580.
Illinois R., Ill. 02, 580.
Kanawha R., W. Va. 02, 580; 07, 815.
Kenosha, Wis. 04, 710.
Kentucky R., Ky. 02, 580.
Kewaunee, Wis. 04, 710.
Lake Superior, Wis. 10, 1019.
Little Kanawha R., W. Va. 02, 580.
Lorain, Ohio. 03, 641; 11, 1078.
Louisville and Portland Canal, Ky. 02, 580;
11, 1078.
Ludington, Mich. 04, 710; 05, 718.
Manistee, Mich. 05, 718.
Manitowoc, Wis. 04, 710.
Menominee, Mich. 04, 710.
Michigan City, Ind. 04, 710.
Milwaukee, Wis. 04, 710.
Mississippi R., New Orleans, La. 12, 1294.
Mobile, Ala. 11, 1078.
Monongahela R., Pa. and W. Va. 02, 580; 03, 641.
Morgans Cut and Canal., Tex. 02, 580.
Muscle Shoals Canal, Tenn. R. 02, 580.
Muskegon, Mich. 04, 710; 05, 718.
Muskingum R., Ohio. 02, 580; 10, 1019.
Nansemond R., Va. 04, 710.
New York H., Ambrose Chan. 05, 718.
Niagara R., N. Y. 12, 1294.
Norfolk, Va. 04, 710.
Norfolk, Va., to Albemarle Sound, N. C. 04, 710.
Ohio R., ls. and ds. 12, 1294.
Pagan R., Va. 12, 1294.
Pamlico Sound to Beaufort Inlet, N. C. 11, 1078.
Pascagoula R., Miss. 12, 1294.
Pentwater, Mich. 04, 710; 05, 718.
Petoskey, Mich. 04, 710; 05, 718.
Portage Lake, Mich. 04, 710; 05, 718.
Portage Lake Ship Canals, Mich. 02, 580; 04, 710; 07, 815.
Port Arthur Ship Canal, Tex. 09, 911.
Port Washington, Wis. 04, 710.
Racine, Wis. 04, 710.
Rough R., Ky. 02, 580.
Sabine-Neches Canal, Tex. 09, 911.
St. Clair Flats Canal, Mich. 02, 580; 07, 815.

St. Clair R., Mich. 07, 815; 09, 911.
 St. Croix R., Minn. 07, 815.
 St. Johns R., Fla. 04, 710.
 St. Joseph, Mich. 04, 710; 05, 718.
 St. Marys Falls Canal, Mich. 02, 580.
 St. Marys R., Mich. 02, 580; 07, 815.
 San Diego, Cal. 05, 718.
 Sandusky H., Ohio. 02, 580.
 San Juan H., Porto Rico. 09, 911.
 Saugatuck, Mich. 04, 710; 05, 718.
 Savannah, Ga. 04, 710.
 Savannah, Ga., to Fernandina, Fla. 04, 710.
 Sheboygan, Wis. 04, 710.
 South Haven, Mich. 04, 710; 05, 718.
 South Pass, La. 03, 641.
 Southwest Pass, La. 09, 911.
 Sturgeon B. and Lake Michigan Ship Canal, Wis. 02, 580; 08, 866.

Tampa, Fla. 09, 911.
 Taylors Bayou, Tex. 09, 911.
 Tennessee R. 12, 1294.
 Tombigbee R., Ala. 04, 710.
 Two Rivers, Wis. 04, 710.
 Vicksburg, Miss. 05, 718.
 Wabash R., Ind. and Ill. 02, 580.
 Warrior R., Ala. 04, 710.
 Waukegan, Ill. 04, 710.
 White Lake, Mich. 04, 710; 05, 718.
 White R., Ark. 05, 718.
 Willamette R., Oreg. 09, 911.
 Yamhill R., Oreg. 02, 580.
 Yazoo R., Miss. 05, 718.

MISC. 124. COMMISSIONS—CALIFORNIA DÉBRIS COMMISSION.

Act of Congress approv. Mar. 1, 1893, provided for the estab. of the California Débris Commission, to consist of 3 officers of the Corps of Engineers, appointed by the President, with the concurrence of the Senate, whose functions relate to hydraulic mining in the territory drained by the Sacramento and San Joaquin R. systems in California.

The commission empowered and required to adopt plans for imp. the navigation of the Rs. in the systems mentioned, to project and construct works for impounding detritus and preventing the deterioration of the Rs. from the deposit of hydraulic mining and other débris, and to devise means and issue permits for resuming and carrying on hydraulic mining operations under conditions

that will not injure other interests in the State. The powers of the commission, methods of procedure, etc., are prescribed in the act in detail.

ENGINEERS.

In charge:

Lt. Col. G. H. Mendell. R., 82, 2543-2640.
 R. A. H. Payson. R., 82, 2584.
 M. Manson. R., 82, 2604.
 A. Larson. R., 82, 2632.

Débris Commission. R., 94, 3169; 95, 4049, 4062; 96, 3861; 97, 3961; 98, 3549; 99, 3747; 00, 5007; 01, 1657.

NOTE.—For the detailed Rs. of the commission, see p. 1580 of this index.

MISC. 125. COMMISSIONS — MISSISSIPPI RIVER COMMISSION.

The Mississippi R. Commission, constituted by act of Congress of June 28, 1879, is in charge of the imp. of the Mississippi R. from Head of Passes to the vicinity of the mouth of Ohio R., including the rectification of Red and Atchafalaya Rs. at their junction with the Mississippi, the building of

levees, and the imp. of the several Hs. for which specific apps. have been made, with the exception of the H. of Vicksburg and the mouth of Yazoo R. It is also charged with the survey of the Mississippi R. from Head of Passes to its headwaters. 01, 658. (See also p. 1067 of this index.)

MISC. 126. COMMISSIONS — MISSOURI RIVER COMMISSION.

The Missouri R. Commission, constituted by act of Congress of July 5, 1884, was in charge of the imp. and surs. of the Missouri R. below Sioux City, Iowa. 01, 658.

Commission was abolished by R. and H. act

June 13, 1902. Work continued under immediate charge of officers of the Corps of Engineers. 03, 406.

(See also p. 1037 of this index.)

MISC. 127. DAMS, DOLPHINS, WEIRS, AND STRUCTURES OTHER THAN BRIDGES.

(See p. 2137 of this index.)

MISC. 128. FUNDS CONTRIBUTED BY STATES, MUNICIPALITIES, AND PRIVATE PARTIES.

1910, \$191,263.22. 10, 33.
1911, \$54,612.06. 11, 33.

1912, \$132,361.90. 12, 32.

MISC. 129. HARBOR LINES.

(See p. 2137 of this index.)

MISC. 130. HARBOR LINES—ABROGATION OF.

"Hell Gate" passage, East R., N. Y., about Great and Little Mill Rocks—pierhead and bulk-

head lines estab. Mar. 9, 1892, were abrogated by War Department action o Oct. 24, 1911. 12, 1293.

MISC. 131. RIVER AND HARBOR WORKS—PRIVATE OR NON-UNITED STATES WORK.

The reports of the Chief of Engineers contain references to important non-U. S. works of imp. in connection with Rs. and Hs. Such references are collected under the subhead of "Private work" in the abstracts of R. and H. Rs., pages 17-1691 of this index.

(See also below.)

Imps. on navigable waters of the U. S. by municipalities, private corporations, or individuals—

Information relative to imp. of Hs. and Rs. which has included or will include inner Hs., or portions of Rs. or inlets within shore lines or corporate city limits, or chans. adjacent to wharves (reported under sec. 13 of the R. and H. act approv. June 13, 1902). The foregoing is a collection of reports rendered by each district office of the Engineer Department concerning what non-U. S. works have been done in the respective districts. 02, 2567-2649.

MISC. 132. LOGS, ETC.—RULES AND REGULATIONS GOVERNING FLOATING OF.

Act May 9, 1900, au. Sec. of War to make regulations governing running of loose logs, etc., on certain Rs. and streams. 02, 580.

Sec. of War prescribed rules and regulations for—

Navigation of Ocklockonee R., Fla.; St. Croix R., Wis. and Minn., above Lake St. Croix; Big Fork R., Minn.; Red Lake R., Minn.; Cheboygan R., Mich.; and North Fork of Coquille R., Oreg. 04, 711.

Navigation of Little R., Ark. and Mo.; Red Lake R., Big Fork R., and Rainy R., Minn. 05, 719.

Navigation of "Inland route," so called, and connecting waters between Cheboygan and Conway, Mich. 09, 912.

R., 11, 1078; 12, 1295.

MISC. 133. MISSOURI RIVER—SIX-FOOT CHANNEL.

(See p. 1037.)

Under the provisions of section 1 of the R. and I. act of June 25, 1910, a board consisting of Col. Frederic V. Abbot, Corps of Engineers; Col. C. McD. Townsend, Corps of Engineers; and Maj. Charles Keller, Corps of Engineers, was appointed by the Sec. of War to consider and report upon the most economical and desirable plan for the improvement of Missouri R., with a view to securing a permanent 6' chan. bet. Kansas City and the

mouth of the R., consideration to be given in said R. to the subject of cooperation on the part of local interests in the work of said imp., and R. thereon, dated Nov. 29, 1910, was transmitted to Congress and printed in H. D. No. 1287, 61st, 3d. A plan for imp. at an est. cost of \$20,000,000 plus the cost of mainten., ultimately reaching \$500,000 an., with an addl. cost for snagging not exceeding \$60,000 an., presented. 10, 1014; 11, 706.

MISC. 134. NAVIGATION — PERMANENT INTERNATIONAL COMMISSION OF CONGRESSES OF NAVIGATION.

1902. By act approv. June 28, 1902, Congress pp. the sum of \$3,000 per year for the support and mainten. of the Permanent International Commission of Congresses of Navigation, and for the payment of the actual expenses of the properly accredited national delegates of the U. S. to the meeting of the congresses and of the commission.

The ninth international congress of navigation was held at Dusseldorf, Germany, in June, 1902. delegates were appointed to represent the U. S., namely, Lt. Col. C. W. Raymond, Corps of Engineers, and Messrs. B. M. Harrod and John Bogart, civil engrs. Lt. Col. Raymond and Mr. Bogart attended the congress.

1903. "The U. S. is represented on the Permanent International Commission of Congresses of Navigation, and on the permanent executive committee of that commission, Lt. Col. Raymond being the principal representative, and Mr. E. L. Corthell, C. E., the substitute. Lt. Col. Raymond attended a meeting of the commission held at Brussels, Belgium, on June 8, 1903.

The expend. during the year from the appropriation made by Congress have been for the expenses of the properly accredited national delegates to the meeting of the congress and of the Permanent International Commission, and for the support and mainten. of the commission, to which the U. S. contributes \$1,000 per annum." 03, 639.

1904. U. S. members increased to 5 by appointment of Maj. H. F. Hodges, Corps of Engineers; Maj. J. C. Sanford, Corps of Engineers; and Mr. John Bogart, civil engr. Mr. Corthell attended a meeting of the commission held at Brussels, Belgium, on May 2, 1904. 04, 708.

1905. The tenth international congress to be held at Milan, Italy, Sept., 1905. Following have been appointed delegates to represent U. S. at meeting: Maj. H. F. Hodges, Corps of Engineers; Maj. J. C. Sanford, Corps of Engineers; Mr. J. A. Ockerson, civil engr.; Brig. Gen. C. W. Raymond, U. S. Army., retired; Mr. John Bogart, Mr. E. L. Corthell, Maj. Gen. G. L. Gillespie, U. S. Army, retired; and Messrs. W. W. Bates, H. W. Ashley, and John A. Sullivan. 05, 718.

1906. Meeting of commission at Milan, Italy, sept. 23, 1905, attended by Mr. Corthell, Maj.

Hodges, and Maj. Sanford. Maj. Sanford attended meeting held at Brussels, Belgium, May 28, 1906. Mr. Corthell attended a meeting of executive committee at Milan, Italy, Sept., 1905. Maj. Hodges, Maj. Sanford, Mr. Ockerson, and Mr. Corthell attended meeting at Milan, Italy, Sept., 1905.

1907. Maj. Sanford attended a meeting of commission held at Brussels, Belgium, May 6, 1907. Questions decided pertaining to proposed eleventh international congress to be held at St. Petersburg, Russia, in 1908. 07, 814.

1908. Maj. Sanford attended a meeting of commission at St. Petersburg, Russia, May 31, 1908. Eleventh international congress of navigation held at St. Petersburg, Russia, May 31 to June 7, 1908. Following delegates appointed to represent U. S.: Maj. J. C. Sanford, Corps of Engineers, chairman; Lt. Commander F. L. Chapin, U. S. N.; Maj. Spencer Cosby, Corps of Engineers; Mr. J. A. Ockerson, civil engr.; and Mr. Arsene Perrilliat, civil engr. All delegates, except Mr. Perrilliat, attended. 08, 864.

1909. Col. Sanford attended meeting of commission at Brussels, Belgium, May 17, 1909; also meeting of executive committee, May 15, 1909. 09, 910

1910. No meeting held. Act June 25, 1910, app. \$50,000 to defray expenses of foreign delegates in inspection of U. S. waterways in the proposed meeting in U. S. 10, 1017.

1911. Under date Sept. 2, 1910, following addl. delegates appointed: Brig. Gen. Wm. H. Bixby, Corps of Engineers, U. S. Army; Hon. J. Hampton Moore, M. C. Two meetings held at Brussels, Belgium, July 30, 1910, and May 15, 1911. U. S. represented by Mr. Corthell and Lt. Col. Sanford. Office opened at Philadelphia; circulars issued and distributed. 11, 1076.

1912. Meeting held at Philadelphia, May 22, 1912. U. S. represented by Gen. Bixby, Lt. Col. Sanford, Mr. Corthell, Mr. Bogart, and Mr. Moore. The twelfth international congress of navigation held at Philadelphia, May 23-28, 1912. City of Philadelphia app. \$50,000 for entertaining members, and funds provided by other places. 12, 1291.

MISC. 135. NEW YORK HARBOR—SUPERVISION.

NOTE.—The office of supervisor of the H. of New York was created by act of Congress approv. June 29, 1888, entitled "An act to prevent obstructive and injurious deposits within the H. and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses." This act has been amended by section 3 of the act of Aug. 18, 1894, entitled "An act making apps. for the constr., repair, and preservation of certain public works on Rs. and Hs., and for other purposes," by which amendment the functions and powers of the officer have been greatly enlarged. Addl. duties are also conferred on the supervisor by section 2 of the last-named act.

Under the provisions of section 5 of the act of June 29, 1888, a line officer of the Navy is designated to discharge the duties created by the act under the direction of the Sec. of War. On May 23, 1889, the Sec. of War directed that all communications in connection with these duties should be addressed to him through this office, and on Feb. 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers. **01**, 656.

APPROPRIATIONS.

| | |
|-------|--|
| 1888, | \$30,000, 90 , 3081. |
| 1889, | 34,070, 90 , 3081. |
| 1889, | 60,000 (purchase of vessel), 90 , 3081. |
| 1890, | 33,000, 91 , 3394; 92 , 2881. |
| 1891, | 33,000, 92 , 2881. |
| 1893, | 33,000, 93 , 3544. |
| 1894, | 33,000, 94 , 2686. |
| 1895, | 76,000, 95 , 3614. |
| 1896, | 96,000, 96 , 3400. |
| 1897, | 59,000, 97 , 3503. |
| 1898, | 59,000, 98 , 3134. |
| 1899, | 59,000, 99 , 3289. |
| 1899, | 110,500, 00 , 4524. |
| 1900, | 76,100, 01 , 3623. |
| 1901, | 76,100, 01 , 3623. |
| 1902, | 72,800, 02 , 2441. |
| 1903, | 80,260, 03 , 2366. |

| | |
|-------|----------------------------|
| 1904, | 120,260, 04 , 3691. |
| 1905, | 73,260, 05 , 2582. |
| 1906, | 85,260, 06 , 2067. |
| 1907, | 80,260, 07 , 2252. |
| 1908, | 90,260, 08 , 2336. |
| 1909, | 85,260, 09 , 2294. |
| 1910, | 85,260, 10 , 2614. |
| 1911, | 100,260, 11 , 2925. |
| 1912, | 85,260, 12 , 3447. |

Total, 1,826,170

ENGINEERS.

Chief of Engineers. **R.**, **90**, 330; **91**, 422; **92**, 395; **93**, 459; **94**, 420; **95**, 468; **96**, 418; **97**, 524; **98**, 527; **99**, 615; **00**, 693; **01**, 656; **02**, 576; **03**, 637; **04**, 705; **05**, 713; **06**, 792; **07**, 808; **08**, 858; **09**, 904; **10**, 1009; **11**, 1067; **12**, 1281.

NAVAL OFFICERS:

Capt. W. A. Kirkland. **R.**, **90**, 3077; **91**, 3393.
 Capt. F. Rodgers. **R.**, **92**, 2879; **93**, 3541.
 Lt. Commander D. Delehanty. **R.**, **94**, 2681; **95**, 3609; **96**, 3395; **97**, 3499.
 Lt. J. F. Parker. **R.**, **97**, 3499; **98**, 3131.
 Lt. Commanders W. L. Field and N. J. K. Patch. **R.**, **98**, 3131.
 Lt. Commanders N. J. K. Patch, J. C. Fremont, and E. J. Berwind. **R.**, **99**, 3281.
 Lt. Commander J. C. Fremont. **R.**, **00**, 4513.
 Lt. Commander H. M. Hodges, U. S. Navy. **R.**, **01**, 3607; **02**, 2435.
 Commander E. F. Qualtrough, U. S. Navy. **R.**, **02**, 2435; **03**, 2359.
 Commander Daniel D. V. Stuart, U. S. Navy. **04**, 3677.
 Commander H. H. Hosley, U. S. Navy. **05**, 2573; **07**, 2245.
 Lt. Commander L. R. De Steigner, U. S. Navy. **R.**, **06**, 2059.
 Capt. Aaron Ward. **R.**, **08**, 2325; **09**, 2281.
 Capt. C. McR. Winslow. **R.**, **10**, 2601; **11**, 2915.
 Commander J. T. Carter. **R.**, **12**, 3441.

Legal Action (1900-1912—Typical of Work of Preceding Years).

CASES.

Tug *Geo. L. Garlick*, began 1898, still pending June 30, 1901. **01**, 3615. Not-prossed. **02**, 2441.

Tug *F. N. Brown*, closed by payment of fine. **01**, 3615. Copy of opinion and decision. **01**, 3616, 3617.

Tug *Emma K. Ross*, closed by payment of fine and imprisonment, copy of opinion and decision. **01**, 3618.

Tug *John Fleming*, case pending. **01**, 3620. Not-prossed. **02**, 2440.

Tug *W. J. Sewall*, case pending. **01**, 3621. Not-prossed. **02**, 2440.

Tug *Genesta*, case pending. **01**, 3621. Not-prossed. **02**, 2440.

Tug *John Fleming*, fine paid. **01**, 3622.

Tug *M. Moran*, pending. **01**, 3622; **02**, 2440. Fine paid. **03**, 2365.

Tug *James D. Leary*, held for grand jury. **01**, 3622.

Tug *Agnes*, fine paid. **01**, 3623.

Tug *Emma J. Kennedy*, decision reserved. **02**, 2439. Pending. **03**, 2365. Fine paid. **04**, 3688.

Tug *George D. Kuper*, fine paid. **03**, 2363.

Tug *John Fleming*, 2 cases, fines paid. **03**, 2364.

Tug *Fidelity*, case held for October term. **04**, 3689. Pending. **05**, 2577. Fine paid. **06**, 2063.
Tug *Senator Rice*, case pending. **04**, 3689. Pending. **05**, 2578. Acquitted. **06**, 2063.

Tug *John Fleming*, case pending. **04**, 3689. Jacobsen pleads guilty; sentence suspended. **05**, 2578.

Tug *Wm. H. Flannery*, case pending. **04**, 3689. Pending. **05**, 2578. Nolle. **06**, 2063.

Tug *John D. Dailey*, case pending. **04**, 3690. Pending. **05**, 2578. Nolle. **06**, 2063.

Tug *John Fleming*, case pending. **05**, 2578. Fine paid. **06**, 2064.

Tug *H. G. Runkle*, case pending. **05**, 2579; **06**, 2064; **07**, 2249; **08**, 2331. Nolle-prossed. **09**, 2289.

Tug *Jas. A. Lawrence*, case pending. **05**, 2579. Dismissed. **06**, 2064.

Tug *Colonel Gaynor*, case pending. **05**, 2580. Fine paid. **06**, 2064.

Tug *Bee*, case pending. **05**, 2580. Sentence suspended. **06**, 2064.

Tug *E. K. Ross*, fine paid. **05**, 2581.

Tug *John Fleming*, case pending. **05**, 2581. Fine paid. **06**, 2064.

Tug *Chas. E. Matthews*, case pending. **06**, 2065. Fine paid. **07**, 2249.

Tug *John Fleming*, case pending. **06**, 2065. Fine paid. **07**, 2249.

Brown & Fleming Cont. Co., case pending. **06**, 2065; **07**, 2249.

Tug *John Fleming*, case pending. **06**, 2066. Fine paid. **07**, 2249.

Tug *Nonpareil*, case pending. **06**, 2066. Fined, remitted. **07**, 2249.

Tug *John T. Pratt*, case pending. **06**, 2066. Fined. **07**, 2249.

Tug *Success*, fined. **07**, 2250.

Tug *O. L. Halenbeck*, case pending. **07**, 2250. Fined. **08**, 2331.

Tug *Julia C. Moran*, fined. **07**, 2251.

Tug *Robt. M. Dwy*, fined. **08**, 2332.

Tug *M. Moran*, failed to indict. **08**, 2332.

Tug *Bouker No. 2*, fined. **08**, 2333.

Tug *Julia C. Moran*, indictment dismissed. **08**, 2333.

Tug *Franklin N. Brown*, ignored by grand jury. **08**, 2333.

Tug *P. J. T. Co. No. 7*, matter never brought before court. **08**, 2335. (Correspondence with U. S. attorney. **08**, 2334, 2335.)

Tug *E. F. Moran*, license of master suspended 30 days. **08**, 2335.

Steamship *Deutschland*, case pending. **09**, 2289. Nolle-pros. entered. **10**, 2609.

Tug *Franklin N. Brown*, case pending. **09**, 2289; **10**, 2609.

Tug *Wm. H. Taylor*, fine paid. **09**, 2290.

Tug *Bouker No. 2*, fine paid. **09**, 2290.

Tug *Bee*, case pending. **09**, 2291; **10**, 2609.

Tug *O. L. Halenbeck*, fine paid. **09**, 2291.

Tug *Ariosa*, fine paid. **09**, 2291.

Tugs *Leonard Richards* and *O. L. Halenbeck* Hasterf paid fine, others nol-prossed. **09**, 2292.

List of cases referred to U. S. district attorney, showing disposition. **09**, 2292.

Tug *M. Moran*, fine paid. **10**, 2610.

Tug *John F. Gaynor*, fine paid. **10**, 2610.

Tug *M. Moran*, fine paid. **10**, 2611.

Tugs *Col. Gaynor* and *Eugene Hughes*, case dismissed, lack of evidence. **10**, 2611.

Tug *Julia C. Moran*, no bill found. **10**, 2611.

Tug *O. L. Halenbeck*, fine paid. **10**, 2612.

Tug *Edmund Moran*, pending. **10**, 2613. Fine paid. **11**, 2923.

Tomasso Ricci, foreman, street cleaners, defendant, discharged. **10**, 2613.

List of cases showing disposition made. **10**, 2613.

Wm. Beard & Co., c-vil action now at issue. **11**, 2923; **12**, 3445.

Morris & Cummings Dr. Co., civi. action "now" at issue. **11**, 2923, 2924; **12**, 3445.

Cahill Towing Co., pending. **11**, 2924; **12**, 3445.

Tugs *Anna W.* and *O. L. Halenbeck*, pending. **11**, 2924 **12**, 3445.

List of cases, showing disposition made. **11**, 2924.

The *Moran Towing & Transportat-on Co.*, pending. **12**, 3445.

OPERATIONS (1901-12; typical of works of preceding years).

1900-01. Patrol plant small compared to territory to be watched. **01**, 3607. Owners of tugboats and dredging plants realize efficiency of patrol and checking system. **01**, 3609. Contractors find it to their interest to keep plants in good condition rather than suffer penalty. **01**, 3609. About 12,000,000 c. y. moved yearly. **01**, 3610. Change in location of dumping ground, notice given. **01**, 3610. Employees of those engaged in dumping resort to every subterfuge to evade the law. **01**, 3611. Waste material used for filling in and reclaiming land. **01**, 3611. Correspondence relative to street sweepings being deposited at mouth of H. **01**, 3612. Efforts must be directed against employment of inferior or unseaworthy vessels upon work of transporting waste material to sea. **01**, 3614. 12,059,450 c. y. material deposited during fiscal year. **01**, 3623.

1901-02. Imp. to dispose of waste material without knowledge of this office. **02**, 2436. In consequence of strict surveillance owners and masters endeavor to conform to all rules and regulations. **02**, 2436. Difficulty in controlling dumping of ashes from small steam craft. **02**, 2436. About 19,000,000 c. y. removed during years. **02**, 2439.

1902-03. Condition of plant. **03**, 2360. System of checking material described. **02**, 2361. 20,460,587 c. y. moved and deposited. **03**, 2365.

1903-04. Remarks relative to repairs to vessels. **04**, 3679. Existence of shoal; notice sent out. **04**, 3680. Navigation menaced by planting of nets and poles in shad-fishing industry; notice given by supervisor forbidding these obstrs. **04**, 3695. 18,833,927 c. y. moved and deposited. **04**, 690.

1904-05. Piles and lumber obstrs. endanger navigation. **05**, 2576. Long tow lines interfere with navigation. **05**, 2577. 20,707,889 c. y. moved and deposited. **05**, 2582.

1905-06. Disposed refuse material increased from 10,000,000 c. y. in 1896 to 21,973,038 c. y. in 1906. **06**, 2059. Action to regulate length of tow lines suggested. **06**, 2061. 21,973,038 c. y. moved and deposited during fiscal year. **06**, 2067.

1906-07. Perceptible decrease in amount of spoil and refuse by diminution of work on tunnels, etc. **07**, 2245. Urgent recom. for a new patrol boat; est., \$50,000. **07**, 2247. 18,636,856 c. y. moved. **07**, 2251.

1907-08. 22,952,563 c. y. moved and deposited. **08**, 2336.

1908-09. 29,096,882 c. y. moved and deposited. **09**, 2293.

1909-10. Act requiring boats or scows to be equipped at all times with certain specified articles for better protection of life and property. **10**, 2602. Methods of inspection. **10**, 2602. 27,535,295 c. y. moved and deposited. **10**, 2614.

1910-11. Remedial measures suggested for adoption by city in disposing of refuse. **11**, 2921. 20,451,546 c. y. moved and deposited. **11**, 2925.

1911-12. 19,622,976 c. y. moved and deposited. **12**, 3446.

MISC. 136. NIAGARA FALLS, ETC.—CONTROL AND REGULATION OF THE WATERS OF NIAGARA RIVER, AND PRESERVATION OF NIAGARA FALLS.

APPROPRIATION.

1906, \$50,000, **07**, 855.

ENGINEERS.

Chief of Engineers. **R.**, **06**, 798; **07**, 854; **08**, 893; **09**, 939; **10**, 1050; **11**, 3022; **12**, 1331.

In charge:

Maj. C. Keller. **R.**, **07**, 2457; **08**, 2538; **09**, 2503.
Maj. C. S. Riche. **R.**, **10**, 2722 (Lt. Col.); **11**, 3005; **12**, 3529.

PERMITS.

For diversion of water. **08**, 895.

For transmission of electrical power from Canada into the U. S. **08**, 895.

Table, operating limitations of Niagara Falls Power Co. **10**, 2724; **12**, 3551.

Hearing in re application of Federal Light & Power Co. **12**, 3552.

SURVEYS, OPERATIONS, AND PROJECTS.

1906. By act of Congress approv. June 29, 1906, the diversion of water from Niagara R. or its tribu-

taries, in the State of New York, is prohibited, except with the consent of the Sec. of War as au. in section 2 of said act, and the act provides that this prohibition shall not be interpreted as forbidding the diversion of the waters of the Great Lakes or of Niagara R. for sanitary or domestic purposes, or for navigation, the amount of which may be fixed from time to time by the Congress of the U. S. or by the Sec. of War under its direction. **06**, 798.

1907. R. by Capt. Kutz concerning power companies on American and Canadian sides. Sur. made. **R.** of Asst. Engr. F. C. Sherehon printed. **07**, 855, 2457.

1908. Details of field operations. **08**, 2538.

Tables, discharge of Niagara R. **09**, 2503.

Slopes of Niagara R., table of R. heights at several gauges. **11**, 3022. Changes in R. heights, 1906-10. **11**, 3025. Simultaneous gauge heights and misc. factors. **11**, 3026.

MISC. 137. RIVERS—OHIO RIVER.

(See District CC., p. 905 of this index.)

The R. and H. act approv. June 25, 1910, made provision for continuing imp. of the Ohio R. with a view to securing a navigable d. of 9' in accordance with the R. submitted in H. D. 492, 60th, 1st, and with a view to the completion of such imp. within a period of 12 years. The item making app. for this work is as follows:

"Imp. Ohio R.: Continuing imp. with a view to securing a navigable d. of 9' in accordance with the R. submitted in H. D. 492, 60th, 1st, or such modification thereof as in the discretion of the Sec. of War may be advisable, and with a view to the completion of such imp. within a period of 12 years, \$1,150,000, which amount shall be applied

to the purchase of sites for 18 ls. and ds. Nos. 9, 10, 12, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 27, 28, 29, 41, and 48, and toward the constr. of ls. and ds. Nos. 7, 9, 10, 12, 19, 20, 29, 41, and 48: Provided, That so much of the sum herein app. as shall be necessary may be applied toward the definite location and purchase of sites for addl. ls. and ds. on said R.: Provided further, That the Sec. of War may enter into a contract or contracts for such materials and work as may be necessary to prosecute the said proj., to be paid for as apps. may from time to time be made by law, not to exceed in the aggregate \$3,500,000, exclusive of the amounts herein and heretofore app."

Work of creating slack-water navigation on the Ohio R. has been in progress for many years, first with a view to securing a d. of 6' and afterwards a d. of 9', and prior to the adoption of the new proj. the practical completion of 12 ls. and ds. and some work at 2 others had been provided for. Of these, Nos. 1-6, inclusive, and the d. at 41 were

in operation; Nos. 13, 18, and 37 will be opened in the next few months, and Nos. 8, 11, 19, and 26 are well under way. The new proj. contemplates a total of 54 ls. and ds. est. at the time the R. was submitted (January, 1908) to cost \$63,781,488, in addition to apps. previously made. This act also au. the purchase of sites for 18 ls. and ds., the beginning of the constr. of 9, and surs., etc., for the location of others.

The execution of the surs., the preparation of plans for the ls. and ds. "now" under constr. or contemplated, and other matters pertaining to the imp. as a whole are made the subject for consideration by a special board of Engineer officers constituted at the "present" time as follows: Col. Wm. T. Russell, Corps of Engineers; Lt. Col. Henry C. Newcomer, Corps of Engineers; Capt. Frederick W. Altstaetter, Corps of Engineers.

Upon the recom. of the board, the following allotments have been made of the cash apps. provided under the new proj.:"

| Dam No. | R. and H. act of June 25, 1910. | R. and H. act of Feb. 27, 1911. | Sundry civil act of Mar. 4, 1911. | R. and H. act of July 25, 1912. | Sundry civil act of Aug. 24, 1912. |
|--------------------|---------------------------------------|---------------------------------------|--|---------------------------------------|---|
| 7..... | \$150,000 | ..... | \$250,000 | \$150,000 | \$122,000 |
| 9..... | 150,000 | ..... | 400,000 | 150,000 | 282,000 |
| 10..... | 40,000 | ..... | ..... | 470,000 | ..... |
| 12..... | 150,000 | ..... | 300,000 | ..... | ..... |
| 14..... | ..... | \$330,000 | ..... | 100,000 | ..... |
| 15..... | ..... | 305,000 | ..... | 150,000 | ..... |
| 19..... | 220,000 | ..... | 300,000 | 100,000 | ..... |
| 20..... | 40,000 | 248,000 | ..... | ..... | 167,000 |
| 28..... | ..... | 250,000 | ..... | 300,000 | ..... |
| 29..... | 150,000 | 52,000 | 460,000 | ..... | ..... |
| 31..... | ..... | ..... | ..... | 330,000 | ..... |
| 41..... | 50,000 | 300,000 | ..... | 420,000 | 570,000 |
| 43..... | ..... | ..... | ..... | 550,000 | ..... |
| 48..... | 50,000 | 435,000 | ..... | ..... | ..... |
| Movable parts..... | ..... | ..... | ..... | 230,000 | ..... |
| Surveys, etc..... | 150,000 | 80,000 | ..... | 250,000 | ..... |
| Total..... | 1,150,000 | 2,000,000 | 1,710,000 | 3,200,000 | 1,141,000 |

R. and H. act of Feb. 27, 1911: Imp. Ohio R.: Continuing imp. by the constr. of ls. and ds. with a view to securing a navigable d. of 9', \$2,000,000: Provided, That the Sec. of War may enter into a contract or contracts for such materials and work as may be necessary to prosecute the said proj., to be paid for as apps. may from time to time be made by law, not to exceed in the aggregate \$3,000,000, exclusive of the amounts herein and heretofore app.

Sundry civil act of Mar. 4, 1911: Imp. Ohio R. below Pittsburgh, Pa.: For continuing imp. by the constr. of ls. and ds. Nos. 7, 9, 10, 12, 19, 20, 29, 41, and 48, \$1,710,000.

R. and H. act of July 25, 1912: Imp. Ohio R.:

Continuing imp. by the constr. of ls. and ds. with a view to securing a navigable d. of 9', \$3,200,000: Provided, That the Sec. of War may enter into a contract or contracts for such materials and work as may be necessary to prosecute the said proj., to be paid for as apps. may from time to time be made by law, not to exceed in the aggregate \$2,200,000, exclusive of the amounts herein and heretofore app.

Sundry civil act of Aug. 24, 1912: Imp. Ohio R. below Pittsburgh, Pa.: For continuing imp. by the constr. of ls. and ds. Nos. 7, 9, 10, 12, 19, 20, 29, 41, and 48, \$1,141,000.

(10, 1006; 11, 1063; 12, 1275.)

MISC. 138. PLANT--FLOATING PLANT.

(See p. 2337 of this index.)

Tabular statement in regard to each dr. and work accomplished by it during the preceding year. **09**, 899; **10**, 1009, 2449; **11**, 1066, 2661-2913; **12**, 1280, 2883-3439.

24 seagoing hy. dredges owned and operated by U. S. **09**, 899-903.

Work, and cost of, done by seagoing suction dredges. **10**, 2450; **11**, 2662; **12**, 3028.

Work, and cost of, pipe line hy. dredges. **10**, 2468; **11**, 2690; **12**, 3119, 3154.

Work, and cost of, dipper dredges. **10**, 2492; **11**, 2738; **12**, 3119, 3154.

List of floating plant, by classes. **10**, 2507; **11**, 2788; **12**, 2887.

List of floating plant, by districts. **10**, 2514; **11**, 2801; **12**, 2902.

Snagboats. **11**, 2763; **12**, 3174.

Derrick boats. **12**, 3203.

Pile drivers. **12**, 3228.

Graders. **12**, 3246.

Drill boats. **12**, 3252.

Maneuver boats. **12**, 3263.

Tow and survey boats (screw). **12**, 3267.

Tow and survey boats (paddle). **12**, 3304.

Steam lighters. **12**, 3302.

Gasoline launches (screw). **12**, 3348.

Gasoline launches (paddle). **12**, 3418.

Dry docks, list of. **12**, 3422.

Boat building plants. **12**, 3426.

Floating plants under construction. **12**, 3430.

Floating concrete plant. **12**, 3438.

MISC. 139. NAVIGATION — STRUCTURES IN THE NAVIGABLE WATERS OF PORTO RICO.

Act of Congress approv. June 11, 1906, empowered the Sec. of War, under certain restrictions, to au. the constr., extension, and mainten. of wharves, piers, and other structures on lands underlying H. areas and navigable streams and bodies of water in or surrounding Porto Rico and the islds. adjacent thereto.

Maj. C. A. F. Flagler, Corps of Engineers, to be sent to Porto Rico as a representative of the War Department to confer with the governor of Porto

Rico, with a view to estab. some definite policy in dealing with applications for privileges under this law. **06**, 797.

Through a conference bet. the district officer and the governor of Porto Rico, definite policy estab. and followed in connection with applications for privileges under this law, several applications being acted on during the year. **07**, 816; **08**, 886; **09**, 912; **10**, 1019; **11**, 1078; **12**, 1295.

MISC. 140. WATER POWER.

The an. Rs. of the Chief of Engineers contain references to the utilization of navigable streams for water-power purposes, but such references are generally incorporated in the abstract pertaining

to whatever stream is concerned. (See index to Rs. and Hs., pp. 17-1691 of this index, and see Topical Index.)

MISC. 141. WATER POWER — MICHIGAN-LAKE SUPERIOR POWER CO.

An. act June 13, 1902. Sec. of War, Dec. 12, 1902, to approv. plans of Michigan-Lake Superior Power Co. for its water-power canal and remedial

works and diversion of water from St. Marys R. subject to conditions. **03**, 641.

IISC. 142. WATERWAYS, INTRACOASTAL — BOSTON, MASS., TO THE RIO GRANDE.

(See p. 2106 of this index.)

R. and H. act of Mar. 3, 1909, directed certain rs. to be made with a view to the constr. of a ntinuous waterway, inland where practicable, om Boston, Mass., to the Rio Grande, which are assigned to the boards of engineers.

R. dated Oct. 4, 1911, with maps, by the special ard of Engineer officers, upon the sur. of that ction of the proposed continuous inland water- ay from Boston, Mass., to Beaufort Inlet, N. C., as duly submitted, and was reviewed by the ERH., pursuant to law, and its R. thereon sub- itted Dec. 12, 1911. These Rs. were transmitted Congress and printed in H. D. 391, 62d, 2d, rojs. and ests. for imp. of the following section esented:

Boston to Narragansett B. section, \$40,000,000.
Narragansett B.-Long Isld. Sound section, \$12,322,000.
New York B.-Delaware R. section, \$45,000,000.
Delaware R.-Chesapeake B. section, \$12,424,500.
Norfolk-Beaufort Inlet section, \$5,400,000.

Only the last 2 sections named above were recom. for adoption at the present time.

It is expected that the Rs. of the other boards on the sections between Beaufort Inlet and the Rio Grande will be transmitted to Congress during its next session. 10, 1015; 11, 1073; 12, 1288.

IISC. 143. RIVER AND HARBOR WORKS—Deterioration of, and Discontinuance of Appropriations for River and Harbor Works Deemed Not Worthy of Further Improvement.

Rs., 99, 38; 00, 40, 5071.

IISC. 144. RIVER AND HARBOR WORKS—Occupation of, by Private Parties.

Rs., 88, 310, 2687; 89, 373, 2805; 90, 13, 334, 39; 91, 19, 436, 3865; 92, 22, 413, 3341; 93, 20, 5, 4267; 94, 20, 431, 3189; 95, 21, 483, 4077; 96, 24, 429, 3875; 97, 24, 536, 3981; 98, 35, 538; 99, 38, 00, 40, 5085.

IISC. 145. WRECKS.

The removal of wrecks within the navigable sters of the U. S. is one of the duties assigned by ngress to the Chief of Engineers.

(For list of wrecks removed, see p. 2137 of this index.)

IISC. 146. WRECKS—REMOVAL OF S. S. "CRISTOBAL COLON," SAN JUAN H., PORTO RICO.

Chief of Engineers. 01, 657.

In charge:

Capt. W. V. Judson, 1901.

Capt. C. A. F. Flagler, 1901.

OPERATIONS.

1900-01. The wreck of the iron-hull steamboat *Christobal Colon* in the entrance to San Juan H. was removed to a min. d. of 36' at m. l. w. at a total cost of \$7,750.27. 01, 657.

MISC. 147. WRECKS—REMOVAL OF WRECK OF BATTLE-SHIP "MAINE."

APPROPRIATIONS.

| | | |
|-------|---------------|-----------|
| 1910, | \$100,000 | 11, 3049. |
| 1910, | 200,000 | |
| 1911, | 350,000 | |
| | <hr/> 650,000 | |
| 1911, | 250,000 | 12, 1345. |
| | <hr/> 900,000 | |

CONTRACTS.

1910. Lackawanna Steel Co., furnishing sheet piling, plates, bolts, etc., prices listed. **11, 3050.**

Chief of Engineers. R., 11, 1119.

Board. Par. 1, S. O. 36, consisting of Col. W. M. Black, Lt. Col. M. M. Patrick, and Maj. H. B. Ferguson. **R., 11, 3039; 12, 3565.**

OPERATIONS.

1910-11. Pile driving begun; dr. of bar done; cylinders filled with drs.; constant repairs made to piles damaged during operations; main deck of *Maine* and captain's cabin exposed; details of wreck as illustrated by exposed portions. **11, 3049.**

1911-12. The st. and clay fill against the inside of the dam completed in October, making a total of 86,766 c. y. of clay and 17,734 c. y. r. for entire work; unwatering of cofferdam continued; inside work finished in February; wreck examined; mainmast removed for transportation to Arlington Cemetery; remains of 66 men recovered, taken to U. S. for interment; cofferdam flooded; hull freed itself from mud and finally rose with water; on Mar. 16, 1912, wreck towed to sea and buried with proper ceremonies; work of removing cofferdam and restoring site started. **12, 3568.**

Rs. relative to removal of wreck and the progress thereof are printed in H. D. 919, 61st, 2d; S. D. 765,

61st, 3d. **R.** of board appointed by Sec. of Navy to examine wreck contained in H. D. 310, 62d, 2d.

PHYSICAL CHARACTERISTICS.

Description of Habana H. **11, 3040.**

Cyclonic disturbance passed over Habana, delaying work. **11, 3043.**

PROJECTS.

The removal of the wreck of the *Maine* from the H. of Habana is being carried on under acts approv. May 9, 1910, June 25, 1910, and Mar. 4, 1911. Requires Sec. of War to provide for raising and removal of the wreck and for proper interment of the bodies therein in Arlington Cemetery, to remove mast of wreck and place it upon a proper foundation in Arlington National Cemetery. Impossible to prepare an accurate est. of sum needed for work. **11, 3039.** Congress desires wreck to be so exposed, without derangement of parts, as to permit all information possible to be obtained as to the nature and location of the explosion or explosions which caused disaster. **11, 3041.** Board approves design for a dam elliptical in shape, composed of cylinders 50' diameter, built of steel sheet piles, driven to d. of 73'; cylinders placed tangent to each other, connected on the outer perimeters by short arcs of similar sheet piles, and with the cylinders and connecting sections filled with stiff clay from the H. bottom near by and rock. The centers of the cylinders were to be on a perimeter of elliptical form, with major and minor axes of 395' and 216' 1, respectively. **11, 3042.**

MAPS.

H. of Habana. **11, 3040.**

Plan of cofferdam around wreck. **11, 3042.**

Photographs showing views of cofferdam, etc. **11, 3050.**

MISC. 148.

ROADS—ALASKA.

APPROPRIATIONS.

| | | |
|-------|--------------|------------------------------------|
| 1904, | \$25,000 | 04, 4219 (Valdez-Fort Egbert sur.) |
| | <hr/> 2,500 | 04, 4219 (Yukon-Coldfoot sur.). |
| | <hr/> 27,500 | |

ENGINEERS.

Chief of Engineers. R., 04, 744; 05, 752.

In charge. Maj. J. Millis. **R., 04, 4203; 05, 2845.**

OPERATIONS AND PROJECTS.

1904. Surs. for the above road and trail were provided for in the Army app. act of Apr. 23, 1904. The Valdez-Fort Egbert road is some 400 m. l., and the Yukon-Coldfoot trail in the neighborhood of 90 m. l.

Coldfoot is on the headwaters of the Koyukuk, within the Arctic Circle, in latitude 67° 20' n.

5 parties were organized in Seattle to make the surs.—1 for the Coldfoot trail and 4 for the Valdez-Fort Egbert road. The Coldfoot party and 2 of

the Valdez-Fort Egbert parties sailed from Seattle on May 31 for Skagway, from which point they were to go by the White Pass R. R. and the Yukon R. to the points of beginning their respective surs. 2 other parties sailed from Seattle for Valdez. 04, 4217.

1905. The sur. from Yukon R. to Coldfoot, Alaska, was completed and party returned to Seattle on Aug. 31, 1904.

The sur. from Valdez to Fort Egbert, Alaska, was completed on Aug. 14, 1904, and the parties returned to Seattle on Sept. 29, 1904.

Pre. R.s. on the surs. were submitted on Dec. 15, 1904, and were published in H. D. 192, 58th, 3d. 05, 2845.

MAPS.

04, 4218.

MISC. 149. ROADS—MOUNT RAINIER NATIONAL PARK.

APPROPRIATIONS.

| | |
|---|--------------------|
| Mar. 3, 1903, to enable the Sec. of War to cause a sur. to be made for a wagon road in said park and for constr. of the road | \$10,000. 04, 4203 |
| Apr. 28, 1904, for continuing the constr. of the wagon road, \$6,000 of which shall be used in sur. and est. the cost of a wagon road from the boundary of Mount Rainier Forest Reserve into said park .. | 30,000. 04, 4205 |
| June 30, 1906, for continuing the constr. of the wagon road into the park from the w. side | 50,000. 06, 831 |
| Mar. 4, 1907, for continuing the constr. of the wagon road into the park from the w. side | 50,000. 07, 472 |
| May 27, 1908, for continuing the constr. of the wagon road into the park from the w. side | 50,000. 08, 2554 |
| Mar. 4, 1909, for completion of the wagon road into the park from the w. side | 25,000. 09, 945 |
| June 25, 1910, for addl. work upon the wagon road into the park from the w. side | 25,000. 10, 1056 |
| Total | 240,000 |

CONTRACT.

1904. A. D. Miller, road constr. 05, 2844.
A. W. Miller. 07, 2471.)

ENGINEERS.

Chief of Engineers. R., 03, 37; 04, 743; 05, 51; 06, 831; 07, 857; 08, 897; 09, 944; 10, 1055; 11, 1117; 12, 1339.

In charge:

Maj. J. Millis. R., 04, 4203; 05, 2839.
Lt. F. A. Pope. 06, 831.
Maj. H. M. Chittenden. R., 06, 2277; 07, 2471; 08, 2553.
Maj. C. W. Kurtz. R., 09, 2514, 2739; 10, 3033; 11, 3033.
Maj. J. B. Cavanaugh. R., 12, 3559.

Assistant. Eugene Ricksecker. R., 04, 4207; 05, 2840.

PHYSICAL CHARACTERISTICS.

Mount Rainier, sometimes known as Mount Tacoma, is an extinct volcano, the top of which is covered with perpetual snow. It has an elevation of 14,526' above sea level, and from certain points of view has a remarkably symmetrical outline. It is detached from the main range of the Cascades, being several m. w. of that range. It is plainly in sight as a very conspicuous feature of the landscape from sea level at Tacoma, only 45 m. distant, and is of course visible from all directions to much greater distances. On account of its height, its symmetry, and its visibility from sea level from a large city and seaport, it is the most remarkable mountain peak in U. S. territory, and one of the remarkable features of its kind on the earth's surface.

Besides the mountain itself and its immense crater, which is still warm, the national park and forest reserve in which it is located contain many features of great scenic and scientific interest, including living glaciers, waterfalls, lakes, canyons, interesting rock formations, and vegetation of great variety and beauty. All these will be rendered accessible to tourists and the general public by the constr. of the roads in progress. 04, 4204.

It seemed, 1903, as though best results would be secured by a road that, in connection with existing means of communication, would afford access to the mountain from Tacoma, the nearest large city, via Longmire Springs, the Nisqually glacier, and Narada Falls, to Paradise Valley and the Camp of the Clouds. From the latter the summit of the mountain can be reached by mountain climbers, at an elevation of 14,526'. 04, 4204.

Bridges. 04, 4214.

Clearing work. 04, 4213.

Curves. 04, 4213.

Drainage. 04, 4213.

Gradients. 04, 4212.

Grading. 04, 4214.

Repairing roads and trails. 05, 2841.

Retaining walls. 04, 4214.

Road constr. 05, 2842.

Surfacing. 04, 4214.

Width of wheeling. 04, 4213.

PROJECTS AND OPERATIONS.

Bids were invited in the latter part of the season of 1903 for beginning the clearing and grubbing of the road, but the proposals received were too high.

Bids again called for, for beginning the clearing and grubbing, but no fav. bid was received. Meanwhile, specifications were prepared for beginning the road constr. under formal contract and on a scale that w. enable contractors to undertake it to advantage.

The proposed road is to enter the park from the w., and, in connection with existing R. R. and stage lines, will render the various points of interest in the park, including glaciers, falls, r. formations, etc., also Paradise Valley, Camp of the Clouds, and the mountain summit, accessible for tourists and others from Tacoma, the nearest large city. **04, 4203.**

Contract made for road constr. into the park from the w. Work began in August, 1904, and was continued as long as the weather permitted. About 1 m. of clearing, grading, and grubbing was done, extending from Longmire Springs toward Paradise Park. Work was not resumed in the spring, owing to financial difficulties of the contractor. The contract time expired June 30, 1905, but the time was extended for a reasonable period. **05, 751, 2839.**

1907. Notification of annulment of contract with A. D. Miller for constr. of road was received at this office on July 8, 1906, and work was commenced with hired labor and Government plant July 9. Operations during the season of 1906 were carried on below Longmire Springs, and 6 m. of road built and about 1½ m. partly built between the w. boundary of the forest reserve and Longmire Springs. Work was carried on until Nov. 20, 1906, when it was suspended on account of unfav. weather.

Work was resumed on Apr. 9, 1907, and the uncompleted road below Longmire Springs was practically finished. **07, 2471.**

The work accomplished under the various apps. to the close of the fiscal year ending June 30, 1908, is as follows: Number of m. of road constr. and in use, 14; number of m. of road partially completed, 1.5; total, 15.5. **08, 898.**

1911. On July 1, 1910, the road was open for public travel from the w. boundary of the forest reserve to Narada Falls, a distance of 19.5 m. It was incomplete from Narada Falls to Camp of the Clouds, a distance of 4.5 m. The unfinished section was so far completed during the season of 1910 that the entire road was opened to the public Sept. 1, and a number of stages made regular trips between Longmire Springs and Camp of the Clouds during September. Work ceased Nov. 3, 1910, on account of rain and was resumed on June 26, 1911.

The work of the fiscal year included the removal of débris which had fallen from the slopes, the completion of the Narada trestle, other brs., and grading, widening, and surfacing the roadbed. **11, 1117.**

SURVEYS.

The sundry civil act of Mar. 3, 1903, au. a sur. for a wagon road into Mount Rainier National Park. **03, 37.**

The sur. was made during the summer and autumn of 1903, and pre. R., with detailed maps and est. of cost, were submitted on Feb. 9, 1904. A collection of photographic views, illustrating some of the natural features which the proposed road will render accessible, was also submitted.

The sundry civil act of Apr. 28, 1904, also provided for a sur. and est. for a road to enter the park from the e. Preparations to begin this sur. at an early date were under way at the close of the fiscal year. This road is to render the park and mountain accessible from North Yakima and Ellensburg. **04, 4203.**

The sur. for the road into the park from the e. was completed in October, 1904, and R. and est. were submitted on Jan. 16, 1905. The est. cost of the proposed road was \$275,600.

The R. of the sur. was printed as H. D. 283, 58th, 3d. **05, 2839.**

MAPS.

04, 4206; (photographs) **08, 2554;** (photographs) **09, 2514.**

MISC. 150. ROADS—MILITARY ROAD, FORT WASHAKIE TO MOUTH OF BUFFALO FORK OF SNAKE RIVER, WYO.

ENGINEERS.

Chief of Engineers. **R., 99, 640; 00, 721; 01, 686; 02, 612; 03, 675.**

In charge:

Capt. J. C. Sanford. **R., 99, 3881.**

Capt. H. M. Chittenden. **R., 00, 5453; 01, 3823; 02, 3075; 03, 2937.**

Assistants:

Lt. A. W. Perry, 9th Cav. **R., 99, 3897.**

Lt. J. A. Ryan, 9th Cav. **R., 99, 3892.**

W. H. Wood. **R., 99, 3898.**

PHYSICAL CHARACTERISTICS.

Detailed description of the routes. **99, 3884.**

PROJECT.

The sundry civil act June 4, 1897, app. \$10,000 for military road from Fort Washakie, Wyo., by the most practicable route near the Wind R., and to the mouth of the Buffalo Fork of Snake R., near Jacksons Lake, in Uinta Co., Wyo.

The purpose of the road to render possible the movement of Cavalry from Fort Washakie with

their supplies, by as direct a line as possible, into Jacksons Hole, a noted game country, much frequented during the hunting season by Indians of the Fort Hall and Wind R. Reservations, where conflicts between these Indians and the Wyoming State game wardens were to be feared.

1897, the work in charge of the Quartermaster Department, August, 1897, plan and map for locating the road prepared by Lt. H. R. Hickok, Ninth Cavalry. Judge Advocate General decides that as amount fell far short of the amount required to complete the work, the app. could not, by its terms, be used as far as it would go, leaving the work incomplete. 1897, a reconnoissance made by Lt. A. J. Perry, Ninth Cavalry., and Lt. J. A. Ryan, Ninth Cavalry. As a result, suggested that if whole of app. were expended on the section of

the road from Clarks Ranch to the mouth of the Buffalo Fork of Snake R., that section could be made passable; and, as the road from Washakie to Clarks was already passable during the greater part of the year, the result of spending the whole of the app. bet. Clarks and the mouth of Buffalo Fork would be to give a passable road over the entire route. This decided legal by the Judge Advocate General.

Capt. J. T. McBlain, Ninth Cavalry, detailed to take charge of the constr. War with Spain stopped preparations. 99, 3884.

Capt. J. C. Sanford, Corps of Engineers, placed in charge of the work, 1898. Work on the road begun Aug. 25. Completed Oct. 7. 99, 2881.

Sundry civil act June 6, 1900, au. \$10,000 for repair and completion of road. 01, 687.

MISC. 151. SURVEYS — ERIE CANAL — PRESERVATION OF BENCH MARKS.

ENGINEERS.

Chief of Engineers. R., 97, 546; 98, 551; 99, 536; 00, 715.

In charge:

Maj. W. S. Stanton. R., 97, 4122; 98, 3778.

Capt. G. D. Fetch. R., 99, 3859; 00, 5402.

MISC. 152. FRONTIERS—MEXICAN FRONTIER.

ENGINEERS.

Chief of Engineers. R., 81, 339.

In charge. Maj. O. M. Poe (Bvt. Brig. Gen.; Col., A. D. C.). R., 81, 2811; 82, 2825.

MISC. 153. SURVEYS — GEOLOGICAL AND GEOGRAPHICAL SURVEYS OF THE WAR DEPARTMENT.

ENGINEERS.

Chief of Engineers.

Information for Congress relating to investigations of all surs. of a scientific character under the War and Interior Departments, and under the

Land Office, by the National Academy of Sciences. 78, iii, 1653.

Letter to the president of the academy. 78, iii, 1661.

MISC. 154. SURVEYS — INSTRUMENTS ISSUED, MAPPINGS, ETC.

(See Misc. 85-96 on p. 2040 of this index.)

ENGINEERS.

In charge. Maj. O. M. Poe (Bvt. Brig. Gen. and Col., A. D. C.). R., 75, ii, 1109; 76, i, 122;

iii, 563; 81, 2811 (progress of railroads in Texas-Mexico); 82, 2825.

MISC. 155. LAKE ERIE—SHOALS IN.

ENGINEERS.

Col. J. A. Smith. R., 97, 4123.

Chief of Engineers. R., 92, 420; 93, 484; 97,
547.

Assistant. W. T. Blunt. R., 97, 4125.

In charge:

Maj. A. Stickney. R., 92, 3424.

MISC. 156. LAKE ERIE — WATER-LEVEL OBSERVATIONS.

ENGINEERS.

Assistant. W. T. Blunt. 90, 3584.

Chief of Engineers. R., 90, 530.

In charge. Maj. L. C. Livermore. R., 90,
3583.

MISC. 157. LAKE SUPERIOR — SURVEY OF WEST END, TO DETERMINE LOCAL VARIATION OF THE COM- PASS.

APPROPRIATIONS.

1904. \$900 allotted Aug. 5, 1902.

R. by Capt. C. L. Potter, Apr. 7, 1904, and As-
sistant Engineer J. H. Darling, including the
following:

CONTENTS.

Chapter I—Outline of methods and results.

Chapter II—Vessel and instruments.

Chapter III—Deviation—method of determining.

Chapter IV—Method of reducing observations
for variation.

Chapter V—Tests of accuracy of azimuth com-
pass observations for variation.

Chapter VI—Effect of change of latitude on
deviation—corrections.

Chapter VII—Location of points of observation.

Appendix A—An. change.

Appendix B—Local attraction in Duluth H.

MAPS AND DIAGRAMS.

Sheet I—Variations on w. portion of Lake Supe-
rior.

Sheet II—Variations in Superior B. and other
data.

Sheet III—Variations near Stony Pt., showing
local attraction.

Sheet IV—Deviation curves, 1902.

Sheet V—Deviation curves, 1903.

Sheet VI—Meridians, parallels of latitude, and
lines of equal deviation.

Sheet VII—Interpolation curves for time.

Sheet VIII—Interpolation curves for latitude.

Sheet IX—Interpolation curves for declination.

Sheet X—Attraction of iron in a pier.

Sheet XI—Local attraction at Grand Marais,
Minn., ashore.

04, 4132.

(See also Misc. 161 on p. 2122 of this index.)

R. by Lt. Col. G. D. Fitch, May 23, 1910.

Detailed R. by Mr. J. H. Darling, assistant engi-
neer. 10, 2725.

Maps.

Chart. 10, 2734.

Deviation curves. 10, 2734.

MISC. 158. LAKE SUPERIOR, NORTH SHORE OF—SUR- VEY AND LOCATION OF DANGEROUS REEF NEAR MOUTH OF GOOSEBERRY RIVER.

ENGINEERS.

Chief of Engineers. R., 90, 530.

In charge. Maj. J. B. Quinn. R., 90, 3583.

MISC. 159. LONGITUDE—Determination of Difference of Longitude Between Detroit, Mich., and Fort Leavenworth, Kans.

(See also Misc. 161 on p. 2122 of this index.)

ENGINEERS.

In charge. Lt. E. H. Ruffner. R., 72, 1118.

MISC. 160. LATITUDE AND LONGITUDE — Colorado (Denver), Kansas (Forts Hays and Wallace), and California (Pueblo).

ENGINEERS.

Assistant. Prof. T. H. Safford. R., 73, 1243.

Chief of Engineers. R., 73, 115.

In charge. Lt. E. H. Ruffner. R., 73, 1224, 1243.

MISC. 161. NORTHERN AND NORTHWESTERN LAKES—CHARTS, BULLETINS, ETC.

NOTE.—The execution of the Lakes sur. which terminated in 1882 involved a great quantity of astronomic, topographic, and hydrographic work, all of which was performed with a high degree of accuracy and skill.

The result was the preparation of a series of reliable charts for lake vessels and the furnishing of a basis for works of chan. imp. upon the lakes themselves and their connecting waters.

This original series consisted of 76 charts, all of which were printed in black from copperplates.

At 1912 the chart work of the Lake Survey was covered by proj. approv. Apr. 17, 1909, printed upon page 937, R. of the Chief of Engineers for 1909. When completed, due to changes and omissions contemplated by this proj., the Lake Survey series will comprise about 104 separate charts, this number, however, being approx., as circumstances may arise in the future necessitating the retention of some of the H. charts as separate publications, instead of insets as planned 1912.

As a result of revisions, cancellations, and additions to the original series, based on the later sur., there were in force (1912) 120 Lake Survey charts, of which 1 was in black from old copperplate, 79 lithographs in colors from copperplate transfers, and 40 lithographs in colors from stone engravings.

The charts issued in colors have all depths of 18 or 21' and less in blue, showing at a glance where vessels may proceed with safety, and are considered by vessel men much preferable to the old style printed in plain black and white. This series of colored charts is believed to constitute a distinct advance in chart constr. and printing and meets with high favor from navigators and others.

APPROPRIATIONS.

See 2124.

ENGINEERS.

Chief of Engineers. Rs., 66, ii, 20; 67, 52; 68, 74; 69, 65; 70, 85; 71, 101; 72, 99; 73, 110;

74, 120; 75, 126; 76, 116; 77, 125; 78, 139; 79, 194; 80, 244; 81, 336; 83, 340; 84, 345; 85, 375; 86, 371; 87, 343; 88, 316; 89, 384; 90, 530; 91, 445; 92, 419; 93, 481; 94, 437; 95, 492; 96, 438; 97, 544; 98, 547; 99, 633; 00, 711.

For reports, 1901-1912, see page 2124.

The progress of operations under the proj. for chart revision approv. Apr. 17, 1909, was as follows at 1912:

| | Existing series. | Final edition. |
|--|------------------|----------------|
| Number of charts in force June 30, 1912..... | 120 | ..... |
| Number of charts contemplated for final edition, by revision and consolidation of existing series and construction of new charts..... | | 111 |
| Number of new charts or charts completely revised. One of the number will eventually be made an inset on another chart and a second will be superseded and dropped, leaving a number of new charts or charts completely revised for final edition..... | 60 | ..... |
| Number of charts under revision..... | 9 | 9 |
| Number of charts to be revised, in whole or part, and issued as separate charts..... | 35 | 35 |
| Number of charts to be revised and issued as insets..... | 4 | ..... |
| Number of charts to be dropped..... | 12 | ..... |
| Number of new charts in course of preparation..... | | 4 |
| Additional new charts proposed..... | | 5 |
| Total..... | 120 | 111 |

¹ 18 of the charts to be revised, in whole or in part, had already been revised for geographic positions and 17 others had been revised for hydrography. Including those partially revised and the new charts and the charts completely revised, the total number of the series in force, based on the standard geodetic datum, was 78, and the total number based on the standard datum for hydrography was 77, making a total of 95 charts either now completely revised or partially revised.

Of the entire series of Lake Survey charts there had been issued in colors—5 on July 1, 1900; 12 on July 1, 1901; 30 on July 1, 1902; 49 on July 1, 1903; 59 on July 1, 1904; 73 on July 1, 1905; 97 on July 1, 1906; 110 on July 1, 1907; 117 on July 1, 1908; 122 on July 1, 1909; 124 on July 1, 1910; 126 on July 1, 1911; and 124 on July 1, 1912, including the 5 general charts formerly published by the Hydrographic Office of the Navy and “now” published and sold by the Lake Survey office.

The reduction of the number of charts in colors from 126, June 30, 1911, to 124, June 30, 1912, is accounted for by the dropping of 5 old charts superseded by the work of revision under the chart proj., and the issuance of 3 new charts; probably more advantageous to reduce the number to 111 instead of to 104.

Up to Feb. 20, 1890, one full set of charts was issued free to each U. S. registered vessel. Any additional charts furnished such vessels and all furnished for other unofficial use were sold at the uniform price of 30¢ each; pursuant to law, since then, the charts have been sold for all private and unofficial use at prices ranging from 5¢ to 30¢ each, the price being intended in each instance to cover only the cost of paper and printing.

Charts may be purchased at the main office at Detroit, at the canal office at Sault Ste. Marie, Mich., and at the U. S. Engineer office in Buffalo.

Complete sample sets may be seen at the U. S. Engineer offices at Duluth, Milwaukee, Chicago, Grand Rapids, Cleveland, and Oswego, enabling purchasers to select exactly the charts they wish to order.

From 1882 to June 30, 1912, \$43,215.24 derived from sale of charts.

During the fiscal year ending June 30, 1912, the number of charts sold by the Detroit office was 13,621, and by the Buffalo office 2,506, the aggregate sales being 16,127. The Detroit office issued 3,156 charts for official use and the Buffalo office 55, a total of 3,211.

To 1912 about 443,770 of these charts had been sold and issued for actual service.

For other Government offices various charts are printed in colors. For the Chief of Engineer's office (under app. “Maps, War Department”) the following were, for example, reproduced and printed (1912): 4 H. charts and 10 different tractor variants of these charts; topographical map of northeast Virginia, in black; Petersburg and Five Forks, in colors; 3 maps illustrating the 3 days' Battle of Gettysburg, in colors; and 7 military maneuver ground maps, 4 in black and 3 in

colors. An engraving on copper of 3 sheets of the military sur. of Luzon, Philippine Islands, was in progress.

The preparation and issue of the series of bulletins supplementary to the charts, relating to the R. and H. imps. and navigation of the Great Lakes, was begun in 1889 and was transferred to the office of the Lake Survey at Detroit in 1902. These bulletins are issued annually, with monthly supplements, during the season of navigation, and give the latest and fullest descriptions of progress in R. and H. imps. on the Great Lakes and their connecting waters, as well as significant results of sur. in those waters made under the direction of district engineer officers and of the Lake Survey. If deemed helpful, small maps showing location of new shoals, changes in important chans., localities hitherto uncharted, etc., are inserted in both bulletins and supplements.

The C. affected by the operations of the Lake Survey and depending upon the publication and constant revision of charts and bulletins is practically the entire C. of the Great Lakes. To keep pace with the needs of this rapidly growing traffic requires that the organization and plant be operated to their utmost capacity during the relatively short seasons available for field work. The greatly increased demand for lake charts and the publication by the Lake Survey of the Mercator charts of the Hydrographic Office, U. S. Navy (5 general charts of the Lakes), have materially increased the office operations.

In charge:

Maj. W. F. Reynolds (Bvt. Col.). **Rs.**, 66, ii, 49; (Lt. Col.) 67, 864; 68, 932; 69, 558; 70, 600.

Maj. C. B. Comstock (Bvt. Brig. Gen.). **Rs.**, 71, 1020; 72, 1068; 73, 1201; 74, ii, 476; 75, ii, 918; 76, iii, 125; 77, 1195; 79, 1971; 80, 2437; (Lt. Col.) 81, 2801.

Capt. H. M. Adams. **Rs.**, 78, 1416.

Lt. Col. O. M. Poe. **Rs.**, 83, 2377; 84, 2373; 85, 2519; 87, 3143; 88, 2810; (Col.) 89, 2865; 90, 3588; 91, 3927; 92, 3407; 93, 4343; 94, 3315; 95, 4159.

Lt. Col. G. J. Lydecker. **Rs.**, 96, 4017; 97, 4069; 98, 3745; 99, 3857; 00, 5317.

For Engineers, 1901-12, see Northern and Northwestern Lakes—Surveys, etc.

OPERATIONS.

See Note at head of this abstract; reports of Engineers in charge above; and Misc. 162, p. 2124 of this index.

MISC. 162. NORTHERN AND NORTHWESTERN LAKES¹— SURVEYS, ETC.

NOTE.—As early as 1816 local sur. of the Great Lakes for special purposes were made by Engineer officers, but the "Lake Survey" as a systematic work was commenced in 1841. It was diligently prosecuted thereafter until 1882, when for a time extended field operations were suspended.

The correction, printing, sale, and issue of charts has continued without cessation, the additions and corrections being largely based upon local sur. and Rs. by Engineer officers in charge of the R. and H. imps. on the lakes.

Systematic field work was resumed in 1889; since prosecuted with increased vigor.

In 1898 operations were extended to include cognate work of observing and investigating the levels of the Great Lakes and their connecting waters, with a view to their regulation in the interest of C.

The sur. proper has from the beginning been carried on under the War Department, being at first conducted by the Chief of Topographical Engineers, and by the Chief of Engineers after the consolidation of the Topographical Engineers with the Corps of Engineers.

A full account of the operations of the Lake Survey from May, 1841, to July 1, 1881, is contained in Professional Papers, Corps of Engineers, U. S. Army, No. 24, which describes in detail the methods of primary triangulation employed. An extract from this publication describing the condition of lake navigation in 1841 is printed in the An. R. of the Chief of Engineers for 1910, p. 1043.

The early operations of the Lake Survey were conducted with a view to meeting the demands of a limited navigation where the greatest draft was 12'. With the expansion of lake C., the in-

¹ Regulation of Lake Erie.—Act June 13, 1902, requested the President to invite Great Britain to join in forming an international commission (3 from the U. S. and 3 to represent Canada) to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between U. S. and Canada, upon mainten. and regulation of suitable levels, upon effect on shores of waters referred to, upon interests of navigation affected by diversions, etc., upon measures to regulate diversion, and to make recoms., etc., as shall best subserve the interests of navigation in the said waters. The commission to report upon the advisability of locating a dam at the outlet of Lake Erie, and to recom. agreement of treaty which should provide for the constr. of the dam; ests., etc.

R. dated Buffalo, N. Y., Jan. 8, 1910.

Members of the commission: Brig. Gen. O. H. Ernst, George Clinton, and E. E. Haskell. Canadians: Geo. C. Gibbons (chairman) and Wm. J. Stewart. Secretary, W. Edward Wilson (American section).

From a study of a large mass of data apparent that regulation of Lake Erie within a range of 1' impracticable, between limits of 573.7 and 574.7. Some notable low levels could have been raised by some regulation. In considering measures for the latter, after weighing the advantages and disadvantages, the commission expressed the opinion "that the advantages are not of such overwhelming character as to justify the two Governments in entering upon that vexatious question, and we therefore recom. that the 'regulation' of Lake Erie be not undertaken, meaning thereby the most complete practicable regulation such as can be secured by a dam and sluice gates located at or near Buffalo."

"Compensating" works, as opposed to "regulating" works suggested for raising the level of Lake Erie "sufficiently to compensate for the damages heretofore inflicted by the Chicago Drainage Canal and other deteriorating influences." Believed that somewhere in the Niagara R. between Lake Erie and the Falls a submerged dam might be placed for the purpose. Surs. in progress to determine exact location.

Discussion of the regulation of Lake Superior, of Lake Michigan-Huron, and Lake Ontario. "If the level of a lake has been lowered, whether by diversion through the Chicago Drainage Canal or by enlargement of the outlet, the remedy seems to lie in 'compensating' rather than in 'regulating' works."

Discussion of the use of Lake Superior as a reservoir, proposed "by persons not familiar with the Great Lakes," to compensate for the diversion of water through the Chicago Drainage Canal. "It is not in the power of man to improve this uniformity of flow (of Lake Superior) to any important degree." Disturbing it would seriously affect levels in lakes below.

Contents: Great Lakes—Areas and watersheds—Water-level records—Equation for stream flow—Discharge, St. Marys R.—Discharge, St. Clair R.—Discharge, Detroit R.—Discharge, Niagara R.—Discharge, St. Lawrence R.—Discharge increments of the R. outlets of the Great Lakes system—Supply factors of the Great Lakes—Regulation of Lake Erie as proposed by the U. S. BE. on Deep Waterways—Practical regulation of Lake Erie bet. stages 573.7 and 574.7, 1903 levels—Effect of regulation of Lake Erie bet. stages 573.7 and 574.7 on water levels of Lake Ontario and St. Lawrence Canals—Practical regulation of Lake Erie bet. stages 572.0 and 574.5, 1903 levels—Effect of regulation of Lake Erie bet. stages 572.0 and 574.5, on water levels of Lake Ontario and St. Lawrence Canals—Effect of regulation of Lake Erie bet. stages 572.0 and 574.5, on water levels of Niagara R.—Effect of regulation on Lake Erie bet. stages 572.0 and 574.5, on water levels of Lake St. Clair, Lake Michigan-Huron, and connecting waters—Regulation of Lake Superior—Diversion of water through Chicago Drainage Canal, the effect of diversion on Lakes Michigan-Huron, Erie, and Ontario, and the regulation of Lake Superior to compensate for the diversion at Chicago—Regulation of Lake Michigan-Huron—Regulation of Lake Ontario—Compensating works in the Niagara R.—Tables and Plates, pages 63 to 158.

R. published as H. D. 779, 61st, 2d.

crease in vessel dimensions, and the creation of chans. and Hs. with progressively increasing d., the Lake Survey has kept pace with the increasing demands by a corresponding extension of the scope of its operations.

The highest attainable standards of accuracy and excellence have characterized the work from the beginning, and the work now in progress under present approv. proj.s is merely an extension of the earlier work to limits which were not anticipated by the most sanguine spirits of former days.

The present general proj. of the Lake Survey (see details in the an. R. for 1907, pp. 844 to 850) proposes the ascertainment and chartering of lake d. in all significant regions of the Great Lakes to a plane 30' below the adopted l.-w. datum of the open lakes and 25' below the corresponding datum in the chans. of the connecting Rs., together with the completion of the related operations of triangulation and precise leveling still needed to control properly the areas under sur.

In addition, the general proj. provides for the extension of R. discharge measurements, for investigations of lake levels, and for magnetic sur.s. in and near main vessel courses, while prompt ex. of areas where obstrs. to navigation have been reported will be continued as heretofore.

The water area charted is about 95,000 sq. m., of which about two-thirds is on the American side of the international boundary. The shore line is about 8,345 m. in length, and of this the American line is 4,700 m. As a basis of comparison, the total shore line of the Atlantic, Pacific, and Mexican seaboard of the U. S., excluding Alaska and all islands, is stated in S. D. 74, 53d, 2d, to be 5,705 m. long.

The work of the sur. has not been limited by the national boundary, as the predominance of the navigation interests of the U. S., amounting to 95% of the C. of the Great Lakes, has warranted sur.s. extending to those parts of the main traveled vessel tracks passing through Canadian waters. Canadian shore line has also been sur. where the delineation of these shores is essential to the integrity of navigation charts, as along Rs. and where vessel courses lay close to Canadian territory.

The scope of operations was enlarged by the act of Congress approv. Mar. 4, 1911, wherein it was provided that the sur. of the northern and north-western lakes should be extended to include the natural navigable waters of the New York canals.

After the completion of the proj., the mainten. of a small equipment and organization will be required for such minor sur.s. as may be needed to observe and verify natural changes and to investigate wrecks and other artificial obstrs. and to keep up the revision and issue of charts.

The state of the field work of the Lake Survey on the Great Lakes and connecting Rs., which includes operations of triangulation, topography, precise leveling, ordinary sounding, deep-sea sounding, sweeping, hydraulic measurement, and magnetic observations, was est., June 30, 1912, to be as follows: Triangulation, 85% completed; topography, 70% completed; precise leveling, 64%

completed; ordinary sounding, 62%, and deep-sea sounding, 15%; sweeping, 51%; hydraulic measurement, 94%; and magnetic observations, 94% completed on land and 35% on water.

While progress toward completion of these branches of the work may thus be definitely stated, the issue of charts, perhaps the most important duty of the Lake Survey, is a continuous function, increasing in importance with the growth of the lake C. and subject to constantly increasing demands.

APPROPRIATIONS.

Surveys:

| | |
|---|-------------|
| Mar. 3, 1841..... | \$15,000 |
| May 18, 1842..... | 20,000 |
| Mar. 1, 1843..... | 30,000 |
| June 17, 1844..... | 20,000 |
| Mar. 3, 1845..... | 20,000 |
| Aug. 8, 1846..... | 25,000 |
| Aug. 12, 1848..... | 25,000 |
| Mar. 3, 1849..... | 10,000 |
| Sept. 28, 1850..... | 25,000 |
| Mar. 3, 1851..... | 25,000 |
| Aug. 30, 1852..... | 25,000 |
| Mar. 3, 1853..... | 50,000 |
| Aug. 5, 1854..... | 50,000 |
| Mar. 3, 1855..... | 50,000 |
| Aug. 30, 1856..... | 50,000 |
| Mar. 3, 1857..... | 50,000 |
| June 12, 1858..... | 75,000 |
| Mar. 3, 1859..... | 75,000 |
| June 21, 1860..... | 75,000 |
| Mar. 2, 1861..... | 75,000 |
| July 5, 1862..... | 105,000 |
| Feb. 9, 1863..... | 106,879 |
| July 2, 1864..... | 100,000 |
| Feb. 28, 1865..... | 125,000 |
| June 12, 1866..... | 50,000 |
| Mar. 2, 1867..... | 77,500 |
| Mar. 2, 1868..... | 77,500 |
| July 20, 1868..... | 75,000 |
| Mar. 3, 1869..... | 100,000 |
| July 15, 1870..... | 100,000 |
| Mar. 3, 1871..... | 175,000 |
| June 10, 1872..... | 175,000 |
| Mar. 3, 1873..... | 175,000 |
| June 23, 1874..... | 175,000 |
| Mar. 3, 1875..... | 150,000 |
| July 31, 1876 (not including \$16,000 applied to sur. of Mississippi R.)..... | 84,000 |
| Mar. 3, 1877 (not including \$25,000 applied to sur. of Mississippi R. and includ- ing \$9,500 received from sale of steamers)..... | 94,500 |
| June 20, 1878 (not including \$49,500 applied to sur. of Mississippi R.)..... | 49,500 |
| Mar. 3, 1879..... | 85,000 |
| June 16, 1880..... | 40,000 |
| Mar. 3, 1881..... | 18,000 |
| Aug. 7, 1882..... | 12,000 |
| Total..... | \$2,939,879 |

Charts for use of navigators, printing and issue of; and electrotyping copper-plates for chart printing:

| | | |
|--------------------|---------|--------|
| Mar. 3, 1883..... | \$3,000 | |
| July 7, 1884..... | 3,000 | |
| Mar. 3, 1885..... | 3,000 | |
| Aug. 4, 1886..... | 2,000 | |
| Mar. 3, 1887..... | 2,000 | |
| Oct. 2, 1888..... | 2,000 | |
| Mar. 2, 1889..... | 2,000 | |
| Aug. 30, 1890..... | 2,000 | |
| Mar. 3, 1891..... | 2,000 | |
| Aug. 5, 1892..... | 2,000 | |
| Mar. 3, 1893..... | 2,000 | |
| Aug. 18, 1894..... | 2,000 | |
| Mar. 2, 1895..... | 2,000 | |
| June 11, 1896..... | 2,000 | |
| June 4, 1897..... | 2,000 | |
| July 1, 1898..... | 3,000 | |
| Mar. 3, 1899..... | 3,000 | |
| June 6, 1900..... | 3,000 | |
| Total..... | | 42,000 |

Surveys, and additions to and correcting engraved plates:

| | | |
|--------------------|---------|---------|
| Mar. 2, 1889..... | \$5,000 | |
| Aug. 30, 1890..... | 10,000 | |
| Mar. 3, 1891..... | 10,000 | |
| Aug. 5, 1892..... | 5,000 | |
| Mar. 3, 1893..... | 25,000 | |
| Aug. 18, 1894..... | 25,000 | |
| Mar. 2, 1895..... | 25,000 | |
| June 11, 1896..... | 25,000 | |
| June 4, 1897..... | 25,000 | |
| July 1, 1898..... | 25,000 | |
| Mar. 3, 1899..... | 25,000 | |
| June 6, 1900..... | 75,000 | |
| Total..... | | 280,000 |

Surveys, including investigations of lake levels, correcting, printing, and issuing charts and bulletins:

| | | |
|-----------------------------|-----------|-----------|
| Mar. 3, 1901..... | \$100,000 | |
| June 28, 1902..... | 150,000 | |
| Mar. 3, 1903..... | 150,000 | |
| Apr. 28, 1904..... | 150,000 | |
| Mar. 3, 1905..... | 100,000 | |
| June 30, 1906..... | 75,000 | |
| Mar. 4, 1907..... | 75,000 | |
| May 27, 1908..... | 125,000 | |
| Mar. 4, 1909..... | 125,000 | |
| June 25, 1910..... | 125,000 | |
| Mar. 4, 1911..... | 125,000 | |
| Total..... | | 1,300,000 |
| Grand total (12, 3549)..... | | 4,561,879 |

ENGINEERS.

Chief of Engineers. R., 66, ii, 20; 67, 52; 68, 74; 69, 65; 70, 85; 71, 101; 72, 99; 73, 110; 74, 120; 75, 128; 76, 116; 77, 125; 78, 139; 79, 184; 80, 244; 81, 336; 82, 325; 83, 340; 84, 345; 85, 375; 86, 371; 87, 343; 88, 316; 89, 384; 90, 350; 91, 445; 92, 419; 93, 481; 94, 437; 95, 492; 96, 438, 439, 440, 441; 97, 544; 98, 547; 99, 633, 637; 00, 711; 01, 677; 02, 598; 03, 660; 04, 732; 05,

739; 06, 821; 07, 842; 08, 887; 09, 931; 10, 1043; 11, 1105; 12, 1322.

In charge:

Maj. W. F. Reynolds. R., 66, ii, 43; (Lt. Col.) 67, 553; 68, 925; 69, 549; 70, 535.

Maj. C. B. Comstock. R., 70, 614; 71, 982, 991; 72, 1031, 1035, 1040, 1042; 73, 1169, 1175, 1178; 74, ii, 402, 444; 75, ii, 852, 857; 76, iii, 3, 126; 77, 1105, 1110, 1128; 79, iii, 1891; 80, 2365; (Lt. Col.) 81, 2781, 2789; 82, 2785.

Measurement of Minnesota Pt. base. 71, 982, 991.

Tides, Lake Michigan. 72, 1031, 1035.

Irregular oscillations in surface of Lake Michigan at Milwaukee. 72, 1040.

Adjustment of a triangulation where angles, not directions, are the data, and where there is a single measured base. 72, 1042.

Adjustment by least squares of triangles connecting Minnesota Pt. and Keweenaw base in Lake Superior. 73, 1175.

Note on the probable error of latitude determinations with zenith telescope. 73, 1178.

Length of Keweenaw base. 74, ii, 444; 77, 1128.

Memoranda respecting Lake Sur. 75, ii, 857.

Standards of length. 77, 1105, 1110.

Variation of length of zinc bar. 81, 2789.

Leveling observations; comments on. 76, iii, 76.

Expansion, 15' brass bar for 1° F. 77, 1123.

SURVEYS, EUROPEAN.

Notes on, compiled under the direction of Maj. C. B. Comstock. Oct. 9, 1876. Lake Survey Office. Contents 76, iii, 126.

British Surveys.—Methods and processes of ordnance surveys, compiled by Capt. H. M. Adams, Corps of Engineers, U. S. Army.

Notes compiled by Lt. P. M. Price, Corps of Engineers, U. S. Army. With ordnance survey maps.

German Surveys.—Notes compiled by Maj. Comstock and Lt. P. M. Price.

State Geological Institute. Translated by F. W. Lehnartz.

Geological map of Prussia and the Thuringian States. Translated by F. W. Lehnartz.

Instructions for royal State geologists. Translated by F. W. Lehnartz.

Austrian Surveys.—Memoir furnished by Austrian Government. Translated by F. W. Lehnartz.

Italian Surveys.—Italian cartography.

Notes by Capt. H. M. Adams, Corps of Engineers, U. S. Army., on Italian maps.

Spanish Surveys.—Translation of description of, by Lt. P. M. Price.

Swiss Surveys.—Notes compiled by Lt. P. M. Price.

Swedish and Norwegian Surveys.—Statistics relating to geodetical and topographical work. Translated by Mr. Liljencrantz.

Notes on maps of Sweden, by Lt. P. M. Price.

Notes on maps of Norway, by Lt. P. M. Price.

Belgian Surveys.—Notes on topographical map of Belgium, by Capt. H. M. Adams.

Russian Surveys.—Notes on, by Maj. Comstock.

Maps.—Sample maps of the various countries named. **76**, iii, 126.

Capt. H. M. Adams. **R.**, **77**, 1109; **78**, iii, 1355

Col. O. M. Poe. **R.**, **83**, 2377; **84**, 2373; **85**, 2519; **89**, 2865; **90**, 3588; **91**, 3927; **92**, 3407; **93**, 4343; **94**, 3315; **95**, 4159.

Lt. Col. G. J. Lydecker. **R.**, **96**, 4017, 4062; **97**, 4069; **98**, 3745; **99**, 3851; **00**, 5317.

Shoal off Port Austin light station, Saginaw B. **96**, 4062.

Maj. W. L. Fisk. **R.**, **01**, 3761; **02**, 2763; **03**, 2671; **04**, 4051.

Maj. L. H. Beach. **R.**, **05**, 2775.

Col. G. J. Lydecker. **R.**, **06**, 2241.

Maj. C. Keller. **R.**, **07**, 2443; **08**, 2511; **09**, 2477.

Maj. C. S. Riche. **R.**, **10**, 2701; (Lt. Col.) **11**, 3005; **12**, 3529.

OPERATIONS.

See "Note" on p. 2124 of this index.

See also "Special Reports," p. 2128 of this index.

MAPS, PLATES, ETC.

Barometric pressure, 1860-64. **66**, ii, 78.

Progress chart, surveys, Great Lakes. **71**, 1026; **72**, 1034; **73**, 1174; **74**, 406; **75**, 858; **76**, iii, 8; **77**, 1108; **78**, 1358; **79**, 1894; **80**, 2366.

Mean solar diurnal water-level curve, Milwaukee, Wis. **72**, 1038.

Curves, level of lake, at Oswego, 1872. **72**, 1038.

Theodolite axes. **72**, 1049.

Sounding from craft. **72**, 1090.

Mean solar diurnal water level, Duluth. **73**, 1194.

Triangulation, Wis. and Mich. **74**, 406; **75**, 858; **76**, iii, 8; **77**, 1108; **78**, 1358.

Triangulation, St. Lawrence R. **76**, iii, 102.

Ordnance charts (sample), foreign countries. **76**, iii, 138.

Triangulation, Lake Ontario. **76**, iii, 8; **77**, 1108.

Triangulation, Lake Erie. **76**, iii, 8; **77**, 1108; **78**, 1358.

Curves, tube changes, base measuring. **77**, 1128, 1130.

Borings, Mississippi R. **77**, 1196; **78**, 1333.

Triangulation, Mississippi R. **79**, 1894.

Sounding machine. **79**, 1964.

Soundings, Mississippi R. **79**, 1966.

Triangulation, s. of Chicago. **80**, 2366.

Triangulation, St. Marys R. **93**, 4350; **94**, 3328; **95**, 4248.

Velocity curves, Niagara R. **94**, 4368.

Scheme of longitude work, etc. **94**, 4368.

Chart of Lake Erie, showing water banking during storm. **94**, 3434.

Targets, St. Marys R. sur. **95**, 4248.

Ice-boring machine, etc. **95**, 4248.

Sweeping apparatus for shoal finding. **96**, 4066.

An. water-level curve, Sand Beach, Lake Huron. **97**, 4070; **98**, 3772; **99**, 3852; **00**, 5318. St. Marys Falls Canal. **97**, 4070; **98**, 3772; **99**, 3852; **00**, 5318.

Gauge records, St. Clair R. **00**, 5326.

Catamaran, current-meter observations. **00**, 5326.

Self-registering water gauges. **00**, 5326.

Current observations, reel. **00**, 5326.

Discharge, Niagara R. **00**, 5360.

Submarine contours, etc., St. Clair R. **00**, 5400.

Slopes in chans. connecting Lakes Huron and Erie. **00**, 5400.

Rating, current meter, 68 observations. **00**, 5400.

Records, self-registering gauges, St. Clair R. **00**, 5400.

Current velocity following fluctuations in water levels. **00**, 5400.

Current "pulsations." **00**, 5400.

Discharge, St. Clair R. **00**, 5400.

Curves, mean velocity. **00**, 5400.

Water surfaces, Lake Huron. **00**, 5400.

Gauge relation, Lake Huron and Lake St. Clair. **00**, 5400.

Characteristics, St. Clair R. **00**, 5400.

Water levels, Lake Huron, Lake St. Clair, Lake Erie, St. Clair R., and Detroit R. **00**, 5400.

Curves show oscillations, Lakes Huron, St. Clair, and Erie. **00**, 5400.

Curves, mean annual variations in fall, St. Clair and Detroit Rs. **00**, 5400.

Water level, Lake Huron, 1894-1900, showing effect of withdrawing 10,000 c. f. per second from Lake Michigan-Huron. **00**, 5400.

Monthly mean water levels. **01**, 3764.

Catamaran, sounding. **02**, 2774.

Variations in level, Lakes Huron and Erie. **02**, 2779.

St. Lawrence R., velocities. **02**, 2792.

Discharge curve, St. Lawrence R. **02**, 2792.

Discharge, St. Clair R. **02**, 2826. When obstructed by ice. **02**, 2826.

Diagram, fall at head of St. Clair R., winter of 1900-01. **02**, 2826.

Resurvey, Apostle Islds. **02**, 2840.

Discharge, Detroit R. **02**, 2870.

Discharge, St. Marys Rapids. **02**, 2878.

Primary triangulation, Great Lakes, adjusted data. **03**, 2678.

Sounding machine. **03**, 2686.

Discharge, Detroit R., temperatures. **03**, 2686.

Sounding, by sweep. **03**, 2764.

Rod tests, precise leveling. **03**, 2784.

Gauging and placing of gauges, and velocities and discharges, St. Marys R. **03**, 2836.

Sketch and slope, St. Clair R. **03**, 2840.

Drainage basins, Great Lakes. **03**, 2856.

Curves, discharge, St. Marys, St. Clair, Niagara, and St. Lawrence Rs. **03**, 2856.

Triangulation, St. Lawrence R. **04**, 4056.

Triangulation, St. Clair R., Lake St. Clair, and Detroit R. **04**, 4056.

Triangulation, St. Marys R. **04**, 4056.

Water gauges, self-registering. **04**, 4064.

Gas-pipe triangulation station. **04**, 4064.
 Stage indicator. **04**, 4064.
 Sounding sweep. **04**, 4064.
 Sketch, Detroit R. **04**, 4130.
 Slope, Detroit R. **04**, 4130.
 Level, Lake Superior, and rainfall. **04**, 4130.
 Level, Lake Huron, and rainfall. **04**, 4130.
 Level, Lake Erie, and rainfall. **04**, 4130.
 "Vidette" fitted for magnetic observations.
04, 4138.
 Magnetic variations, Lake Superior. **04**, 4170;
10, 2734.
 Triangulation, Detroit R. **05**, 2784.
 Wire sweep. **09**, 2498.

SPECIAL REPORTS.

See also under "Engineers in charge," p. 2126 of this index.

O. B. Wheeler. **R.**, **66**, ii, 56; **68**, 930; **70**, 552;
71, 1017; **76**, iii, 112.
 Meteorology. **71**, 1008; **72**, 1068; **73**, 1197; **74**,
 472; **76**, iii, 103.
 Longitude and latitude. **71**, 1014; **72**, 1054,
 1066; **74**, ii, 434.
 Astronomy. **71**, 1017.
 Computing. **72**, 1095; **73**, 1192; **76**, iii, 112;
77, ii, 1204.
 Astronomical determination of points in the
 interior of Illinois and Wisconsin. **74**, ii, 425.
 Difference of longitude between Detroit, Mich.,
 and Ogden, Utah. **74**, ii, 434.
 Water levels. **75**, ii, 915; **76**, iii, 80; **77**, ii,
 1193; **78**, iii, 1411.
 Longitude of Toledo from Detroit. **82**, 2790.
 St. Marys R. sur. **92**, 34.

J. M. Bigelow. **R.** Meteorology. **66**, ii, 62.

O. N. Chaffee. **R.** Theodolite comparison. **66**,
 ii, 218.

Lt. J. F. Gregory. **R.** Astronomy. **67**, 573; **68**,
 330.

D. F. Henry. **R.**, **67**, 582.
 Outflow of Lakes. **70**, 554.
 Theodolite comparison. **66**, ii, 218.
 Meteorology. **67**, 586; **68**, 966; **69**, 636; **70**, 600.
 Gauging. **68**, 949; **69**, 562.
 Base-line measurements. **68**, 947.

G. Y. Wisner. **R.**, **68**, 930; **72**, 1097; **73**, 1181;
74, ii, 407; **75**, ii, 860; **76**, iii, 113; **77**, ii, 1201; **78**,
 iii, 1395; **79**, iii, 1930.
 Triangulation. **80**, 2410.
 Theodolite constants. **74**, ii, 470.

Lt. Mercur. **R.**, **68**, 930.

I. A. Lapham. **R.** Mean temperatures on the
 Lakes. **68**, 993.

Capt. F. U. Farquhar. **R.**
 Determination of the l. of standard bar of the
 Lake Survey base-measuring apparatus. **68**, 930,
 337.

Capt. J. A. Smith. **R.**, **70**, 549.
 Primary triangulation of Lake Superior. **71**,
 994.

Lt. E. H. Ruffner. **R.**, **70**, 550, 593. Niagara R.
 (Maj.) **93**, 4364. (See p. 2130.)

E. S. Wheeler. (See p. 2131.) **R.**, **74**, ii, 410; **77**,
 ii, 1205.

Testing theodolite. **70**, 553; **72**, 1048.
 Determination of the constants of primary base
 apparatus. **71**, 1003.

Comparison of sur. yards. **74**, ii, 466; **75**, ii,
 906.

Comparison of 15' bar. **74**, ii, 468.
 Measurement, Chicago base line. **78**, iii, 1401;
 Sandusky base line. **79**, iii, 1941.
 Olney base line. **80**, 2408.
 Computing machines. **82**, 2786.
 St. Marys R. sur. **92**, 3420; **96**, 4022.
 Buffalo base line. **76**, iii, 113.
 Measuring base line, s. shore Lake Ontario. **75**,
 ii, 900.
 Resur., St. Marys R. **96**, 4022.

Maj. H. L. Abbot. **R.**, Discussion and criticism
 of gauging methods, Lake Survey, **70**, 616, 629.

Lt. A. N. Lee. **R.**, **71**, 995; **72**, 1094; (Capt.)
73, 1184.
 Magnetic observations. **73**, 1195; **74**, ii, 440.

Lt. J. H. Weeden, jr. **R.**, **71**, 996; **72**, 1093.

Lt. C. F. Powell. **R.**, **71**, 998; (1st Lt.) **73**,
 1188; **74**, ii, 421; **76**, iii, 110.
 Astronomy. **73**, 1188; **75**, ii, 871; **78**, iii, 1371.
 Magnetic work. **77**, ii, 1181.
 Sur. Mississippi R. **78**, iii, 1385.

H. Custer. **R.**, **71**, 998; **73**, 1185; **74**, ii, 414.

Lt. E. Maguire. **R.**, **71**, 1019; **74**, ii, 420. Astron-
 omy. **75**, ii, 894.

S. I. Smith. **R.**
 Dredging studies. Bathymetrical distribution
 of species, Lake Superior. **71**, 1020.

J. E. Hilgard. **R.** Length of Lake Survey yards.
72, 1046.

Rear-Admiral B. F. Sands, U. S. Naval Ob-
 servatory. **R.**
 Description of instruments used in determining
 clock corrections. **72**, 1052.

Lt. W. R. Livermore. **R.**, **72**, 1080. Triangula-
 tion, system employed. **72**, 1085.

A. R. Flint. **R.**, **72**, 1099; **73**, 1190; **74**, ii, 410;
75, ii, 863; **76**, iii, 114; **77**, ii, 1202; **78**, iii, 1407
79, iii, 1940; **80**, 2409.
 Astronomical work. **76**, iii, 92; **81**, 2793.
 Water levels. **79**, iii, 1962; **80**, 2436; **81**, 2799;
82, 2818.

Instrument test. **82**, 2789.
Longitude, San Antonio, Tex. **82**, 2812.
Longitude difference, Detroit, Mich., and Tonawanda and Mannsville, N. Y. **76**, iii, 92.
Primary triangulation, Green B. to Minnesota Junction. **73**, 1190.

G. A. Marr. **R.**, **72**, 1101; **73**, 1182; **74**, ii, 408; **75**, ii, 862; **76**, iii, 116; **77**, ii, 1205.

L. Foote. **R.**, **72**, 1104.

A. C. Lamson. **R.**, **72**, 1106; **73**, 1190; **74**, ii, 417; **76**, iii, 119; **77**, ii, 1200; **78**, iii, 1398.

J. R. Mayer. **R.**, **72**, 1106; **73**, 1188; **74**, ii, 418; **75**, ii, 866; **76**, iii, 121.

F. M. Towar. **R.**, **72**, 1107; **73**, 1191; **74**, ii, 419; **75**, ii, 867; **76**, iii, 120; **77**, ii, 1199; **78**, iii, 1398.

R. S. Woodward. **R.**, **73**, 1183; **74**, ii, 412; **75**, ii, 870; **76**, iii, 116; **77**, 1203; **78**, iii, 1396; **79**, iii, 1401.

Measures. **74**, ii, 469.

Station twist. **75**, ii, 913.

Theodolite errors. **76**, iii, 64; **77**, 1203.

Theodolite constants. **79**, iii, 1945.

Triangulation. **80**, 2411.

Lt. D. W. Lockwood. **R.**, **73**, 1193; **74**, ii, 413; **75**, ii, 859; **76**, iii, 12.

Screw of comparator. **74**, ii, 453.

Telegraphic longitude. **76**, iii, 12; **77**, 1164.

Sur., Mississippi R. **77**, ii, 1196; **78**, iii, 1381; **79**, iii, 1922.

Sur., Lake Erie. **78**, iii, 1394.

Magnetic work. **79**, iii, 1918.

Longitude and latitude work. **80**, 2382.

Maj. J. M. Wilson. **R.** Water-level observations, **73**, 1193.

T. Russell. **R.**, **74**, ii, 456; **76**, iii, 117; **79**, iii, 1952; **80**, 2412; **94**, 3329; **95**, 4214, 4218; **96**, 4029; **97**, 4104. (See p. 2131.)

Thermometer comparisons. **74**, 456; **80**, 2412.

Latitude and longitude work. **94**, 3329. St. Marys R. **95**, 4218.

Resur., St. Marys R. **95**, 4214; **96**, 4029.

Lt. T. N. Bailey. **R.**, **75**, ii, 859. Astronomy. **76**, iii, 56. Magnetic work. **77**, ii, 1187.

J. Eisenmann. **R.**, **75**, ii, 868; **76**, iii, 123; **79**, iii, 1935.

F. Terry. **R.**, **75**, ii, 869; **76**, iii, 122; **77**, ii, 1210; **78**, iii, 1399.

T. W. Wright. **R.**, **75**, ii, 870. Computing-machine comparison. **82**, 2789.

Capt. H. M. Adams. **R.**, **76**, iii, 110; **77**, ii, 1109.

Astronomy. **75**, ii, 889; **78**, iii, 1358.

Topography and hydrography. **76**, iii, 9.

Telegraphic longitude. **77**, ii, 1132; **78**, iii, 1358; **79**, iii, 1895.

Methods, Lake Survey. **76**, iii, 9.

Lt. Col. Clarke (Royal Engineers, England). **R.** Constants of Clarke yards. **75**, ii, 904.

Standard inch. **76**, iii, 79.

L. L. Wheeler. **R.**

Leveling. **76**, iii, 70; **77**, ii, 1189; **79**, iii, 1942; **80**, 2426.

Lt. P. M. Price. **R.**, **77**, ii, 1198; **79**, iii, 1929. Astronomy. **76**, iii, 50. Telegraphic longitude. **78**, iii, 1400. Longitude and latitude work. **80**, 2396.

F. W. Lehnartz. **R.**

Leveling. **76**, iii, 70; **77**, ii, 1189; **78**, iii, 1386, 1408; **79**, 1942.

J. H. Darling. **R.**, **76**, iii, 118; **77**, ii, 1203; **79**, iii, 1938. (See p. 2131.)

Remarks on flashing. **78**, iii, 1396.

Triangulation, Lakes Erie and Michigan. **80**, 2411.

Instrument tests. **82**, 2789.

A. T. Morrow. **R.**, **76**, iii, 124.

J. A. Ockerson. **R.**, **79**, iii, 1931.

J. B. Johnson. **R.**

Results, sand-wave and sediment observations. **79**, 1963.

Prof. W. Foerster. **R.**

Comparison, Lake Survey meter. **80**, 2368; **81**, 2787.

Prof. H. A. Rowland and Prof. W. W. Jacques, **IL.**

Comparison, Lake Survey thermometer. **80**, 2375.

W. Voigt. **R.**

Repold base apparatus compared with standard brass bar of Lake Survey. Cass farm comparisons. **81**, 2784.

Capt. W. A. Jones. **R.** Longitude, Fort McDermit, Nev. **81**, 2792.

Maj. J. D. Quinn. **R.**

Danger Reef, near Gooseberry R., Lake Superior. **90**, 3583.

Maj. L. Cooper. **R.**

Water-level observations, Lake Erie. **90**, 3583.

W. T. Blunt. R.

Gauges and reference points, Lake Erie; reduction to a common plane. **90**, 3584.

Variations, surface, Lake Erie, during gale. **94**, 31.

Capt. W. L. Fisk. R. Sur., Marquette H., Mich. 91, 3927.

Maj. W. L. Fisk.

Investigation of Lake levels. **R., 02**, 2769; **03**, 78.

Reduction of Lake Survey latitudes and longitudes. **02**, 2769.

Lt. C. S. Riché. (See p. 2131.) R. Lake Erie r. 92, 3415.

Resur., St. Marys R. **93**, 4348; **94**, 3321; **95**, 65.

A. O. Wheeler. R.

St. Marys R. resur., levels (Waiska B.). **92**, 23.

B. J. Thomas. R.

Levels, resur., St. Marys R. (Waiska B.). **92**, 23.

Maj. A. Stickney. R. Sur., Waverley Shoal Lake Erie. 92, 3424.

Maj. M. B. Adams. R. Sur., shoals, St. Lawrence R. 92, 3425, 3426.

F. M. Barstow. R. Sur., St. Lawrence R. 92, 25, 3426.

Capt. W. L. Marshall. R. Resur., Chicago lake front. 92, 3427; **93**, 4372.

Capt. D. C. Kingman. R.

Sur., Black Creek Shoal, Lake Ontario. **92**, 28.

Sur., mouth of Niagara R. **93**, 4378.

Water level, Lake Ontario. **93**, 4382.

L. M. Mann. R. Sur., Chicago lake front. 92, 28; **93**, 4372.

W. P. Judson. R. Sur., Lake Ontario Shoals. 92, 3429. Sur., mouth of Niagara R. **93**, 4379.

J. C. Quintus. R. Discharge, Niagara R. 93, 34.

Maj. E. H. Ruffner. R. Measurement, discharge, Niagara R. 93, 4364. (See p. 2128.)

J. E. Balch. R.

Resur., St. Marys R. **93**, 4355; **94**, 3404; **95**, 4; **96**, 4028.

E. E. Haskell. R.

Resur., St. Marys R. **93**, 4358, 4360; **94**, 3403, 3409, 3426; **96**, 4023; **97**, 4073, 4092; **98**, 3747.

Measurement, Soo base. **93**, 4360.

Triangulation, resur., St. Marys R. **94**, 3403; **95**, 4178.

Levels, reduction. **94**, 3426.

Lake levels. **99**, 3856; **00**, 5322.

R., 01, 3768; **02**, 2773; **03**, 2681; **04**, 4060; **05**, 2785.

Investigation of Lake levels. **01**, 3768; **02**, 2773; **03**, 2681; **04**, 4060; **05**, 2785.

H. Von Schon. R.

Resur., St. Marys R. **93**, 4363; **94**, 3419; **95**, 4220; **96**, 4056; **97**, 4115, 4118.

Instructions to field parties. **95**, 4220.

Photogrammetry. **95**, 4220.

F. Morley. R.

Triangulation, s. end of Lake Superior; connection with triangulation of Mackinac Straits. **93**, 4552.

Triangulation, resur., St. Marys R. **94**, 3397.

D. Molitor. R. Resur., St. Marys R. 94, 3422.

Capt. S. S. Leach. R.

Ex., St. Lawrence R. **94**, 3428; **95**, 4249; **96**, 4062.

J. Ripley. R. Resur., St. Marys R. 95, 4228; **96**, 4055.

B. Rohnert. R. Ice sur., resur., St. Marys R. 95, 4235.

C. Y. Dixon. R. Ice sur., resur., St. Marys R. 95, 4240.

L. P. Morrison. R. Resur., St. Marys R. 95, 4245.

F. C. Shenehon. R., 01, 3772; **06**, 2449; **07**, 2520, 2526.

R. Niagara R. 00, 5326.

Hydraulics, St. Lawrence R. **02**, 2779-2811; **03**, 2759, 2764.

Resur., St. Lawrence R. **R., 03**, 2765.

Sur., w. end of Lake Erie; off Thunder B. Isld., Lake Huron; and St. Joseph H., Lake Michigan. **08**, 2520.

Gauging, "Preservation of Niagara Falls." **08**, 2541.

Wire sweeping. **09**, 2496.

L. C. Sabin. R., 02, 2812.

R. Gauging. 00, 5362.

Resur., St. Clair R. **02**, 2814-2837.

F. G. Ray. **R.**, **02**, 2838. Resur., Apostle Isld. **02**, 2838; **03**, 2768.
Resur., s. end of Lake Michigan. **09**, 2486.
Sur., s. end of Lake Huron. **09**, 2488.
Precise levels, Milwaukee. **09**, 2487.
Water triangulation. **05**, 2786; **10**, 2716.

M. Blanchard. **R.**, **02**, 2856. Resur. and discharge measurements, Detroit R. **02**, 2856; **03**, 2813.
Discharge, Detroit and St. Clair Rs. **03**, 2813.

W. E. Wilson. **R.**, **02**, 2872. Discharge measurements, St. Marys R. **02**, 2872; **03**, 2817-2837.

J. F. Hayford and T. Russell. **R.**, Adjustment of Lake Survey triangulation and its adaptation to the U. S. standard datum of the Coast and Geodetic Survey. **02**, 2883-3031. (Has its own special index. **02**, 2903.)
Tables of bench marks. **03**, 2687-2758. (Has its own special index. **03**, 2745.)

A. H. Horton. **R.**
Precise levels, St. Lawrence R., and along Erie and Oswego Canals. **03**, 2783.

T. Russell. **R.** (See p. 2129.)
Reduction of Detroit and St. Clair Rs. triangulations and their adaptation to U. S. standard datum of Coast and Geodetic Survey. **03**, 2787.
Discharge, St. Clair R. **03**, 2810.
Discussion, discharge measurements, St. Clair and Detroit Rs., to determine effect of the varying levels of Lakes Huron, St. Clair, and Erie in causing variations in the discharge. **03**, 2837-2855; **04**, 4069.
Magnetic declination, s. shore of Lakes Erie and Ontario, Fort Gratiot, St. Clair R., and near Algonac. **04**, 4066. Along shores of Lakes Superior and Michigan. **05**, 2791.

Maj. W. H. Bixby. **R.**
Special report on the outflow, rainfall, and evaporation in the valley of the Northern and Northwestern Lakes. **03**, 2855.

E. S. Wheeler. **R.** (See p. 2128.)
Special report on the outflow, rainfall, and evaporation in the valley of the Northern and Northwestern Lakes. **03**, 2855-2883.

Maj. J. G. Warren. **R.**
Reefs, Manitowoc, Wis., and Racine, Wis. **03**, 2883.-

Capt. C. L. Potter. **R.**
Sur. of w. end of Lake Superior to determine the local variations of the compass. **04**, 4132.

J. H. Darling. **R.** (See p. 2129.)
Magnetic variation over westerly portion of Lake Superior. **04**, 4133; **10**, 2725.

Maj. C. Keller. **R.**
Investigation of Lake levels. **07**, 2456; **08**, 2535.
Preservation of Niagara Falls. **07**, 2457; **08**, 2538. And supervision over power and transmission companies. **09**, 2503.
Chart production; printing methods. **08**, 2516.
Expansion of Lake Survey. **08**, 2527.
Wire sweeping; details. **08**, 2528; **09**, 2485, 2495.
Proj. for chart production. **09**, 2483.
Hydraulics of St. Lawrence R. **09**, 2491. Of St. Clair R. **09**, 2493.

Maj. C. S. Riché. **R.** (See p. 2130.)
Lake Survey takes over work formerly done by Navy Hydrographic Office. **10**, 2703.
Hydrographic Office Charts. **10**, 2707; **11**, 3009.
Discharge measurements, "recent" and "past," St. Marys R. **10**, 2713.
Water triangulation (see also **05**, 2786). **10**, 2716.
Investigation of Lake levels. **10**, 2720; **11**, 3018, 3020; **12**, 3545.
Preservation of Niagara Falls and supervision of power companies. **10**, 2722; **11**, 3022. (Gauge heights and other factors. **11**, 3026. Tests of turbines. **11**, 3028; **12**, 3551.) **12**, 3550, 3552.
Discharge, St. Lawrence R., and sur., Niagara R. **12**, 3539.
New York State canals. **12**, 3540.
Magnetic sur., Lake Huron. **12**, 3541.
Measurement of diversion, Niagara Falls. **12**, 3552.

Lt. Col. G. D. Fitch. **R.**
Determination of magnetic variations over certain portions of Lake Superior. **10**, 2725.

Jr. Engr. Moore. **R.** Sur., w. shore of Lake Michigan. **12**, 3536.

MISC. 163. NORTHERN AND NORTHWESTERN LAKES— GAUGING OUTLET.

ENGINEERS.

Chief of Engineers. **R.**, **70**, 86; **93**, 464.

In charge:

Maj. H. L. Abbot (Bvt. Brig. Gen.). Criticism

of Assistant Engineer Henry's gauging observations. **70**, 616, 629.

Maj. E. H. Ruffner. **R.**, **93**, 4364.

MISC. 164. NORTHERN AND NORTHWESTERN LAKES— VALLEY OF, OUTFLOW, RAINFALL, AND EVAPORATION.

ENGINEERS.

Chief of Engineers. 03, 665.

In charge. Maj. W. H. Bixby. 03, 2855.

PHYSICAL CHARACTERISTICS.

Drainage basins. 03, 2856. Lake elevations. 03, 2856. Outflow and discharge formulæ. 03, 2857, 2862. Rainfall. 03, 2859. Evaporation. 03, 2860. Weather Bureau records. 03, 2861. Mean

monthly elevations, discharges, rainfall, temperature, humidity, velocity of wind. 03, 2866.

MAPS.

Drainage basins of the Great Lakes. 03, 2856. Curves showing graphically the discharge in second-feet through St. Marys, St. Clair, Niagara, and St. Lawrence Rs. 03, 2856.

MISC. 165. NORTHERN AND NORTHWESTERN LAKES— WATER LEVELS.

(See Misc. 121, 156, 161-164 on pp. 2106, 2121, 2122-2132 of this index.)

NOTE.—In addition to the field work of the Lake survey, operations have been continued under the general proj. for the exhaustive investigation of lake levels, in continuation and extension of the proj. outlined in the an. R. for 1898, pp. 774-776. This work comprises lake temperature observations and the mainten. of a staff and self-registering gauges to supply accurate, continuous records of all changes in elevation of the water surfaces on the lakes and Rs. 12, 1327.

For table of discharges for all of the Great Lakes at the mean stage of each for the past 52 years as determined by the standard gauges see 12, 3544.

This work is now fully organized, methods of making measurements and observations to the best advantage have become fixed and settled, and the results are of increasing importance, bearing, as they do, on questions affecting international relations and obligations, and on the propriety and advisability of the numerous diversions under consideration.

APPROPRIATIONS.

See page 2125 of this Index.

CURVES.

See each an. R. from 1873 to 1912, inclusive.

ENGINEERS.

Chief of Engineers. R., 88, 316; 92, 422; 93, 86; 94, 441; 95, 497; 96, 442; 97, 547; 98, 551; 99, 637; 00, 715; 01, 681; 02, 602; 03, 665; 04, 36; 05, 743; 06, 825; 07, 854; 08, 893; 09, 939; 10, 1050; 11, 1105; 12, 1322.

In charge:

Col. O. M. Poe. R., 88, 2807; 92, 3429; 93, 381; 94, 3319, 3430; 95, 4159, 4251.

Lt. Col. G. J. Lydecker. R., 96, 4067; 97, 4127; 98, 3779; 99, 3851; 00, 5319, 5402.

Capt. D. C. Kingman. R. (Lake Ontario), 93, 4382; 94, 3436.

Maj. J. F. Gregory. R. (Lake Michigan), 93, 4383; 94, 3435.

Capt. S. S. Leach. R. (Ogdensburg), 93, 4384.

W. T. Blunt. R. (Lake Erie), 94, 3431.

Capt. G. A. Zinn. R. (Lake Michigan), 96, 4071; 97, 4129; 98, 3781.

Maj. W. S. Stanton. R. (Lake Ontario), 96, 4068; 97, 4128; 98, 3780.

Capt. G. D. Fitch. R. (Lake Ontario), 99, 3862.

Lt. Col. J. A. Smith. R. (Lake Erie), 94, 3431; 96, 4068; (Col.) 97, 4128; 98, 3780; 99, 3861.

Capt. J. G. Warren. R. (Lake Michigan), 99, 3860.

Maj. C. B. Sears. R. (Lake Superior), 96, 4070; 97, 4129; 98, 3781; 99, 3860.

Maj. W. L. Fisk. R., 01, 3776; 02, 3032; 03, 2671; 04, 4051.

Maj. L. H. Beach. R., 05, 2782.

Col. G. J. Lydecker. R., 06, 2249.

Maj. C. Keller. R., 07, 2455; 08, 2511, 2534; 09, 2477, 2500; 10, 2701, 2719.

Lt. Col. C. S. Riché. R., 11, 3019; 12, 3544.

Assistants:

W. H. Harding. R., 93, 4384.

Wm. T. Blunt. R. (Lake Michigan), 94, 3431.

Lt. C. H. McKinstry. R. (Lake Michigan), 94, 3435.

E. E. Haskell. 00, 5322.

OPERATIONS.

See Note at beginning of this abstract; also each an. R. for detailed tables, etc.; "Engineers," above; and p. 2124.

MISC. 166. LAKE MICHIGAN—REEF SOUTH OF MANI-TOWOC, WIS.

ENGINEERS.

Chief of Engineers. 03, 665.

In charge. 03, 2883.

Steamer *Tuscarora* reported striking reef; d. of

water not over 13 or 14'; ex. made; R. submitted sur. made, showing locations and soundings thereon, submitted Apr. 13, 1903. 03, 2883.

MISC. 167. LAKE MICHIGAN—REEF OFF WIND POINT, NEAR RACINE HARBOR, WIS.

ENGINEERS.

Chief of Engineers. 03, 665.

In charge. Maj. J. G. Warren. 03, 2883.

1903-04. Inset of sur. published in colors in Supplement No. 4, of Bulletin No. 13, Northern and Northwestern Lakes. 04, 737, 4051.

OPERATIONS.

1902-03. Reef located and plainly marked. Sur. in progress. 03, 665, 2883.

MISC. 168. UNITED STATES ARMY—EQUIPMENT OF COAST ARTILLERY, ARMORIES, ORGANIZED MILITIA.

The Army app. act approv. Mar. 3, 1911, provided the sum of \$338,170 for the equipment of armory buildings provided by States for instructional purposes for Coast Artillery companies of the Organized Militia. With these funds equipments installed for the instruction of Coast Artillery militia at the following places:

Boston, Mass., South Armory.

Bridgeport, Conn.

New York City:

Ninth District Armory.

Thirteenth District Armory.

Savannah, Ga.

San Francisco, Cal.

For the work required of the Engineer Department in this connection the sum of \$105,426.56 assigned to this department for expend. by the Sec. of War. At the close of 1911-12 the Engineer work at the Boston Armory had been completed so far as possible pending the arrival of the armament and other equipment, and the work remaining to be done at this armory and the necessary work at the other armories had been placed under contract.

By the Army app. act of Aug. 24, 1912, the availability of this app. was extended to include obligations incurred during the fiscal year ending June 30, 1913. 12, 29.

MISC. 169. EQUIPMENT, ENGINEER — EQUIPMENT OF OFFICERS' SCHOOLS, MILITARY POSTS.

For the purchase of instruments for issue to officers' schools at military posts the sum of \$3,000 was assigned from the app. for "Equipment of officers' schools, military posts, 1912," by the Sec. of War. This amount applied to purchase of in-

struments for issue from the Engineer depot at Washington Barracks. For similar purchases during 1912-13 the sum of \$1,500 assigned to the Engineer Department. 12, 26.

MISC. 170. PHILIPPINES—MILITARY STRUCTURES.

The constr. of a pumping plant, electric power plant, and certain Army storehouses for military purposes in the Philippine Islds. assigned to the

Engineer Department; funds from various apps. applied thereto; funds insufficient; est. addl. sum of \$170,000 required. **12, 23.**

MISC. 171. RESERVATIONS — GOVERNORS ISLAND, NEW YORK HARBOR, ENLARGEMENT OF.

(See New York Harbor, N. Y., on p. 233 of this index; also p. 1881.)

APPROPRIATIONS.

| | |
|-------|--------------------------------|
| 1901, | \$200,000, 01, 1298. |
| 1902, | 200,000, 02, 981. |
| 1903, | 150,000, 03, 923. |
| 1904, | 200,000, 04, 133, 1128. |
| 1905, | 100,000, 05, 1023. |
| 1907, | 100,000, 07, 1039. |
| 1908, | 75,000, 08, 1086. |
| 1909, | 75,000, 09, 1098. |

Total, 1,100,000 (incl. misc., \$1,100,002.60, **12, 1512).**

CONTRACTS.

1901. R. G. Packard, dr. 89,750 c. y., 78¢ c. y.; Roosevelt & Sullivan, building pile dock; approx. cost, \$25,362.16; Brown & Fleming, building riprap bulkhead, 142,000 t. st., 35¢ t. **02, 981.**

1902. New York Filling Co., building embankment; R. G. Packard Co., removal of r. **03, 924.**

1903. J. D. Miller, building riprap bulkhead. **03, 924.**

1904. Humphrey Toomey, building st. sea wall. **05, 1023.**

1905. Brown & Fleming Contracting Co., building st. sea wall (2d contract), \$20.25 l. f. **06, 991.**

1907. Henry Steers (Inc.), building embankment; inner section, 17¢, and outer section, 22.6¢ c. y. **08, 1086.**

1909. Henry Steers (Inc.), building embankment and sea wall, \$70,400. **10, 1222.**

1910. Henry Steers (Inc.), furnishing and spreading and fertilizing material on new embankment and seeding same, \$89,400. **10, 1223.**

1911. Henry Steers (Inc.), suppl., increased quantity of earth under contract of Jan. 5, 1910, from 102,850 c. y. to 140,000 c. y. **11, 1298.**

ENGINEERS.

Chief of Engineers. **R., 01, 228; 02, 150; 03, 144; 04, 133; 05, 139; 06, 145; 07, 153; 08, 160, 09, 163; 10, 186; 11, 192; 12, 232.**

In charge:

Maj. W. L. Marshall, 1901-08. **R., 01, 1298; 02, 969; 03, 920; (Lt. Col.) 04, 1124; 05, 1021; 06, 989; 07, 1037; 08, 1084.**

Col. S. W. Roessler, 1909. **R., 09, 1097; 10, 1221; 11, 1296; 12, 1510.**

LEGAL PROCEEDINGS.

Land conveyed to U. S. by State of New York, to be covered by bulkhead as orig. designed; extension of bulkhead can not be built until grant of land is correspondingly extended. **02, 980.** State of New York, Mar. 6, 1903, au. the issue to U. S. of a further grant of land under water, to admit extension of isld. Letters patent granted June 5, 1903. **03, 921.**

OBSTRUCTIONS.

Sea wall ran into by ferryboat; damage to. **11, 1297.** Sea wall (1912) again run into about $\frac{1}{2}$ m. from Castle Williams. **12, 1511.**

OPERATIONS.

1901-02. Pile wharf: Work begun and nearly completed; in daily use by Quartermaster Department, which laid track along wharf to connect with large warehouse; 8 iron mooring posts and cleats purchased and placed. **02, 979.** Dr. in front of wharf: 69,944 c. y. sand, gravel, clay, and bowlders dr. **02, 979.** Riprap bulkhead: 2,430 . f. completed and 750' in progress; se. wall along Buttermilk Chan., 2,230' l., completed up to 2' above l. w., and sw. or cross wall begun; operations suspended to admit of completion of arrangements for further extension of proposed enlargement as per plans of McKim, Mead & White, architects. **02, 980.** Engineer landing: Small dock near Castle Williams extended to 9 $\frac{1}{2}$ ' d., m. l. w., with landing face of 51'; area in front dr. to 15', m. l. w.; during dr. 3 submarine mine cables were picked up by the dr., and were repaired and relaid without cost to U. S. **02, 980-81.**

1902-03. Pile wharf: Dock completed Aug. 6, 1902; measurements given. **03, 920, 921.** Dr. in front of wharf: 606 c. y. removed; 19 c. y. bowlders removed; work completed. **03, 920.** Riprap bulkhead: 89,079 t. riprap delivered; the pile platform carrying light and fog bell near outer end of nw. bulkhead run into by car float and wrecked

beyond repair; a small schooner hired and anchored near end of bulkhead for carrying light and fog bell. **03, 921.**

Two intercepting sewers built for removal of sewage, discharging, respectively, into Buttermilk Chan. and North R. current near Castle Williams. **03, 922.**

Embankment behind bulkhead: 836,668 c. y. material placed, of which 46,985 c. y. above l.-w. level; area above l. w. a strip along North R. bulkhead about 1,700' l. and from 40'-150' w. **03, 922.**

1903-04. Removal of ledge in front of new wharf: R. shattered by blasting and removed by dr., making 26', m. l. w., at approaches; 35 c. y. r. removed. **04, 1124.** Riprap bulkhead: 123,233 t. riprap delivered; bulkhead w. of gap, 1,068', completed, and part e. of gap in progress; total l. of bulkhead completed, 1,366'. **04, 1125.** Embankment behind bulkhead: 745,878 c. y. material delivered; difficulty experienced in building up above l. w. **04, 1125.** Masonry sea wall: Tests made to ascertain whether riprap embankment would support masonry sea wall. **04, 1125.**

1904-05. Riprap bulkhead: 45,933 t. riprap placed, building 629 l. f. of work; gap about 352' wide left at s. end, to admit scows bringing materials for embankment; total l. of completed bulkhead, 6,795'. **05, 1021.** Embankment behind bulkhead: 105,792 c. y. material placed; total material in embankment above l. w., 185,082 c. y. **05, 1021, 1022.** Masonry sea wall: Buttermilk Chan. side of inclosure completed; work begun on North R. side of Castle Williams wall; total l. of wall, 2,195' at coping and 2,681' at foundation. **05, 1022.**

1905-06. Embankment: 343,325 c. y. sand and cinders brought behind bulkhead, 203,504 c. y. of said total pumped up above l.-w. level; area inclosed by bulkhead built above low tide for 800' beyond old sea wall, an area of 37 acres, 20 acres above ordinary h. w. **06, 989.** Masonry sea wall: 2,210' sea wall built; 2,514 t. riprap added to bulkhead to protect it against undermining. **06, 989.**

1906-07. Embankment: 65,399 c. y. material, mainly sand, delivered and dumped within inclosed area; 43,650 c. y. filling pumped into embankment at m. l. w.; contractor claimed that full amount of filling had been delivered and contract was completed, notwithstanding embankment must be built up to certain grades; contractor refused to continue work; with sanction of Chief of Engineers, contract annulled June 8, 1907, and proposals for further constr. invited. **07, 1037.** Masonry sea wall: Extended 1,982', making total l. 6,757'; in March sea wall was run into on Buttermilk Chan. side, about 2,000' from orig. isld. **07, 1038.** Office building on sea wall destroyed by lightning, replaced. **07, 1038.**

1907-08. Embankment: 1,181,225 c. y. material delivered, of which 597,750 c. y. placed above l. w., 295,565 c. y. in the inner section, and 302,185 c. y. in the outer section; about 32 acres of embankment built up to required grade, 27 acres of which

are in the inner section. **08, 1084.** Masonry sea wall: The sea wall on the Buttermilk Chan. side run into by a steamer on night of Jan. 23-24, damaging wall for l. of 16' at bottom, and 124' or more at coping; repairs made to wall. **08, 1084.** Light and fog bell maintained. **08, 1085.**

1908-09. 1,124,388 c. y. material brought into inclosure, of which about 1,000,000 c. y. was from sand dr. in H. and rest from street and cellar excavations in the city; material pumped overboard into embankment behind temporary bulkhead to retain embankment; of total, 638,339 c. y., prism measurement, placed above m. l. w.; 22,216 t. riprap placed along base of sea wall, covering section of 3,200' along Hudson R. side and 2,000' along Buttermilk Chan. side, where erosion and yielding affected foundation of wall. **09, 1097-98.**

1909-10. 151,406 c. y. embankment above l. w. placed; area built up to approx. grade, about 8½ acres; 2,819 c. y. soil placed in line to grade up for R. R. track to be used in spreading the soil. **10, 1221-22.**

1910-11. 155,363 c. y., prism measurement, delivered and place above plane of m. l. w., adding 8.2 acres to area filled; 16,964 t. riprap placed in foundation for sea wall; constr. of masonry wall on this foundation progressed for l. of about 103 l. f.; 117,931 c. y., prism measurement, of surface earth placed and graded, covering area of 63 acres, 41 acres of which have been fertilized, harrowed, seeded, and rolled. **11, 1297.**

1911-12. Sea wall and embankment finished; 172,983 c. y. filling delivered; amount placed above l.-w. plane, 80,538 c. y., prism measurement; contractor built 358 l. f. sea wall, closing gap; 18,148 c. y. surface earth placed, delivered, and harrowed in 4,664 c. y. fertilizer, and seeded down 38 acres; damage to sea wall caused by ferryboat *Nassau* repaired; the light and fog bell, maintained by Engineer Department since beginning of operations, transferred to Lighthouse Department, with small building and other appliances, May 10, 1912. **12, 1510, 1511.**

PHYSICAL CHARACTERISTICS.

Condition of work. **05, 1022; 07, 1038.**

Settling of masonry sea wall. **06, 989; 07, 1037; 12, 1511.**

85 acres land built up to grade. **09, 1098.**

Sea wall and embankment completed; area inclosed about 100 acres. **12, 1511.**

PROJECTS.

Sundry civil act Mar. 3, 1901, au. enlargement in accordance with plan by board of officers, Aug. 17, 1900, including constr. of dock, and dr. chan.; est., \$215,000; constr. of bulkhead and filling; est., \$385,000. **01, 228.**

Proj. modified Aug. 22, 1901, substituting riprap bulkhead, built to about 2' above m. l. w., for crib bulkhead, on account of bottom being too soft to support cribwork; further modification to provide for extending and repairing old Engineer

anding near Castle Williams, for landing Quartermaster stores, etc., and saving rental of storehouses; to provide d. of 15', m. l. w., at that landing by dr. Again modified, Apr 14, 1902, to defer rection of steel shed or cover upon wharf, and to pply funds intended for same to continuing bulkhead for enlargement of isld. 02, 979.

Plan for expend. of \$200,000 submitted June 14, 901; au. by Sec. of War July 5, 1901, viz: Constr. f pile dock and covered wharf on n. shore to communicate with proposed Quartermaster storehouse, \$65,000; excavation of chan. 26' over shoal nd exterior and adjacent to dock and wharf, 75,000; building crib bulkhead, w. side of Butter-

milk Chan., as part of sea wall supporting enlargement of isld. over s. shoal. 02, 979.

The orig. plan for reclaiming 82 acres of land was extended to 101 acres by au. of Sec. of War; no increase in cost. 03, 144.

At 1912, est. \$15,000 required in next 3 years to care for probable settlement of wall and embankment. 12, 233.

SURVEYS.

Congressional documents, etc., relating to exs., surs., plans, etc. 12, 233.

MAP. 03, 922.

PART IV.

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, UNITED STATES ARMY, 1866-1912.

- Section 1. SUPERVISION OF BRIDGE CONSTRUCTION, ETC.**
- Section 2. SUPERVISION OF STRUCTURES OTHER THAN BRIDGES IN CONNECTION WITH NAVIGABLE WATERS.**
- Section 3. ESTABLISHMENT OF HARBOR LINES.**
- Section 4. WRECK REMOVALS.**
- Section 5. SUMMARY OF RIVER AND HARBOR APPROPRIATIONS.**
- Section 6. ALPHABETICAL LIST OF ENGINEERS IN DIRECT CHARGE OF RIVER AND HARBOR IMPROVEMENTS.**
- Section 7. ALPHABETICAL LIST OF CONTRACTORS ON RIVER AND HARBOR WORKS.**
- Section 8. INDEX TO LAWS AFFECTING THE CORPS OF ENGINEERS.**
- Section 9. CLASSIFIED LIST OF FLOATING PLANT.**

SPECIAL SUBJECTS.

Reports, Chief of Engineers, 1866-1912.

SECTION 1.—SUPERVISION OF BRIDGE CONSTRUCTION.

NOTE.—The bridges referred to in this section are indexed under the name of the stream or harbor they cross.

The letter or letters in parentheses after each title are symbols or abbreviations having the following meaning:

A., alterations. O., navigation obstructed; alterations required within a specified time. S., bridge erected under State laws, or altered under them. Sp., erected under special act of Congress. Dr., rules prescribed for opening drawbridges.

A.

ACOAKSETT R., Westport Pt., Mass. (S.) (Westport town br.) Reconstr., approv. Apr. 22, 1904. **04**, 718.

ACUSHNET R., between New Bedford and Fairhaven, Mass. (S.) (Bristol County br.) PLANS.—Reconstr. plans partly (from Fairhaven to Popes Isld.) approv. June 23, 1896, pending results of sur. au. act June 3, 1896, **96**, 426. Modified plans approv. Sept. 23, 1896; constr. plans (second part between Popes and Fish Islds.) approv. July 17, 1897, **97**, 532.

ACUSHNET R., between Popes and Fish Islds., New Bedford H., Mass. (S.) (Union Street Ry. Co.) **97**, 535. PLANS.—Plans for a temporary br. during reconstr. of county br. between Popes and Fish Islds., approv. (revocable permit) Aug. 20, 1897, **97**, 535.

ACUSHNET R., New Bedford to Fish Isld., Mass. (S.) (City br.) PLANS.—Reconstr., including temporary str., approv. Mar. 8, 1901, **01**, 665.

ADAMS CREEK, Winthrop, N. C. (See Smiths Creek.)

AHNAPEE R., Algoma, Wis. (S.) (City br.) PLANS.—Approv. Apr. 11, 1899, **99**, 622.

ALABAMA R., near Montgomery, Ala. (Sp.) (Mobile & Ohio R. R. Co., successors to the Montgomery, Tuscaloosa & Memphis Ry. Co., formerly the Alabama Great Northwestern Ry. Co.) LEGISLATION.—Original company au. to constr. br. by act Aug. 6, 1888, **90**, 336. Act June 11, 1896, this franchise granted to the Mobile & Ohio R. R. Co., **97**, 530. PLANS.—Original company's plans approv. Aug. 5, 1889, **90**, 336. Plans, June 10, 1897, for a different location, approv. June 16, 1897, **97**, 530.

ALABAMA R., near Montgomery, Ala. (Sp.) (Montgomery Br. Co.) LEGISLATION.—Com-

pany au. to constr. br. act Mar. 1, 1893, **94**, 425. PLANS.—Submitted Feb. 8, 1894; modified Feb. 23, 1894; approv. Mar. 27, 1894, **94**, 425.

ALABAMA R., Montgomery, Ala. (S.) (Montgomery Br. & Improvement Co.) PLANS.—Approv. Jan. 18, 1904, **04**, 716.

ALABAMA R., Selma, Ala. (A.) **ENGINEERS**.—BE. Br. considered obstr. to navigation; recom. that the br. company prepare a chan. between pivot span and n. bank for passage of boats at all stages exceeding a 24' stage, and provide such future facilities to navigation as might be required, **86**, 2136. PLANS.—It having been represented that the br. was likely to create an obstr., BE. convened in 1886 to consider and R., **86**, 370, 2136; **88**, 309.

ALABAMA R., Selma, Ala. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Approv. Feb. 7, 1901, **01**, 665.

ALAFIA R., Riverview, Fla. (S.) (Hillsboro County br.) PLANS.—Approv. Jan. 16, 1901, **01**, 664.

ALBEMARLE SOUND, between Hornblower Pt. and Mackeys Creek, N. C. (S.) (Norfolk & Southern Ry. Co.) PLANS.—Modified plans approv. June 23, 1909, **09**, 918.

ALBEMARLE SOUND and **JOHNSON** and **MACKEYS CREEKS**, N. C. (S.) (Brs. of Norfolk & Southern R. R. Co.) PLANS.—Approv. Dec. 6, 1906, **07**, 824.

ALEQUA CREEK, near Portland, Fla. (S.) (Walton County br.) PLANS.—Approv. Aug. 11, 1897, **97**, 534.

ALGER (or Brooks) **SLOUGH**, Wahkiakum County, Wash. (Sp., etc.) (County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec 7 and act of Washington,

92, 404. PLANS.—Approv. Mar. 19, 1892. Completion of br. reported June 25, 1892, 92, 404.

LHAMBRA SLOUGH. (See Pacheco Slough.)

LEGHENY R. (See Ohio River, etc.)

LEGHENY R., near Bullis Mills, Pa. (S.) (Pittsburgh, Shawmut & Northern R. R. Co.) PLANS.—Approv. Apr. 13, 1909, 09, 917.

LEGHENY R., Creighton, Pa. (S.) (Creighton Br. Co.) PLANS.—Approv. Feb. 27, 1894, 94, 428.

LEGHENY R., at Foxburg, Pa. (S.) (Baltimore & Ohio R. R. Co.) PLANS.—False work for repair to existing br. approv. Nov. 1, 1911, 12, 1302.

LEGHENY R., at Franklin, Pa. (S.) (Oil City Station Ry. Co.) PLANS.—Approv. Nov. 26, 1900, 01, 663.

LEGHENY R., Franklin, Pa. (A.) (Venango County br.) PLANS.—Reconstr. approv. July 21, 1902, 03, 651. Modified plans approv. Dec. 17, 1903, 04, 720.

LEGHENY R., near Franklin, Pa. (A.) (Big Rock Br. Co., Big Rock Br.) PLANS.—Reconstr. approv. May 6, 1903, 03, 651.

LEGHENY R., Freeport, Pa. (S.) (Armstrong and Westmoreland Counties' br.) PLANS.—Approv. May 6, 1896, 96, 428.

LEGHENY R., Back Chan., Herr Isld., Pa. (S.) (Western Pennsylvania R. R. Co.) PLANS.—Plans of a temporary and 2 permanent bns. approv. Aug. 29, 1902, Sept. 19, 1902, and Mar. 9, 1903, respectively, 03, 649.

LEGHENY R., Kennerdell, Venango County, Pa. (S.) (Venango County br.) PLANS.—Approv. Jan. 13, 1903, 03, 647. Plans in lieu thereof approv. June 13, 1906, 06, 808, and Sept. 13, 1906, 07, 822.

LEGHENY R., Mahoning, Pa. (S.) (Pittsburgh & Shawmut R. R. Co.) PLANS.—Approv. Mar. 24, 1910, 10, 1028.

LEGHENY R., near Mosgrove, Pa. (S.) (Allegheny & Western Ry. Co.) PLANS.—Modified plans approv. Feb. 23, 1898. Modified plans reducing l. of spans and changing constr. of ps. approv. May 24, 1898, 98, 535.

LEGHENY R., New Kensington, Pa. (S.) (New Kensington Br. Co.) PLANS.—Modified plans approv. Apr. 8, 1898, 98, 535.

LEGHENY R., New Kensington, Pa. (S.) (Tarentum Br. Co.) PLANS.—Approv. June 10, 1893, 93, 470.

LEGHENY R., Oakmont and Hulton Ferry, Pa. (Sp.) (Allegheny County br.) Au. act Jan. 12, 1907. PLANS.—Approv. June 11, 1907, 07, 819.

LEGHENY R., Oil City, Pa. (Sp., etc.) (Relief Br. Co.) LEGISLATION.—Company au. to constr. br. under act July 13, 1892, sec. 3, and act of Pa., 92, 410. PLANS.—Approv. Sept. 1, 1892, 92, 410.

LEGHENY R., Oil City to Franklin, Pa. (S.) (Rouseville & Franklin R. R. Co.) PLANS.—Approv. Dec. 13, 1900, 01, 663.

ALLEGHENY R., Oil City, Pa. (S.) (Venango County br.) PLANS.—Plans of br. to replace existing str., approv. Sept. 14, 1908, 09, 915.

ALLEGHENY R., at Pittsburgh, Pa. (S.) ENGINEERS.—Chief of Engineers. R., 75, ii, 121. Approv. R. of Maj. Merrill, 75, ii, 684. LEGISLATION.—Br. au. by Pa., 75, ii, 685. PLANS.—Maj. Merrill R. br. a serious and unnecessary obstr. to navigation, 75, ii, 687, 688. Drawspan recom., 75, ii, 687, 688. Plan, 75, ii, 686.

ALLEGHENY R., near Pittsburgh, Pa. (Sp.) (Pittsburgh & Butler R. R. Co.) Au. act June 11, 1896, 96, 424. PLANS.—Approv. Aug. 18, 1896, 96, 424.

ALLEGHENY R., Highland Park, from a point at or near Pittsburgh, Pa., to Sharpsburg, Pa. (S.) (Highland Park Br. Co.) PLANS.—Approv. Sept. 13, 1899, 00, 699.

ALLEGHENY R., Pittsburgh (6th Street), Pa. (Sp.) (Allegheny Br. Co.) LEGISLATION.—Au. act Sept. 19, 1890, sec. 7, and act of Pa., 91, 431. PLANS.—Approv. May 2, 1891, 91, 431. Plans for false work, erected during progress of work, approv. Aug. 4, 1892, 92, 408.

ALLEGHENY R., Pittsburgh to Sharpsburg, Pa. (S.) (Pittsburgh & Sharpsburg Br. Co.) PLANS.—Approv. Aug. 24, 1893, 93, 537.

ALLEGHENY R., Pittsburgh to Allegheny, Pa. (S.) (Pittsburgh, Fort Wayne & Chicago Ry. Co.) PLANS.—Reconstr. approv. Sept. 1, 1900, 01, 662.

ALLEGHENY R., Brilliant Station, Pittsburgh, Pa. (S.) (Pennsylvania R. R. Co.) PLANS.—Approv. Mar. 11, 1903, 03, 649.

ALLEGHENY R., between Pittsburgh and Allegheny, Pa. (O.) (Union Br. Co., Union Br.) PLANS.—Alterations to be completed within 18 months from Jan. 26, 1903, 03, 651.

ALLEGHENY R. (N. side Pt. Br.), near site of Old Union Br., Pittsburgh, Pa. (S.) (City br.) PLANS.—Approv. Sept. 8, 1909, 10, 1024.

ALLEGHENY R., below Tarentum, Pa. (S.) (Kensington Rapid Transit Br. Co.) PLANS.—Submitted Mar. 28, 1894; modified Apr. 14, 1894; approv. Apr. 23, 1894, 94, 428.

ALLEGHENY R., at Tuttlestown, Pa. (S.) (Pennsylvania R. R. Co.) PLANS.—Reconstr. of br. No. 111, on the Salamanca Branch, approv. June 23, 1910, 10, 1030.

ALLEGHENY R., Venango County, near mouth of E. Sandy R., Pa. (S.) (Franklin & Clearfield R. R. Co.) PLANS.—Approv. Oct. 18, 1905, 06, 802.

ALLEY CREEK, at Bayside Douglaston, Borough of Queens, New York City. (S.) (New York & North Shore Traction Co.) PLANS.—Approv. Oct. 6, 1910, 11, 1083.

ALLIGATOR R., N. C. (See Mill Tail Creek.)

ALLOWAY CREEK, Salem County, N. J. (S.) (Salem County br.) PLANS.—Rebuilding approv. Oct. 19, 1905, 06, 803.

ALTAMAHA (Middle) R., Ga. (See Altamaha R.)

ALTAMAHA (South) R., Ga. (See Altamaha R.)

ALTAMAHA R. (Delta), Ga. (S.) (Georgia Coast & Piedmont R. R. Co.) PLANS.—Approv. Aug. 9, 1910, 11, 1082.

ALTAMAHA R., Ga. (S.) (Georgia & Florida Ry.) PLANS.—Approv. June 28, 1907, 07, 828.

ALTAMAHA R., Doctortown, Ga. (A.) (See Ashley R.; Ogeechee R.) (Savannah, Florida & Western R. R. Co.) PLANS.—Without a draw; an obstr., 88, 2549, 2550.

ALTAMAHA R., at Doctortown, Ga. (S.) (Atlantic Coast Line R. R. Co.) PLANS.—Reconstr. approv. June 7, 1911, 11, 1090.

ALTAMAHA R., Vidalia and Hazlehurst, Ga. (S.) (Georgia & Florida Ry.) PLANS.—approv. June 28, 1907, and modified plans approv. June 22, 1908, 08, 873.

AMOS CREEK, N. J. (See Leonards Thoroughfare.)

ANACOSTIA R. (E. Branch of Potomac R.) (Benning's Br., upper.) ENGINEERS.—Maj. N. Michler, 1867-70. R., 67, 521; 68, 890; 69, 493; 70, 518; 71, 974. Maj. O. E. Babcock, 1871-77. R., 71, 969; 72, 1015; (Col.) 74, ii, 394; 75, ii, 810; 76, ii, 690; 77, ii, 1066. Lt. Col. T. L. Casey, 1879-80. R., 79, 1882; 80, 2342. Col. A. F. Rockwell, 1881-84. R., 81, 2715; 82, 2738; 83, 2101; 84, 2346. Lt. Col. J. M. Wilson, 1885-86. R., 85, 2509; 86, 2084. Lt. Col. C. J. Allen, 1899. R., 99, 1447. OPERATIONS.—1867. Recently rebuilt, 67, 521. 1868-72. Minor repairs made, 68, 890; 70, 518; 71, 969, 974; 72, 1015. 1874-77. Repairs made, 74, ii, 394; 76, ii, 690; 77, ii, 1066. 1878-79. Thoroughly repaired, 79, 1882. 1880-82. Extensive repairs made, 80, 2342; 81, 2715; 82, 2738. 1883-86. Roadway repaired, 83, 2101; 84, 2346; 85, 2509; 86, 2084. PROJECTS.—Br. forms an important connection between D. C. and Md., 70, 518. Lt. Col. Wilson est., 1886, \$10,000 to imp. the br., 86, 2084.

ANACOSTIA R. (E. Branch of Potomac R.) (New Navy Yard Br.) APPROPRIATIONS.—1874. \$146,000, 75, ii, 806. CONTRACTS.—1874. Clark, Reeves & Co., br. (within limit of app., \$146,000), 75, ii, 806. ENGINEERS.—Chief of Engineers. R., 75, 126; 76, ii, 688. In charge: Col. O. E. Babcock, 1875-77. R., 75, ii, 806; 76, ii, 687; 77, ii, 1066, 1070. Lt. Col. T. L. Casey, 1879-80. R., 79, 1882; 80, 2342. Col. A. F. Rockwell, 1881-84. R., 81, 2715; 82, 2738; 83, 2101; 84, 2346. Col. J. M. Wilson, 1885-86. R., 85, 2509; 86, 2084. Lt. Col. C. J. Allen, 1899. R., 99, 1447. LEGISLATION.—Constr. au. act June 22, 1874; 75, ii, 806. One of the R. R. tracks removed according to act Mar. 3, 1879; 79, 1882. OPERATIONS.—1874-75. Br. completed and opened to the public June 17, 1875, 75, ii, 806. 1876-77. Some repairs made, 77, ii, 1066. 1879-80. Roadway and footwalks repaired, 80, 2342. 1880-81. Extensive repairs made, 81, 2715. 1881-82. Sidewalks, roadway, and brick pavements repaired, 82, 2738.

1882-86. Roadway repaired, 83, 2101; 84, 2346; 85, 2509; 86, 2084. PRIVATE (CORPORATE) WORK.—Permission to lay rails across the Anacostia Br. granted Mar. 14, 1876, to the Anacostia & Potomac R. R. Co., by the Sec. of War, under certain restrictions and regulations, 76, ii, 688. Company removed e. track, 79, 1882. PROJECTS.—Lt. Col. Wilson est., 1886, \$5,500 to imp. the br., 86, 2084. SURVEYS.—Made, 1875, 75, ii, 806. R., 1875, by Col. Babcock, on the application of the Anacostia & Potomac R. R. Co. for permission to lay rails across the Anacostia Br. (see Private work), 76, ii, 687.

ANACOSTIA R. (E. Branch of Potomac R.) (Old Navy Yard Br., lower.) ENGINEERS.—In charge: Maj. N. Michler, 1867-71. R., 67, 521; 68, 891; 69, 494; 70, 518; 71, 975. Maj. O. E. Babcock, 1870-74. R., 71, 969; 72, 1015; (Col.) 74, ii, 394. LEGISLATION.—Application, 1868, to Congress to incorporate the Uniontown & Washington City R. R. with au. to lay tracks along certain streets and to cross this br., 68, 891. OPERATIONS.—1867. Br. recently renovated, 67, 521. 1867-68. Floor repaired, 68, 891. 1869-70. Continual repairs being made, 70, 518; 71, 975. 1873-74. Broken span repaired, 74, ii, 394. 1874-76. Repairs made, 76, ii, 690. PROJECTS.—Act au. br. to be sold by auction, June 21, 1875. Bids too low; no sale. 75, ii, 810. SURVEYS.—Sur. of the lower br., known as the Navy Yard Br., across the Anacostia R., and plan for a permanent str. across same, capable of sustaining R. R. track and cars, with est. of cost, ordered by a resolution of the Senate, June 20, 1868; made, 1868, by Maj. Michler, 68, 891; 69, 494.

ANACOSTIA R. (E. Branch of Potomac R.) (Washington, D. C.) ENGINEERS.—Chief of Engineers. R., 96, 430. In charge: Maj. C. E. L. B. Davis, 1896. R., 96, 3889. PHYSICAL DATA.—Borings for site, 96, 3892, 3901. Comparison of routes, 96, 3895. PROJECTS.—Description of proposed br., 96, 3895. Maj. Davis est., 1896, \$779,130 to constr. br. at the foot of 1st Street SW., 96, 3899. SURVEYS.—Sur., plan, and est. of constr. of a substantial and suitable br., with necessary approaches, from foot of South Capitol Street, or below it at the most available pt., across the E. Branch of the Potomac R., and R. thereon, au. act Mar. 2, 1895; made, 1896, by Maj. Davis (R. unfav. to site) (see Projects), 96, 3890.

ANACOSTIA R., D. C. (Baltimore & Potomac R. R.) PROJECTS.—Description of br., 99, 1447.

ANACOSTIA R., D. C. (Pennsylvania Avenue br.—highway.) PROJECTS.—Description of br., 99, 1447.

ANACOSTIA R. (in line with Massachusetts Avenue extended). (Washington, D. C.) ENGINEERS.—Chief of Engineers. R., 98, 541. In charge: Lt. Col. C. J. Allen, 1898. R., 98, 3598. PHYSICAL DATA.—Borings, 98, 3600. PROJECTS.—Col. Allen est., 1897, \$441,208 for

- a steel truss br., **98**, 3606. Description of proposed br., **98**, 3602-3606. **SURVEYS**.—Sur., plan, and est. of br. across the E. Branch of the Potomac R. (Anacostia R.) in line with Massachusetts Avenue extended eastward, au. act Feb. 17, 1897; made, 1897, by Col. Allen (see Projects), **98**, 3599.
- ANACOSTIA R.**, Washington, D. C. (S.) (Pennsylvania R. R. Co.) **PLANS**.—Approv. Sept. 22, 1903, **04**, 714.
- ANACOSTIA R.**, Washington, D. C. (A.) (District of Columbia br.) **PLANS**.—Provision for reconstr. existing br. made by D. C. app. act Apr. 27, 1904, as amended by act Mar. 3, 1905. Plans approv. Apr. 7, 1905, **05**, 729.
- ANAHEIM INLET** and navigable chans. in Alamitos B., Cal. (S.) (Brs. (8) of Pacific Electric Ry. Co.) **PLANS**.—Approv. Apr. 22, 1904, **04**, 718.
- ANNAVILLE CREEK**, N. Y. (Dr.) **08**, 865.
- ANNEMESSEX R.**, Md. (Dr.) **08**, 865.
- APALACHICOLA R.**, Fla. (Sp.) (Apalachicola Northern R. R. Co.) Au. act Mar. 3, 1905. **PLANS**.—Approv. Dec. 13, 1905, and modified plans Feb. 24, 1906, **06**, 799.
- APPONAGANSETT R.**, S. Dartmouth, Bristol County, Mass. (S.) (City br.) **PLANS**.—Approv. Oct. 30, 1901, **02**, 585.
- APPOQUINIMINK R.**, New Castle County, Del. (S.) (New Castle County br.) **PLANS**.—Approv. Aug. 30, 1905, **06**, 801.
- AQUIA CREEK**, Va. (Dr.) **07**, 815.
- AQUIA CREEK**, Va. (S.) (Richmond, Fredericksburg & Potomac R. R. Co.) **PLANS**.—Plans for new draw in br. approv. June 6, 1895, **95**, 479.
- AQUIA CREEK**. (See Neabsco Creek.)
- ARKANSAS R.** (Dr.) (See Ouachita R. and Petit Jean R.) **05**, 719.
- ARKANSAS R.** and tributaries. (Dr.) **07**, 815.
- ARKANSAS R.**, between Arkansas and Desha Counties, Ark. (Sp.) (Memphis, Helena & Louisiana Ry. Co.) Au. act Feb. 24, 1902. **PLANS**.—Approv. Aug. 14, 1902, **03**, 643.
- ARKANSAS R.**, Cummings Landbg. Ark. (Sp.) (Kansas City, Arkansas & New Orleans R. R. Co. at.) Au. act July 24, 1888, **90**, 337. **PLANS**.—Plan and location submitted and approv. by Sec. of War, Feb. 25, 1890, **90**, 337.
- ARKANSAS R.**, Dardanelle, Ark. (Sp.) (Cable City Br. Constr. Co.) **LEGISLATION**.—Company au. to constr. br. by act Sept. 30, 1890, **91**, 430. Au. to erect an addl. tower to operate draw, conditionally, May 16, 1891, **91**, 430. **PLANS**.—Approv. Dec. 23, 1890, **91**, 430.
- ARKANSAS R.**, near Fort Gibson, Ind. T. (Sp.) (Ozark & Cherokee Central Ry. Co.) Au. act Feb. 24, 1902. **PLANS**.—Approv. July 17, 1902, **03**, 642.
- ARKANSAS R.**, Fort Smith, Ark. (Sp.) (Kansas & Arkansas Valley R. R. Co.) **LEGISLATION**.—Au. act Mar. 15, 1890. **PLANS**.—Plan and location submitted and approv. by Sec. of War, May 17, 1890, **90**, 338.
- ARKANSAS R.**, at Fort Smith and Van Buren, Ark. (Sp.) (Fort Smith & Van Buren br. district.) Au. Feb. 26, 1910. **PLANS**.—Approv. May 5, 1910, **10**, 1022.
- ARKANSAS R.**, near Hicks Rock, Ind. T. (Sp.) (Kansas City, Pittsburg & Gulf R. R. Co. **LEGISLATION**.—Company au. to constr. br. by act Feb. 27, 1893. **PLANS**.—Plans submitted June 21, 1895; modified July 22, 1895; approv. July 29, 1895, **95**, 476.
- ARKANSAS R.**, Little Rock, Ark. (Sp.) Chief of Engineers. **R.**, **81**, 267; **84**, 270, 1789. **LEGISLATION**.—Br. au. acts July 1, 1870, and May 31, 1872, **81**, 2010; **84**, 270, 1789. **PLANS**.—Submitted by Little Rock Br. Co. in compliance with act May 31, 1872; approv. by Chief of Engineers and Sec. of War, Feb. 15, 1873, **73**, 591, 592. Requirements of Congress, **81**, 2010. Plan, br. company, **81**, 2013. Board of surveyors convened at Little Rock. Br. unequal to the requirements of commerce, **81**, 2013. Modifications recom. by Maj. Adams, concurred in by Chief of Engineers, and approv. by Sec. of War, **84**, 1790, 1791.
- ARKANSAS R.**, Little Rock, Ark. (Sp.) (Choctaw & Memphis R. R. Co.) **LEGISLATION**.—Company au. to constr. br. by act Jan. 10, 1899. **PLANS**.—Approv. Mar. 1, 1899, **99**, 618.
- ARKANSAS R.**, Little Rock, Ark. (Sp.) (Little Rock Br. & Terminal Ry. Co.) **LEGISLATION**.—Company au. to constr. br. by act Mar. 2, 1891; amendment by act Feb. 11, 1893. **PLANS**.—Approv. Dec. 7, 1893, **94**, 425.
- ARKANSAS R.**, Little Rock, Ark. (Sp.) (Pulaski County br.) **LEGISLATION**.—County au. to constr. br. by act Feb. 28, 1893; amending act, May 13, 1896. **PLANS**.—Approv. June 12, 1896, **96**, 423.
- ARKANSAS R.**, at or near Muskogee, Okla. (Sp.) (Muskogee & Fort Gibson Br. Co.) Au. act Aug. 16, 1911. **PLANS**.—Plans and map of location approv. May 31, 1912, **12**, 1298.
- ARKANSAS R.**, Pine Bluff, Ark. (Sp.) (Jefferson County br.) Au. act Mar. 5, 1906. **PLANS**.—Approv. Aug. 31, 1906, **07**, 817.
- ARKANSAS R.**, below Pine Bluff (Rob Roy), Ark. (Sp.) (St. Louis & Southwestern Ry. Co.) Au. act June 27, 1882. **PLANS**.—Plans for br. to replace existing str. approv. Aug. 3, 1909, **10**, 1020.
- ARKANSAS R.**, Van Buren, Ark. (Sp.) **84**, 270, 1792. **LEGISLATION**.—Br. au. by act July 3, 1882, **84**, 270. **PLANS**.—Plans as orig. proposed modified by recom. of a B. E. R. R. company objected to the changes. In 1884 the R. R. proposed to constr. at its own expense any work which might subsequently be found necessary for the mainten. of navigation. Chief of Engineers thereupon recom. approval of orig. site, which was approv. by Sec. of War. **84**, 270, 1792, 1796.

- ARKANSAS R.**, near Van Buren, Ark. (Sp.) (Fort Smith & Van Buren Ry. Co.) **LEGISLATION**.—Company au. to constr. br. by act Mar. 9, 1894. **PLANS**.—Approv. Mar. 8, 1895, **95**, 475.
- ARTHUR KILL**, N. J., and tributaries. (Dr.) **06**, 797.
- ASHEPOO R.**, S. C. (A.) (Charleston & Savannah R. R. br.—new.) Engineer in charge: Capt. F. V. Abbot, 1899. **R. PLANS**.—Company should be required to remove piles of old br. if the U. S. ever does any work on this R., **89**, 2796.
- ASHLEY R.**, S. C. (O.) (New br. company.) **PLANS**.—Required alterations to be, and were completed by July 1, 1891, **91**, 433.
- ASHLEY R.**, S. C. (S.) (Charleston, S. C., Mining & Manufacturing Co.) **PLANS**.—Approv. Mar. 7, 1902, **02**, 587.
- ASHLEY R.**, Bees Ferry, S. C. (O.) (Atlantic Coast Line R. R. Co.) **PLANS**.—Alterations to be completed on or before 6 months from Apr. 12, 1909, **09**, 920.
- ASHLEY R.**, Charleston, S. C. (O.) (Charleston Br. Co.) **PLANS**.—Alterations to be completed on or before 8 months from Feb. 5, 1909, **09**, 919.
- ASHLEY, EDISTO, SALKAHATCHIE, CHEEHAN, SAVANNAH, and ALTAMAHA RS.**, and **ST. AUGUSTINE CREEK**, Ga. and S. C. (A.) **PLANS**.—Description of the brs. and of the modifications proposed therein, **88**, 2629, 2630. Modifications suggested by Col. Gillmore in such of these structures as obstruct navigation **88**, 2663.
- ASHTABULA R.**, Ohio. (O.) (Ashtabula County br.) **PLANS**.—Specified alterations required on or before Apr. 1, 1898, **96**, 429. Alterations to be completed on or before Apr. 15, 1905, **04**, 723.
- ASHTABULA R.**, Ashtabula, Ohio. (S.) (Lake Shore & Michigan Southern Ry. Co.) **PLANS**.—Reconstr. plans approv. May 11, 1897, **97**, 534. Reconstr. approv. Mar. 14, 1911, **11**, 1087.
- ASSISCUNK CREEK**, at Mitchell Avenue, Burlington, N. J. (S.) (Burlington County br.) **PLANS**.—Approv. July 7, 1904, **05**, 722.
- ASSISCUNK CREEK**, N. J. (S.) (Brs. of the Pennsylvania R. R. Co.) **PLANS**.—Plans and maps of locations approv. Nov. 4, 1911, **12**, 1302.
- ATCHAFALAYA R.**, near mouth of Malboeuf Bayou, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) **PLANS**.—Approv. Apr. 30, 1906, **06**, 806.
- ATCHAFALAYA R.**, near Melville, La. (S.) (Colorado Southern, New Orleans & Pacific R. R. Co.) **PLANS**.—Approv. Aug. 15, 1906, **07**, 821. For altering, approv. June 30, 1909, **09**, 919.
- ATCHAFALAYA R.**, Morgan City, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) **PLANS**.—Rebuilding approv. Aug. 26, 1907, **08**, 869.
- ATKINS B.**, Kennebec R., Phippsburg, Me. (Sp., etc.) (Sagadahoc County br.) **LEGISLATION**.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Maine, **92**, 405. **PLANS**.—Submitted July 30, 1891. On May 2, 1892, no objections, **92**, 405.

B.

- BACK BAY**, Biloxi, Miss. (Sp.) (City br.) Au. act May 10, 1900. PLANS.—Approv. Sept. 4, 1900, 01, 659.
- BACK COVE** (chan. leading to), Portland H., Me. (q. v.). (O.) (Grand Trunk Ry. Co. of Canada.) PLANS.—Specified alterations required on or before Jan. 1, 1892, 91, 435.
- BACK R.**, Md. (S.) (The United Railways & Electric Co. of Baltimore, Md.) PLANS.—For rebuilding approv. Apr. 10, 1903, 03, 649.
- BACK R.**, Md. (S.) (Chesaco Park Br. Co.) PLANS.—Plans and map of location approv. Sept. 20, 1911, 12, 1301.
- BACK R.**, at Eastern Avenue, Baltimore, Md. (S.) (County br.) PLANS.—Approv. Jan. 9, 1911, 11, 1085.
- BACK R.**, between Tibbetts Isld. and the mainland in town of Boothbay, Me. (S.) (Br. of W. O. Whitman.) PLANS.—Approv. Apr. 7, 1911, 11, 1088.
- BACK R.**, Md. (See North East Creek.)
- BACK (Butler) R.**, Ga. (See Atlamaha R.)
- BAHIA HONDA.** (See Florida Keys.)
- BAINES CREEK**, near Port Norfolk, Va. (S.) (Atlantic Coast Line R. R. Co.) PLANS.—Plans and map of location for reconstr. of existing br. approv. Jan. 13, 1912, 12, 1304.
- BALL CLUB R.**, Minn. (S.) (Eastern Ry. Co.) PLANS.—Approv. Apr. 7, 1898, 98, 535.
- BALL CLUB R.**, Itaska County, Minn. (S.) (Great Northern Ry. Co.) PLANS.—For br. to replace existing str. approv. Sept. 10, 1907, 08, 870.
- BAE H. and BAR ISLD.** (chan. between), Me. (S.) (Eden Township br.) PLANS.—Approv. Apr. 21, 1909, 09, 917.
- BARLOWS R.**, Bourne, Mass. (S.) (Town br.) PLANS.—Reconstr. plans approv. May 24, 1898, 98, 535.
- BARNEGAT B.**, at Seaside Park, N. J. (S.) (Philadelphia & Long Branch R. R. Co.) PLANS.—For reconstr. of existing br. approv. Nov. 13, 1911, 12, 1302.
- BARRINGTON R.**, at Barrington, R. I. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—For reconstr. of existing br. (including erection of temporary trestle br.) approv. Sept. 7, 1911, 12, 1301.
- BARROWS CANAL**, La. (Dr.) 08, 865.
- BARTHOLOMEW BAYOU**, Portland, Ark. (Sp.) (Mississippi R., Hamburg & Western Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 12, 1898, 98, 531. Act extending au. Feb. 4, 1902, 02, 582. PLANS.—Approv. May 17, 1898, 98, 531. Br. built, but not in accordance with permit. Rebuilding approv. Mar. 15, 1902, 02, 582.
- BARTHOLOMEW BAYOU**, Parkdale, Ark. (Sp.) (Ashley County br.) Au. act Apr. 1, 1908. PLANS.—Approv. Oct. 25, 1910, 10, 1020.
- BARTHOLOMEW BAYOU**, near Portland, Ark. (Sp.) (Ashley County br.) Au. act Feb. 20, 1908, and Jan. 27, 1910. PLANS.—Approv. Oct. 6, 1910, 11, 1080.
- BARTHOLOMEW BAYOU**, La. (Sp.) (New Orleans & Northwestern Ry. Co.) Au. act May 4, 1900. PLANS.—Approv. Apr. 30, 1901, 01, 660.
- BARTHOLOMEW BAYOU**, La. (Sp.) (Arkansas, Louisiana & Gulf Ry. Co.) Au. act Mar. 23, 1906, and Feb. 22, 1907. PLANS.—Approv. Sept. 20, 1907, 08, 866.
- BASS R.**, Beverly, Mass. (S.) (Essex County br.) PLANS.—Reconstr. approv. Oct. 8, 1904, 05, 724.
- BASS R.**, Yarmouth and Dennis, Mass. (S.) (Barnstable County br.) PLANS.—Reconstr. approv. May 15, 1907, 07, 827.
- BASTROP BAYOU and CHOCOLATE BAYOU**, Tex. (Sp., etc.) (Brazoria County brs.) LEGISLATION.—County au. to constr. brs. under act July 13, 1892, sec. 3, and act Texas. PLANS.—For these 2 brs. approv. Aug. 24, 1892, 92, 409.
- BAUDETTE R.**, Beltrami County, Minn. (S.) (County br.) PLANS.—Approv. Apr. 21, 1906, 06, 806.
- BAY R.**, at Bayboro, N. C. (O.) (Pamlico County br.) PLANS.—Alterations to be completed on or before Nov. 1, 1902, 03, 652.
- BAY R.**, near Bayboro, N. C. (S.) (Virginia & Carolina Coast R. R. Co.) PLANS.—Approv. Nov. 3, 1906, 07, 823.
- BAY ST. LOUIS**, Miss. (Dr.) 08, 865.
- BAYOU BOEUF**, La. (Dr.) 08, 865.
- BAYOU CONNER**, La. (Dr.) 08, 865.
- BAYOU COURTABLEAU**, La. (Dr.) 08, 865.
- BAYOU DES ALLEMANDS**, La. (Dr.) 08, 865.
- BAYOU LACASINE**, La. (Dr.) 08, 865.
- BAYOU LAFOURCHE**, La. (Dr.) 08, 865.
- BAYOU SARA**, La. (Dr.) 08, 865.

BAYOU VERMILION, La. (Dr.) 08, 865.

BEACH THOROUGHFARE. (See Schuylkill R., etc.)

BEACH THOROUGHFARE, Atlantic City, N. J. (S.) (Pleasantville & Atlantic Turnpike or Plank Road Co.) PLANS.—Approv. Jan. 5, 1903, 03, 647.

BEACH THOROUGHFARE, near Atlantic City, N. J. (S.) (Atlantic City & Shore R. R. Co.) PLANS.—Approv. Jan. 25, 1906, 06, 803.

BEACH THOROUGHFARE, at Riviera Beaches and Atlantic City, N. J. (S.) (Atlantic City Riviera Parkway Co.) PLANS.—Approv. June 8, 1910, 10, 1030.

BEAR CREEK, near Sparrows Pt., Md. (S.) (Dundalk, Sparrows Pt. & North Pt. Ry. Co.) PLANS.—Approv. Apr. 14, 1902, 02, 588.

BEAR CREEK, between Sunflower and Washington Counties, Miss. (S.) (Delta Southern Ry. Co.) PLANS.—Approv. Sept. 27, 1906, 07, 822.

BEAR CREEK, at Swift, Miss. (S.) (Leflore County br.) PLANS.—Approv. Jan. 26, 1911, 11, 1086.

BELFAST B., Me. (S.) (City br.) PLANS.—Approv. Dec. 6, 1895, 96, 425.

BELLE R., St. Clair County, Mich. (S.) (Detroit, Mount Clemens & Marine City Ry. Co.) PLANS.—Approv. May 9, 1901, 01, 666.

BELLE R., Marine City, Mich. (S.) (Rapid Ry. Co.) PLANS.—Approv. July 3, 1899, 99, 623.

BELLE R., Marine City, Mich. (S.) (Detroit & Northern Ry. Co.) PLANS.—Approv. July 26, 1899, 99, 623.

BELLMANS CREEK, Granton, N. J. (S.) (New York Central & Hudson R. R. Co.) PLANS.—Reconstr. approv. Sept. 6, 1904, 05, 724.

BELVEDERE and TIBURON (tidal estuary between), Morin County, Cal. (O.) (County br.) PLANS.—Alterations to be completed on or before May 1, 1910, 10, 1031.

BENNETTS CREEK, Va. (S.) (Seaboard Traction Co.) PLANS.—Approv. June 23, 1905, 05, 728.

BERNARD BAYOU, Handsboro, Miss. (S.) (Handsboro Township br.) PLANS.—Approv. July 30, 1908, 09, 914.

BERRY CREEK, Paterson Plank Road, Bergen County, N. J. (S.) (Bergen County br.) PLANS.—Approv. May 22, 1909, 09, 918.

BERRYS CREEK, N. J. (Dr.) 10, 1019.

BERWICK B., La. (Dr.) 08, 865.

BEVERLY H., between Salem and Beverly, Mass. (S.) (Essex County br.—Essex br.) PLANS.—Reconstr. plans for the draw and plans for a temporary br. approv. Nov. 19, 1896, 97, 532.

BIG BLACK R., Miss. (A.) Engineer in charge. Capt. E. Bergland. PLANS.—Description of Louisville, New Orleans & Texas R. R. br. An obstr. at all stages of water. Center span

should be made a pivot draw. The 2 county brs. should be changed to drawbrs. Description of Vicksburg & Meridian R. R. br. Au. by Mississippi, 1865. An obstr. at all stages. 1 of the ps. should be replaced by a pivot br. and 2 of the spans by a pivot draw. 88, 2554.

BIG BLACK R., Baldwin Ferry (about 15 m. e. of Vicksburg, Miss.) (Sp., etc.) Warren County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act Mississippi. PLANS.—Approv. Apr. 23, 1892, 92, 405.

BIG BLACK R., Hankinsons Ferry, Miss. (S.) (Warren County br.) PLANS.—Approv. Aug. 30, 1894, 94, 430. Rebuilding approv. Aug. 22, 1908, 09, 915.

BIG BLACK R., Ivanhoe Ferry, Miss. (S.) (Warren County br.) PLANS.—Approv. Sept. 25, 1907, 08, 870. Modified plans approv. Aug. 10, 1908, 09, 914.

BIG FORK R., Itaska County, Minn. (S.) (Minneapolis & Rainy R. Ry. Co.) PLANS.—Approv. July 19, 1906, 07, 820.

BIG FORK AND LITTLE SHOALS RS., Minn. (S.) (Brs. of International Br. & Terminal Co.) PLANS.—Approv. Aug. 16, 1910, 11, 1083.

BIG HATCHEE R., near Brownsville, Tenn. (S.) (Haywood County br.) PLANS.—Approv. July 16, 1898, 98, 536.

BIG HORN R., Mont. (across the). (A.) (Br. of the Northern Pacific R. R. Co.) PLANS.—An obstr.; should be provided with a draw giving a free chan. way of 100' width, 88, 2670.

BIG MUDDY R., at Murphysboro, Ill. (S.) (Murphysboro & Southern Illinois Ry. Co.) PLANS.—Approv. Feb. 8, 1910, 10, 1027.

BIG MUDDY R., at 35 m. above its mouth near Murphysboro, Ill. (S.) PLANS.—Reconstr. of existing br. approv. Aug. 17, 1911, 12, 1300.

BIG SANDY R. (See Ohio R., etc.)

BIG SANDY R., W. Va. (near the mouth of the). (A.) (Chesapeake & Ohio R. R. Co.) PLANS.—Capt. Post recom. removal of pile and cofferdam obstrs. about one of the ps., 88, 2578.

BIG SANDY R., at Catlettsburg, Ky. (Sp.) (Chesapeake & Ohio R. R. Co.) LEGISLATION.—Constr. au. act Feb. 15, 1893, 93, 464. PLANS.—To replace existing str., approv. Feb. 25, 1893, 93, 464. Modified plans, omitting the roadway and sidewalks, Nov. 23, 1894, approv. Nov. 30, 1894, 95, 474.

BIG SANDY R., near Dolorme (Tug Fork), W. Va. (Sp.) (Frank P. Harman.) Au. act Apr. 18, 1904. PLANS.—Approv. Oct. 8, 1904, 05, 720.

BIG SANDY R., from Kenova, W. Va., to Catlettsburg, Ky. (Sp.) (Ohio Valley Electric Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 30, 1900, 00, 697. PLANS.—Approv. June 12, 1900, 00, 697.

BIG SANDY R., Levisa Fork, Ky. (S.) Millers Creek R. R. Co.) PLANS.—Approv. June 25,

- 1909, 09, 919. Modified plans approv. July 31 1909, 10, 1023.
- BIG SANDY R.** (Levisa Fork), near Auxier, Ky. (S.) (North-East Coal Co.) PLANS.—Approv. Apr. 20, 1910, 10, 1029.
- BIG SANDY R.**, Levisa Fork, Pikeville, Ky. (S.) (Pike County br.) PLANS.—Approv. May 27, 1908, 08, 872.
- BIG SANDY R.** (Levisa Fork), Prestonburg, Ky. (S.) (William H. May et al.) PLANS.—Approv. Mar. 18, 1907, 07, 826.
- BIG SANDY R.** (Levisa Fork), Torchlight, Ky. (S.) (Louisa Coal Co.) PLANS.—Approv. June 25, 1909, 09, 918.
- BIG SANDY R.** (Levisa Fork), near Whitehouse, Ky. (S.) (Big Sandy Ry. Co., Chesapeake & Ohio Ry. Co.) PLANS.—Approv. Oct. 28, 1902, 03, 647.
- BIG SANDY R.** (Russell Fork), at Elkhorn City, Ky. (S.) (Pike County br.) PLANS.—Approv. Feb. 27, 1912, 12, 1305.
- BIG SANDY R.**, Tug and Levisa Forks, Louisa, Ky., and Cassville, W. Va. (Sp.) (Louisa & Fort Gay Br. Co.) Au. act Mar. 3, 1905. PLANS.—Approv. May 12, 1905, 05, 722.
- BIG SANDY R.**, Tug Fork (91 and 95½ m. above Catlettsburg, Ky.—2 brs.). (Norfolk & Western R. R. Co.) LEGISLATION.—Company au. to constr. brs. by act Feb. 9, 1891. PLANS.—Plans for the 2 brs. approv. Feb. 13, 1891, 91, 431.
- BIG SANDY R.**, Tug Fork, near Devon, W. Va. (Sp.) (Majestic Collieries Co.) Au. act Feb. 8, 1907. PLANS.—Approv. Feb. 6, 1908, 08, 867.
- BIG SANDY R.**, Tug Fork, near Matewan, W. Va. (Sp.) (Blackberry, Kentucky & West Virginia Coal & Coke Co., Inc.) Au. act Apr. 21, 1904. PLANS.—Approv. June 22, 1904, 04, 712.
- BIG SANDY R.**, Tug Fork, in Mingo County, W. Va., and Buchanan County, Va. (Sp.) (Brs. of Norfolk & Western Ry. Co.) Au. act Apr. 12, 1904. PLANS.—Approv. June 6, 1905, 05, 722.
- BIG SANDY R.**, Tug Fork, between Mingo County, W. Va., and Pike County, Ky. (Sp.) (Norfolk & Western Ry. Co.) Au. act Apr. 12, 1904. PLANS.—Approv. June 24, 1904, 04, 712.
- BIG SANDY R.**, Tug Fork, at Nolan, W. Va. (Sp.) (Borderland Coal Co.) Au. act Mar. 3, 1905. PLANS.—Approv. Apr. 27, 1905, 05, 721.
- BIG SANDY R.**, Tug Fork (2 m. e. of Nolan, W. Va.). (Sp.) (Borderland Coal Co.) Au. act Feb. 19, 1910. PLANS.—Approv. May 12, 1910, 10, 1022.
- BIG SANDY R.**, Tug Fork, near Sprigg, W. Va. (Sp.) (Burnwell Coal & Coke Co.) Au. act Mar. 2, 1907. PLANS.—Approv. July 23, 1907 08, 866.
- BIG SANDY R.**, Tug Fork, Vulcan, W. Va. (Sp.) (Vulcan Coal Co.) Au. act Apr. 12, 1904. PLANS.—Approv. Apr. 25, 1904, 04, 712.
- BIG SANDY R.**, Tug Fork, Williamson, W. Va. (Sp.) (Kentucky & West Virginia Br. Co.) Au. act Feb. 27, 1907. PLANS.—Approv. May 21, 1907, 07, 819.
- BIG SUNFLOWER R.**, Boyers Mill, near Vicks Landing, Miss. (Sp.) (Sunflower County br.) Au. act Jan. 24, 1905. PLANS.—Approv. May 29, 1906, 06, 800.
- BIG SUNFLOWER R.**, Sharkey County, Miss. (Sp.) (Delta Southern Ry.) Au. act Jan. 28, 1905. PLANS.—Approv. Feb. 12, 1906, Jan. 27, 1906, and Oct. 25, 1906, 06, 799; 07, 817.
- BIG SUNFLOWER R.** (See Little Sunflower R.)
- BIG TIMBER CREEK**, below Gloucester, N. J. (S.) (Camden, Gloucester & Woodbury Ry. Co.) PLANS.—Reconstr. approv. Mar. 30, 1901, 01, 666.
- BIG TIMBER CREEK**, Westville, N. J. (S.) (Pennsylvania R. R. Co.) PLANS.—Reconstr. approv. Mar. 2, 1906, 06, 804.
- BILOXI**, Miss. (Dr.) 04, 710.
- BILOXI R.**, Miss. (Dr.) 08, 865.
- BILOXI R.**, at Lorraine, Miss. (S.) (Harrison County br.) PLANS.—Approv. June 28, 1912 12, 1308.
- BIRCH R.**, W. Va. (See Elk R.)
- BISCAYNE B.**, at Miami, Fla. (S.) (John S. Collins.) PLANS.—Approv. May 17 1912, 12, 1307.
- BLACK CREEK**, Fla. (S.) (Walton County br.) PLANS.—Approv. July 9, 1898, 98, 536.
- BLACK CREEK**, Clay County, Fla. (S.) (Jacksonville, Tampa & Key West Ry. Co.) PLANS.—Reconstr. approv. Aug. 15, 1893, 93, 470.
- BLACK CREEK**, 6 m. e. of Freeport, Fla. (S.) (Walton County br.) PLANS.—Approv. Feb. 14, 1912, 12, 1305.
- BLACK R.** (See Monongahela R. and.)
- BLACK R.**, Ark. (Dr.) 07, 815.
- BLACK R.**, near Beattys Br., N. C. (S.) (Blanden County br.) PLANS.—Approv. Dec. 26, 1900, 01, 664.
- BLACK R.**, Earlington, Wash. (S.) (Jones-Thompson Investment Co.) PLANS.—Approv. Aug. 2, 1907, 08, 868.
- BLACK R.**, Fishers Ferry, Miss. (S.) (Warren County br.) PLANS.—Approv. Oct. 10, 1901 02, 585.
- BLACK R.**, near Jonesville, in Catahoula Parish, La. (S.) (Louisiana & Arkansas Ry. Co.) PLANS.—Approv. Oct. 3, 1911, 12, 1301.
- BLACK R.**, King County, Wash. (S.) (Seattle & Renton Ry. Co.) PLANS.—For br. to replace existing str. approv. Aug. 5, 1902, 03, 645.
- BLACK R.**, King County, Wash. (S.) (Columbia & Puget Sound R. R. Co.) PLANS.—For br. to replace str. approv. June 5 1908 08, 873.
- BLACK R.**, Lorain, Ohio. (S.) (Lorain County br.) PLANS.—Approv. Oct. 19, 1898, 99, 621.
- BLACK R.**, Lorain, Ohio. (S.) (New York, Chicago & St. Louis R. R. Co.) PLANS.—For

- br. to replace existing str. approv. July 17, 1902, 03, 645.
- BLACK R.**, near Paroquet, Ark. (Sp.) (St. Louis, Iron Mountain & Southern Ry. Co.) Au. act Feb. 19, 1910. PLANS.—For reconstr. approv. Mar. 16, 1910, 10, 1021.
- BLACK R.**, Pocahontas, Ark. (Sp.) (Pocahontas Br. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 21, 1898. PLANS.—Approv. Nov. 17, 1898, 99, 618.
- BLACK R.**, at Pocahontas, Ark. (Sp.) (St. Louis & San Francisco R. R. Co.) Au. act Aug. 5, 1909. PLANS.—Approv. Aug. 19, 1910, 11, 1079.
- BLACK R.**, 10th Street, Port Huron, Mich. (S.) (City br.) PLANS.—Approv. June 20, 1897, 97, 534.
- BLACK R.**, Elwood Street, Port Huron, Mich. (S.) (City br.) PLANS.—Modified plans approv. Oct. 26, 1897, 98, 533.
- BLACK R.**, connecting Huron Avenue and Military Street, Port Huron, Mich. (S.) (City br.) PLANS.—Approv. June 8, 1912, 12, 1308.
- BLACK R.**, near Renton, Wash. (S.) (State br.) PLANS.—Approv. Oct. 15, 1910, 11, 1084.
- BLACK R.**, South Haven, Mich. (A.) PLANS.—Wooden br., narrow draw opening, partly obstr. navigation; an all-iron swinging br. to take its place under consideration, 89, 800, 2801.
- BLACK R.**, Still Bluff, N. C. (S.) (Fender County br.) PLANS.—Approv. July 5, 1900, 01, 661. Modified plans approv. Feb. 6, 1903 03, 648.
- BLACK R.**, Wash. (S.) (Seattle & Rainier Beach Ry. Co.) PLANS.—Approv. Sept. 11, 1896, 97, 531.
- BLACK ROCK H.**, Niagara R., and Erie Canal at Buffalo, N. Y. (O.) (International Br. Co. and Grand Trunk Ry. Co.) PLANS.—Alterations to be completed on or before Mar. 1, 1910, 08, 873.
- BLACK WARRIOR R.**, Demopolis, Ala. (S.) (Demopolis Improvement Co.) PLANS.—Approv. Apr. 4, 1906, 06, 805.
- BLACK WARRIOR R.** (Locust Fork of), Ala. (S.) (North Alabama R. R. Co.) PLANS.—Approv. Jan. 13, 1906, 06, 803.
- BLACK WARRIOR R.** (Locust Fork of), near Short Creek, Ala. (S.) (Ensley Southern Ry. Co.) PLANS.—Approv. Jan. 5, 1907, 07, 824.
- BLACK WARRIOR R.** (Mulberry Fork of), at foot of Sanders Shoals, Ala. (S.) (Walker County br.) PLANS.—Approv. Dec. 30, 1911, 12, 1303.
- BLACK WATER CREEK**, Dorchester County, Md. (S.) (County br.) PLANS.—Approv. Dec. 20, 1910, 11, 1085.
- BLACKWATER R.**, Fla. (S.) (Louisville & Nashville R. R. Co.) PLANS.—For rebuilding approv. Dec. 9, 1909, 10, 1026.
- BLACKWATER R.**, Bagdad, Fla. (S.) (Stearns & Culver Lumber Co.) PLANS.—Approv. Sept. 2, 1904, 05, 723.
- BLACKWATER R.**, South Quay, Va. (S.) (Br. of Nansemond and Southampton Counties.) PLANS.—Approv. Nov. 14, 1906, 07, 823.
- BLIND R.**, in St. John the Baptist and Livingston Parishes, La. (S.) (Lyon Cypress Lumber Co.) PLANS.—Approv. Aug. 16, 1910, 11, 1082.
- BLIND R.**, between Ascension and Livingston Parishes, La. (S.) (Lyon Cypress Lumber Co.) PLANS.—Approv. Nov. 2, 1910, 11, 1084.
- BLIND SLOUGH**, Ore. (Dr.) 02, 581.
- BLIND SLOUGH**, Ore. (S.) (Astoria & Columbia R. R. Co.) PLANS.—Submitted May 22, 1896; approv. Mar. 8, 1897, 97, 533.
- BLOUNTS CREEK**, Beaufort County, N. C. (S.) (Beaufort County br.) PLANS.—Approv. July 19, 1901, 02, 583.
- BLUE RUN** (Wekiva R.). (See Withlacoochee R.)
- BODINE CREEK**, Port Richmond, Staten Isld., N. Y. (S.) (Baltimore & Ohio R. R. Co., Staten Isld. Rapid Transfer R. R.) PLANS.—Rebuilding approv. June 21, 1906, 06, 808.
- BOEUF BAYOU**, at Avoca Plantation, La. (S.) (Avoca Drainage District Commission.) PLANS.—Approv. Apr. 1, 1912, 12, 1306.
- BOEUF BAYOU**, St. Mary and Assumption Parishes, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Recon. approv. Aug. 28, 1907, 08, 869.
- BOEUF BAYOU**, Lafourche Parish, La. (S.) (Bowie Lumber Co.) PLANS.—Approv. Mar. 28, 1904, 04, 717.
- BOEUF R.**, Rayville, La. (Sp.) (New Orleans & Northwestern Ry. Co.) PLANS.—Reconstr. approv. Jan. 7, 1902, 02, 582.
- BOGUE CHITTO**, Franklinton, Washington Parish, La. (S.) (Washington Parish br.) PLANS.—Br. to replace existing str. approv. Apr. 16, 1903, 03, 650.
- BOGUE PHALIA**, near Elizabeth, Miss. (S.) (Yazoo & Mississippi Valley R. R. Co.) PLANS.—Reconstr. approv. May 20, 1908, 08, 872.
- BOOTHBAY**, Me. (See Back R.)
- BOOTHBAY H.**, Me. (S.) (Town br.) PLANS.—Approv. June 5, 1901 01, 666.
- BOSTON H.** and tributaries, Mass. (Dr.) 10, 1019.
- BOSTON H.** (navigable waterway bet. Q Street and Castle Island), Mass. (Sp., etc.) (Board of Park Commissioners of Boston Mass.) LEGISLATION.—Commissioners au. to constr. br. under act Sept. 19 1890, sec. 7, and act of Massachusetts. PLANS.—Approv. Dec. 12, 1891, 92, 402.
- BOSTON H.**, Boston to E. Boston. (S.) COMMERCE.—Number of vessels that passed brs.

across Charles and Mystic Rs., 1867, **68**, 821. C. interests involved, **68**, 822. Discussion by Col. Foster of the injury to navigation thereby, **68**, 821; by Gov. Bullock, **68**, 826. Effect upon the interests of the U. S. navy yard at Charlestown, **68**, 823, 826.—Chief of Engineers. **R.**, **68**, 69. Objections apparent, **68**, 820. Senate Committee on C. asked views of Sec. of War on Senate bill 566. Views of Chief of Engineers, **68**, 820. LEGISLATION.—Act of Massachusetts incorporating the Maverick Br. Co., **68**, 824; passed over governor's veto, **68**, 823; veto message, **68**, 826. Act of Massachusetts au. purchase by U. S. of navy-yard site, **68**, 827. PLANS.—By Maverick Br. Co., **68**, 821. **R.** of Lt. Col. Foster on plan, **68**, 821.

BOSTON H., Fort Pt. Chan., Mass. (O.) (Boston city br., Congress Street br.) PLANS.—Alterations to be completed before Dec. 31, 1903, **03**, 652.

BOSTON H., Fort Pt. Chan., Mass. (O.) (Boston city br., Mount Washington Avenue br.) PLANS.—Alterations to be completed before Dec. 31, 1903, **03**, 652.

BRANDON CREEK, Manatee County, Fla. (S.) (Manatee County br.) PLANS.—Approv. Oct. 11, 1906, **07**, 822.

BRANDYWINE CREEK (4th Street extended, Wilmington, Del.). (Sp., etc.) (Cherry Isld. Marsh Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Delaware. PLANS.—Approv. Oct. 26, 1891. Completion of br. reported on May 12, 1892. **92**, 400.

BRANDYWINE CREEK, Wilmington, Del. (S.) (Brandywine Ry. Co.) PLANS.—Approv. Mar. 17, 1902, **02**, 587.

BRANDYWINE CREEK, Wilmington, Del. (S.) (Philadelphia, Baltimore & Washington R. R. Co.) PLANS.—Rebuilding approv. Apr. 13, 1903, **03**, 649, 650.

BRANDYWINE R. (connecting Moylan Avenue and 4th Street, Wilmington, Del.). (S.) (New Castle County br.) PLANS.—Reconstr. plans approv. Aug. 12, 1899, **99**, 623.

BRANDYWINE R., Del. (Dr.) **02**, 581.

BRAVE BOAT H., between Kittery and York, Me. (S.) (Portsmouth, Kittery & York Street Ry. Co.) PLANS.—Approv. June 18, 1897, **97**, 534.

BRAVS BAYOU, Harrisburg, Tex. (S.) (Galveston, Harrisburg & San Antonio Ry. Co.) PLANS.—Approv. Jan. 13, 1903, **03**, 647, 648.

BRAZOS R., Tex. (S.) (St. Louis, Brownsville & Mexico Ry. Co.) PLANS.—Approv. Oct. 6, 1905, **06**, 802.

BRAZOS R., at Brazoria, Tex. (S.) (Brazoria County br.) PLANS.—Approv. July 20, 1911, **12**, 1300.

BRAZOS R., Columbia, Tex. (S.) (Brazoria County br.) PLANS.—Approv. Feb. 12, 1894, **94**, 428; approv. July 20, 1911, **12**, 1300.

BRAZOS R., near Orchard, Tex. (S.) (Fort Bend County br.) PLANS.—Approv. July 20, 1911, **12**, 1300.

BRAZOS R., near Rosenberg, Tex. (S.) (Fort Bend County br.) PLANS.—Approv. Feb. 6, 1908, **08**, 871.

BRAZOS R., near Thompson, Tex. (S.) (Fort Bend County br.) PLANS.—Approv. July 20, 1911, **12**, 1299.

BRAZOS R., near Wellborn, Tex. (S.) (Missouri Valley Br. & Iron Co.) PLANS.—Approv. Nov. 12, 1907, **08**, 871.

BREACH INLET, between Sullivans Isld. and Long Isld., S. C. (S.) (Charleston Consolidated Ry., Gas & Electric Co. successors to the Charleston & Seashore R. R. Co.) PLANS.—Orig. company's plans approv. July 6, 1898, on condition that the drawspan be increased to 40' w. by Mar. 1, 1899, **98**, 536. Condition not complied with; company's request of Sept. 20, 1899, to be relieved of this requirement granted Nov. 29, 1899, **00**, 700.

BRICES CREEK. (See Swift Creek.)

BRIDGEPORT, Conn. (See Coscob, etc.) (Dr.) **07**, 815.

BRIDGEPORT H., Conn. (See Lewis Gut.)

BROAD CREEK, near Laurel, Del. (A.) (Philadelphia, Wilmington & Baltimore R. R. Co.) PLANS.—Alteration of br. draw made as required by act June 6, 1888, **90**, 335. Reconstr. approv. Mar. 21, 1901, **01**, 666.

BROAD CREEK R., near Laurel, Del. (S.) (Pennsylvania R. R. Co.) PLANS.—Reconstr. plans approv. Oct. 29, 1910, **11**, 1084; and modification of instrument in name of Philadelphia, Baltimore & Washington R. R. Co., lessee of Delaware R. R. Co., approv. Nov. 29, 1910, **11**, 1084.

BROAD CREEK, Va. (S.) (Elizabeth Park & Land Co.) PLANS.—Approv. Feb. 14, 1902, **02**, 587. New plans approv. June 17, 1912, and instrument dated Feb. 14, 1902, revoked, **12**, 1308.

BROAD R., near Columbia, S. C. (S.) (Columbia, Newberry & Laurens R. R. Co.) PLANS.—Reconstr. of existing br. approv. July 6, 1911, **12**, 1299.

BRONX (or Harlem) **KILLS.** (See East R.)

BRONX R., Westchester Avenue, New York City. (S.) (City br.) PLANS.—Permanent and a temporary br. approv. Dec. 2, 1897, **98**, 534. Approv. Jan. 30, 1901, in lieu of plans approv. Dec. 2, 1897, **01**, 664.

BRONX R., Westchester Avenue, New York, N. Y. (S.) (Harlem R. & Port Chester R. R. Co., New York, New Haven & Hartford system.) PLANS.—Rebuilding approv. July 13, 1905, **06**, 801.

BRONX R., below West Farms, N. Y. (S.) (Harlem R. & Portchester R. R. Co.) PLANS.—Reconstr. plans approv. May 17, 1893, **93**, 469.

BUCKHANNON R. (See Ohio R., etc.)

BUFFALO BAYOU, Tex. (Sp.) (Galveston, La Porte & Houston Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 1, 1895. PLANS.—Approv. Sept. 30, 1895, 96, 422.

BUFFALO BAYOU, Houston, Tex. (S.) (City br.) PLANS.—Approv. Mar. 12, 1894, 94, 428. Plans for a br. between Hill and Marsh Streets in lieu of the one above (to connect Factory and Bayou Streets), approv. Sept. 4, 1895, 96, 424.

BUFFALO BAYOU, Houston, Tex. (O.) (Gulf, Colorado & Santa Fe Ry. Co.) PLANS.—Specified alterations to R. R. br. required on or before Oct. 11, 1892, 92, 412.

BUFFALO BAYOU, near Houston, Tex. (O.) (San Antonio & Aransas Pass R. R. Co.) PLANS.—Specified alterations required in 1892, completed on or before Jan. 24, 1893, 93, 473.

BUFFALO BAYOU, near Houston, Tex. (S.) (Harris County br.) PLANS.—Approv. Jan. 17, 1896, 96, 425.

BUFFALO BAYOU, San Jacinto Street, Houston, Tex. (O.) (City br.) PLANS.—Specified alterations to highway br. required on or before Oct. 14, 1892, 92, 412.

BUFFALO BAYOU, at Houston, Tex. (S.) (Houston Belt & Terminal Ry. Co.) PLANS.—Approv. May 10, 1910, 10, 1030.

BUFFALO BAYOU, McKee Street, Houston, Tex. (S.) (Harris County br.) PLANS.—Approv. June 1, 1904, 04, 719.

BUFFALO CREEK (R.), Ohio Street, Buffalo, N. Y. (S.) (City br.) PLANS.—Approv. July 13, 1904, 05, 722.

BUFFALO CREEK, near Buffalo, N. Y. (S.) (Lake Shore & Michigan Southern Ry. Co.)

PLANS.—Reconstr. of existing br. approv. July 8, 1911, 12, 1299. New plans approv. Mar. 16, 1912, and instrument dated July 8, 1911, canceled, 12, 1306.

BUFFALO CREEK, city of Buffalo, N. Y. (S.) (Buffalo Creek R. R.) PLANS.—Approv. Jan. 10, 1912, 12, 1304.

BUFFALO LAKE, Packwaukee, Wis. (S.) (Packwaukee town br.) PLANS.—Approv. Aug. 22, 1905, 06, 801.

BUFFALO LAKE (a portion of Fox R.), near Packwaukee, Wis. (S.) (Milwaukee, Sparta & Northwestern Ry. Co.) PLANS.—Approv. Aug. 12, 1910, and modified plans Jan. 26, 1911, 11, 1082, 1086.

BUFFALO and WHITE OAK BAYOUS, at Houston, Tex. (S.) (City br.) PLANS.—Approv. Nov. 6, 1911, 12, 1302.

BULLOCKS COVE (arm of Narragansett B.), R. I. (S.) (Hope Land Co.) PLANS.—Approv. Apr. 7, 1906, 06, 805.

BURNHAMS CANAL, Milwaukee, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Reconstr. approv. Nov. 23, 1906, 07, 823.

BUSH R., Md. (S.) (Philadelphia, Baltimore & Washington R. R. Co., through the Pennsylvania R. R. Co.) PLANS.—Reconstr. existing br. approv. Mar. 19, 1912, 12, 1306.

BUTLER (back) R., Ga. (See Altamaha R.)

BUTTERMILK B., Bourne and Wareham, Mass. (S.) (Middleboro, Wareham & Buzzards B. Street Ry. Co.) PLANS.—Approv. July 18, 1901, 02, 583.

C.

- CABANOSSE** (Grand) **BAYOU**, La. (S.) (Bowie Lumber Co., Ltd.) PLANS.—Approv. Aug. 7, 1906, **07**, 821.
- CACHE R.**, Ark. (Dr.) **07**, 815.
- CACHE R.**, Ark. (O.) (See Petit Jean R.) (Choctaw, Oklahoma & Gulf R. R. Co.) PLANS.—Specified alterations required on or before Aug. 1, 1900, **00**, 703.
- CACHE R.**, Cottonplant, Ark. (S.) (Woodruff County br.) PLANS.—Approv. May 22, 1907, **07**, 827.
- CACHE R.**, Woodruff County, Ark. (Sp.) (Missouri & North Arkansas R. R. Co.) Au. act Feb. 1, 1908. PLANS.—Approv. May 26, 1908, **08**, 868.
- CACHE R.**, Woodruff County, Ark. (S.) (County br.) PLANS.—Approv. Jan. 26, 1911, **11**, 1086.
- CAHABA R.**, in Bibb County, Ala. (Sp.) (Mobile & Ohio R. R. Co.) LEGISLATION.—Company au. to constr. br. by act June 11, 1896. PLANS.—Approv. June 16, 1897, **97**, 530.
- CAHABA R.**, Ala. (8 and 16 m. above its mouth). (A.) (Selma & New Orleans R. R. and the Alabama Central R. R.) PLANS.—Descriptions of the brs., **88**, 2550. Both brs. fixed str., impassable during the navigable stage of the R.; should have draw openings of 100', **88**, 2551, 2553.
- CALCASIEU R.**, Lake Charles, La. (S.) (Kansas City, Shreveport & Gulf Ry. Co.) PLANS.—Approv. Sept. 14, 1896, **97**, 531.
- CALCASIEU R.**, La. (Dr.) **08**, 865.
- CALCASIEU R.**, La. (S.) (Southern Pacific Co., on line of Louisiana Western R. R.) PLANS.—Approv. Feb. 10, 1903, **03**, 648.
- CALCASIEU R.**, Calcasieu Parish, La. (S.) (Lake Charles & Northern R. R. Co.) PLANS.—Approv. Feb. 26, 1907, **07**, 825.
- CALOOSAHATCHEE R.**, ferry crossing, Alva, Lee County, Fla. (S.) (Lee County br.) PLANS.—Approv. Dec. 18, 1902, **03**, 647.
- CALOOSAHATCHEE R.**, Beautiful Isld., Fla. (S.) (Florida Southern R. R. Co.) PLANS.—Approv. Apr. 6, 1903, **03**, 649.
- CALOOSAHATCHEE R.**, Denaud, Fla. (S.) (Lee County br.) PLANS.—Approv. May 8, 1907, **07**, 827.
- CALOOSAHATCHEE R.**, Labelle, Fla. (S.) (Br. of Lee and De Sota Counties.) PLANS.—Approv. Oct. 28, 1908, **09**, 915.
- CALUMET R.**, Ill. and Ind. (Dr.) **04**, 711, **05**, 719; **07**, 815.
- CALUMET R.**, Ill. (A.) PLANS.—List of br. forming an obstr. to the R., with changes suggested for each, **88**, 2583, 2650, 2651.
- CALUMET R.**, Ill. (Sp.) (Hammond & Blue Isld. R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 28, 1896. PLANS.—Modified plans approv. Aug. 11, 1896, **96**, 424.
- CALUMET R.**, Ill. (S.) (Michigan Central R. R. Co.) PLANS.—For rebuilding approv. Oct. 28, 1902, **03**, 647.
- CALUMET R.**, S. Chicago, Ill. (A.) (Baltimore & Ohio R. R. Co.) PLANS.—Reconstr. plans submitted Dec. 23, 1893; modified Jan. 26, 1894; approv. Mar. 1, 1894, **94**, 430. Change in location of p. requested Oct. 5, 1899; approv. Oct. 25, 1899, **00**, 699.
- CALUMET R.**, S. Chicago, Ill. (Sp.) (Lake Shore & Michigan Southern R. R. Co.) LEGISLATION.—Company au. to reconstr. br. by act Mar. 3, 1893, **94**, 425. PLANS.—Submitted Dec. 23, 1893; modified Jan. 26, 1894; approv. Mar. 1, 1894, **94**, 425.
- CALUMET R.**, S. Chicago, Ill. (Sp.) (Calumet & Blue Isld. Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 1, 1893; amending act, June 8, 1894. PLANS.—Approv. Oct. 3, 1894, **95**, 473.
- CALUMET R.**, 95th Street, Chicago, Ill. (S.) (City br.) PLANS.—Reconstr. plans approv. June 15, 1900, **00**, 701.
- CALUMET R.**, Chicago, Ill. (Sp.) (Chicago & Western Indiana R. R. Co.) Au. act Aug. 5, 1909. PLANS.—Approv. Sept. 14, 1909, **10**, 1020.
- CALUMET R.**, in Chicago, Ill. (O.) (Pennsylvania, Lake Shore & Michigan Southern, and Baltimore & Ohio R. R. Cos.) PLANS.—Alterations to be completed on or before 2 years from Feb. 23 and 25, and Mar. 18, 1910, **10**, 1031.
- CALUMET R.**, 92d Street, Chicago, Ill. (Sp.) (City br.) PLANS.—For br. to replace existing str. approv. Nov. 12, 1908, **09**, 913.
- CALUMET R.**, near E. Chicago and Gary, Ind. (Sp.) (Chicago, Lake Shore & South Bend Ry. Co.) Au. act Feb. 5, 1907. PLANS.—Approv. Feb. 16, 1907, **07**, 818.
- CALUMET R.**, near the forks, Cook County, Ill. (Sp.) (Kensington & Eastern R. R. Co.) Au. act Feb. 7, 1905, and Mar. 5, 1906. PLANS.—Approv. Dec. 18, 1906, **07**, 818.

- CALUMET R.**, Cummings, Ill. (Sp.) (New York, Chicago & St. Louis R. R. Co.) Au. act July 1, 1902. PLANS.—To replace existing str. approv. Jan. 15, 1903, **03**, 643, 644.
- CALUMET R.**, near Gary, Ind. (Sp.) (Chicago, Lake Shore & Eastern Ry. Co.) Au. act Mar. 3, 1909. PLANS.—Approv. Apr. 26, 1909, **09**, 913.
- CALUMET R.**, near Hyde Park (now annexed to the city of Chicago), Ill. (A.) PLANS.—Wagon-road br. across the R. obliquely, **89**, 2799.
- CALUMET R.**, Ill., near the Illinois and Indiana State line. (A.) (Chicago & Calumet R. R. Co.) PLANS.—Chicago & Calumet R. R. br., upon completion of the Calumet R. imp. as projected, would have 1 draw span that could not be used at all, and the other would be contracted to 59', which is too narrow, **89**, 2799.
- CALUMET (Little Calumet) R.**, Riverdale, Ill. (S.) (Pittsburgh, Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Approv. Feb. 14, 1839, **99**, 622.
- CALUMET R.**, Hammond, Ind. (S.) (Chicago, Indianapolis & Louisville Ry. Co.) PLANS.—Reconstr. plans for the superstr. and strengthening abutments approv. Aug. 2, 1899, **99**, 623.
- CALUMET R.**, Columbia Avenue, Hammond, Ind. (Sp.) (Lake County br.) Au. act Feb. 5, 1907. PLANS.—Approv. Mar. 12, 1907, **07**, 818.
- CALUMET R.**, Hammond, Ind. (Sp.) (New York, Chicago & St. Louis R. R. Co., and Chicago & Erie R. R. Co.) Au. act July 1, 1902. PLANS.—Approv. Nov. 13, 1903, **04**, 711.
- CALUMET R.**, Hammond, Ind. (Sp.) (Chicago, Indianapolis & Louisville R. R. Co.) Au. act Feb. 20, 1908. PLANS.—Reconstr. approv. July 29, 1908, **09**, 912.
- CALUMET (Little Calumet) R.**, Riverdale, Ill. (S.) (Illinois Central R. R. Co.) PLANS.—Approv. Jan. 30, 1901, **01**, 664.
- CALUMET (Grand) R.**, Ind. (Sp.) (Gary Land Co.) Au. act June 16, 1910. PLANS.—Approv. Sept. 12, 1910, **11**, 1079. (Possibly 2 separate brs. under this head.)
- CALUMET (Grand) R.**, Ind. (Township 36). (Sp.) (Gary Land Co.) PLANS.—Approv. Sept. 12, 1910, **11**, 1079.
- CAMBRIDGE H.**, Cambridge, Md. (S.) (Dorchester County br.) PLANS.—Alteration plans approv. July 11, 1894, **94**, 429.
- CANE R.**, at Bermuda, Natchitoches Parish, La. (S.) (Police jury br.) PLANS.—Approv. June 8, 1911, **11**, 1090.
- CANE R.**, Derry Station, La. (S.) (Natchitoches Parish br.) PLANS.—Approv. May 12, 1904, **04**, 718.
- CANE R.**, at Natchitoches, La. (Sp.) (Natchitoches Cane R. Br. Co.) LEGISLATION.—Constr. au. by act Apr. 22, 1890; amending act Jan. 9, 1893, **93**, 465. PLANS.—Approv. July 1, 1893, **93**, 465.
- CANEY FORK R.**, Ballards Ferry, Tenn. (S.) (Carthage & Granville Br. Co.) PLANS.—Approv. Mar. 6, 1907, **07**, 825.
- CANEY FORK R.**, Buffalo Valley, Tenn. (S.) (Southern Ry. Co.) PLANS.—Reconstr. approv. Dec. 11, 1906, **07**, 824.
- CANEY FORK R.**, Smith and Putham Counties, Tenn. (Sp.) (Nashville & Knoxville R. R. Co.) LEGISLATION.—Au. by acts Mar. 3, 1885; amended Feb. 25, 1889. PLANS.—Plan and location submitted, and approv. by Sec. of War, Dec. 12, 1889, **90**, 337.
- CANEY FORK R.**, near Trousdale Ferry, Tenn. (S.) (Cane Fork br.) PLANS.—Approv. July 26, 1904, **05**, 722.
- CANOE PASS.** (See Deception Pass.)
- CAPE FEAR R.**, N. C. (See Northeast R.)
- CAPE FEAR R.**, Fayetteville, N. C. (Sp.) (Yadkin Valley Ry. Co.) LEGISLATION.—Company au. to constr. br. by act June 6, 1888. PLANS.—Approv. Dec. 1, 1888, **89**, 369.
- CAPE FEAR R.**, Navassa, N. C. (S.) (Wilmington Ry. Br. Co.) PLANS.—Reconstr. plans approv. Aug. 20, 1898, **98**, 537.
- CAPE FEAR R.**, at Navassa Guano Factory, N. C. (O.) (Wilmington Ry. Br. Co.) PLANS.—Alterations to be completed on or before 1 year from June 27, 1910, **10**, 1032.
- CAPE FEAR R.** (NE. branch), Hilton, N. C. (S.) (Wilmington Ry. Br. Co.) PLANS.—Reconstr. plans approv. Aug. 20, 1898, **98**, 537.
- CAPE FEAR R.** (NE.), above Wilmington, N. C. (A.) (Wilmington, Columbia & Augusta R. R. Co.) PLANS.—Capt. Bixby recom. the removal of a sunken p. obstr. the draw, at the expense of the U. S., and that the R. R. be required to provide suitable fenders for the draw opening, **88**, 2547.
- CAPE FEAR R.** (NE.), above Wilmington, N. C. (A.) (Wilmington & Weldon R. R. Co.) PLANS.—Capt. Bixby recom. that the owners be required to provide br. with suitable draw, 40'-60' wide, **88**, 2547.
- CAPE ISLD. CREEK**, at Schellingers Landing, N. J. (S.) (Cape May County br.) PLANS.—To replace existing br. approv. Feb. 25, 1910, **10**, 1028.
- CAPE JELLISON H.**, Stockton Springs, Me. (S.) (Northern Maine Seaport Ry. Co.) PLANS.—Approv. June 27, 1905, **05**, 728.
- CAPE NEDDICK R.**, York, Me. (S.) (Atlantic Shore Line Ry. Co.) PLANS.—Approv. Nov. 21, 1906, **07**, 823.
- CASCO B.**, between Cousins and Littlejohns Islds., Me. (S.) (Yarmouth br.) PLANS.—Plans submitted May 10, 1895; approv. May 8, 1897, **97**, 534.
- CASPER (Gasper) R.**, near its mouth, Ky. (O.) (Warren County br.) PLANS.—Br. to be raised 6', to make its clear height above pool level 24.6', on or before July 1, 1892, **92**, 411.

CEDAR CREEK, at Lake Side Park, Jacksonville, Fla. (S.) (Johnson & Hyde.) PLANS.—Approv. June 25, 1910, **10**, 1031.

CERRITOS SLOUGH, Long Beach, Cal. (S.) (Los Angeles Dock & Terminal Co.) PLANS.—Approv. Aug. 22, 1906, **07**, 821.

CERRITOS SLOUGH, Long Beach, Cal. (S.) (San Pedro, Los Angeles & Salt Lake R. R. Co.) PLANS.—For reconstr. approv. Nov. 7, 1906, **07**, 823.

CERRITOS SLOUGH, Long Beach, Cal. (S.) (Los Angeles Interurban Ry. Co.) PLANS.—Two trestle brs. approv. Jan. 19, 1910, **10**, 1026.

CHARLES R., Mass. (O. and A.) COMMERCE.—C. interests affected, **90**, 3474. Chief of Engineers. **R.**, **90**, 340. BE. Convened at Boston, Mass., Feb. 1, 1890, by S. O. No. 82, to report upon the brs. crossing Charles R. which interfered with navigation. Draw openings of the Charles R. and Warren brs. of insufficient width. **90**, 3482. Descriptions of existing brs., **90**, 3471, 3474. LEGISLATION.—Notices served upon br. owners as to alterations required, **90**, 340.

CHARLES R., between the R. mouth and E. Cambridge. (A.) (Boston & Maine and the Eastern and Boston & Lowell R. Rs.) PLANS.—Delays in opening draws, caused by frequent passage of trains, not to be obviated by any practical alteration of the brs., **88**, 2528.

CHARLES R., Boston and Cambridge, Mass. (S.) (Boston & Maine R. R. Co.) PLANS.—Alterations submitted Jan. 31, 1893; approv. Feb. 3, 1893, on condition that in 10 years the company rebuild on st. or iron ps. all its brs. over Charles R., **93**, 467. Reconstr. approv. Sept. 15, 1904, **05**, 724.

CHARLES R. (W. Boston br.), between Boston and Cambridge, Mass. (S. and Sp.) (Cambridge city br.) LEGISLATION.—City au. to constr. new br. by act Mar. 29, 1900, **00**, 697. PLANS.—For temporary br. to be used during reconstr. of W. Boston br., approv. Sept. 14, 1898, **99**, 620. Plans for a drawless br. to replace existing str. approv. June 5, 1900, **00**, 697.

CHARLES R., Boston, Mass. (O.) (Boston & Maine R. R. Co.; Eastern R. R. Co., controlled by Boston & Maine R. R. Co.; and Boston & Lowell R. R. Co., controlled by Boston & Maine R. R. Co.) PLANS.—Alterations to 4 R. R. brs. required by Jan. 1, 1891, **89**, 375.

CHARLES R., Boston, Mass. (S.) (Boston Transit br.) PLANS.—Reconstr. plans approv. Dec. 27, 1895, **96**, 425.

CHARLES R., at Boston, Mass. (O.) (Charles R. br. and Warren br.) PLANS.—Alterations required by Jan. 1, 1891, **89**, 375.

CHARLES R., Boston (city limits). (O.) (Fitchburg R. R. Co.) PLANS.—Alterations required by Jan. 1, 1891, **89**, 374.

CHARLES R., Boston, Mass. (S.) (State br.) PLANS.—For temporary br. on site of Boston & Maine R. R. br., approv. Sept. 1, 1904, **05**, 723.

CHARLES R., Market and Arsenal Street Boston, Mass. (Sp.) (City br.) LEGISLATION.—City au. to reconstr. brs. under a Sept. 19, 1890. PLANS.—For rebuilding the drawways approv. July 20, 1892, **92**, 407.

CHARLES R., W. Boston, Mass. (O.) (W. Boston br., and canal, or Craigies br.) PLANS.—Alterations required by Jan. 1, 1891, **89**, 375, 37.

CHARLES R., Cambridge and Boston, Mass. (S.) (Cambridge city br.) PLANS.—Approv. May 27, 1905, **05**, 727.

CHARLES R., at Brookline Street, Cambridge and Essex Street, Boston, Mass. (S.) (Cambridge City br.) PLANS.—For rebuilding approv. Dec. 10, 1904, **05**, 725.

CHARLES R., Boston and Cambridge, Mass. (S.) (New York Central & Hudson R. R. Co., lessee of Boston & Albany R. R.) PLANS.—For rebuilding approv. Dec. 10, 1904, **05**, 725.

CHARLES R., Boston and Cambridge, Mass. (S.) (Boston Elevated Ry. Co.) PLANS.—Approv. Aug. 15, 1907, **08**, 889.

CHARLES R., between Boston and Cambridge Mass. (Sp.) (Metropolitan Park Commission Mass.) Au. act Feb. 27, 1911. PLANS.—Approv. Apr. 24, 1912, **12**, 1298.

CHARLEVOIX H., Mich. (Dr.) **12**, 1294.

CHARLEVOIX H., Mich., between Round Lake and Lake Michigan. (A.) (Iron highway br.) PLANS.—No complaints made, although delay sometimes caused in opening the draw from slowness, **89**, 2800.

CHARTERS CREEK, McKees Rocks, Pa. (S.) (George Orbin Br. Co.) PLANS.—Approv. May 27, 1907, **07**, 827.

CHATTAHOOCHEE R., Ala. (Dr.) **06**, 797.

CHATTAHOOCHEE R., Alaga, Ala. (Sp.) (Atlantic Coast Line R. R. Co.) Au. act Aug. 6, 1888. PLANS.—For reconstr. approv. May 24, 1911; new plans approv. Oct. 31, 1911, **11**, 1081; **12**, 1297, 1302.

CHATTAHOOCHEE R., Columbia, Ala. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. by act Apr. 16, 1896. PLANS.—Modified plans approv. June 9, 1896, **96**, 423.

CHATTAHOOCHEE R., Eufula and Fort Gaines, Ga. and Ala. (A.) (2 wagon brs. and the Southwestern R. R. br.) PLANS.—Introduction of a draw of suitable width with sheer booms recom. in each case, **88**, 2553.

CHATTAHOOCHEE R., at or near Gordon, Ala. (Sp.) (Alabama Midland Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 6, 1888. PLANS.—Approv. June 12, 1889, **89**, 372.

CHAUMONT R., near Chaumont, N. Y. (O.) (New York Central & Hudson R. R. Co.) PLANS.—Specified alterations to be completed within 9 months from Oct. 25, 1901; time extended to Apr. 1, 1903, **02**, 590.

CHAUMONT R., near its mouth, N. Y. (O.) (New York Central & Hudson R. R. Co., and the city of Lyme, N. Y.) PLANS.—Al-

terations to be completed on or before June 15, 1910, **10**, 1031.

CHEEHAN R. (See Ashley R.)

CHEAT R., Pt. Marion, Pa. (S.) (State Line R. R. Co.) PLANS.—Approv. Sept. 24, 1892, **93**, 466.

CHEAT R., Pt. Marion and Springhill, Pa. (S.) (Payette County br.) PLANS.—Approv. Mar. 26, 1907, **07**, 826. Modified plans in lieu thereof approv. Aug. 21, 1907, **08**, 869.

CHEBOYGAN R., near Cheboygan, Mich. (S.) (Detroit & Mackinac Ry. Co.) PLANS.—Approv. Mar. 23, 1904, **04**, 717.

CHEESEQUAKE CREEK, N. J. (S.) (Jersey Central Traction Co.) PLANS.—Approv. June 27, 1903, **03**, 650.

CHEESEQUAKE CREEK, near its mouth, N. J. (S.) (Middlesex County br.) PLANS.—Reconstr. plans approv. Apr. 7, 1911, **11**, 1088.

CHEF MENTEUR PASS, La. (O.) (Louisville & Nashville R. R. Co.) PLANS.—Alterations to be completed on or before 6 months from Sept. 3, 1910, **11**, 1091.

CHEHALIS R., between Aberdeen and Cosmopolis, and Johns R., near its confluence with Grays H., Wash. (Sp.) (Tacoma, Olympia & Grays H. Co.) LEGISLATION.—Company au. to constr. brs. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—For the 2 brs. approv. Feb. 9, 1891, **91**, 430.

CHEHALIS R., Aberdeen, Wash. (S.) (City br.) PLANS.—Approv. Nov. 19, 1903, **04**, 715.

CHEHALIS R., Aberdeen, Wash. (S.) (Grays Harbor & Puget Sound Ry. Co.) PLANS.—Approv. June 20, 1907, **07**, 828. Modified plans in lieu thereof approv. Dec. 9, 1907, **08**, 871. New plans, Jan. 19, 1910, **10**, 1026.

CHEHALIS R., near Centralia, Wash. (S.) (Grays Harbor & Puget Sound Ry. Co.) PLANS.—Approv. Dec. 23, 1908, **09**, 916.

CHEHALIS R., Elbow Riffle, Chehalis County, Wash. (County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington, **92**, 405. PLANS.—Approv. May 14, 1892, **92**, 405. Reconstr. approv. Apr. 2, 1904, **04**, 717.

CHEHALIS R., at Montesano and Wynooche, Wash. (S.) (Chehalis County br.) PLANS.—Approv. May 27, 1910, and modified plans approv. July 19, 1910, **10**, 1030; **11**, 1082.

CHEHALIS R., near Montesano, Wash. (S.) (Oregon-Washington R. R. & Navigation Co.) PLANS.—Approv. June 7, 1912, **12**, 1307.

CHEHALIS R., Porter, Wash. (S.) (Chehalis County br.) PLANS.—Approv. July 31, 1905, **06**, 801.

CHAHALIS R., near Rochester, Wash. (S.) (Chicago, Milwaukee & Puget Sound Ry. Co.) PLANS.—Approv. Feb. 16, 1910, **10**, 1027.

CHELSEA CREEK, Chelsea Street, Boston, Mass. (S.) (Boston city br.) PLANS.—For rebuilding br. approv. May 7, 1894, **94**, 428.

CHELSEA CREEK, Boston to Chelsea, Mass. (S.) (Boston & Albany R. R. Co.) PLANS.—Reconstr. approv. July 28, 1900, **01**, 662.

CHELSEA CREEK, Boston and Chelsea, Mass. (S.) (Boston & Albany R. R. Co., New York Central & Hudson R. R. Co., lessee.) PLANS.—Rebuilding approv. June 16, 1908, **08**, 873.

CHELSEA CREEK, Boston and Chelsea, Mass. (S.) (City br.) PLANS.—Reconstr. approv. June 29, 1908, **08**, 873.

CHELSEA CREEK, at Meridian Street, Boston, Mass. (S.) (City br.) PLANS.—Reconstr. of existing br. approv. July 20, 1911, **12**, 1300.

CHEVRENIL BAYOU and BAY OF CHEVRENIL, opposite Thibodeaux, La. (S.) (Brs. of Highway Department, La.) PLANS.—Approv. July 1, 1911, **12**, 1299.

CHESTER CREEK. (See Schuylkill R.)

CHICAGO R., Ill. (Dr.) **07**, 815.

CHICAGO R., Canal Street, Chicago, Ill. (O.) BE.—Convened by S. O. No. 39, to ex. and R. on br., recom. (1) removal of the pivot p., the protection wings or br. rests, and all the adjuncts obstr. navigation; (2) postponement of further constr. until the R. should have been so widened as to provide for the full opening of the s. draw; (3) provision be made when the br. is restored for maneuvering it by steam power, **91**, 3864. (Majs. Ludlow and Davis and Capt. Marshall.) PLANS.—Alterations required by May 1, 1892, **91**, 436.

CHICAGO R., Chicago, Ill. (O.) (Illinois Central R. R. Co.) PLANS.—Alterations to be completed on or before Apr. 15, 1904; subsequently extended to July 15, 1904, **04**, 721.

CHICAGO R., Dearborn Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Dec. 27, 1905, **06**, 803.

CHICAGO R., Harrison Street, Troop Street, and Ashland Avenue, Chicago, Ill. (S.) (Brs. of Sanitary District.) PLANS.—Reconstr. approv. Sept. 14, 1900, **01**, 662.

CHICAGO R., 19th Street, Chicago, Ill. (S.) (Pittsburgh, Fort Wayne & Chicago R. R. Co.) PLANS.—Approv. Apr. 17, 1907; modified plans approv. Dec. 15, 1908, **09**, 916.

CHICAGO R., Orleans and Franklin Streets, Chicago, Ill. (S.) (City br.) PLANS.—Approv. July 23, 1907, **08**, 868.

CHICAGO R., State Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Oct. 28, 1902, **03**, 646, 647.

CHICAGO R., Wells Street br. (e. of), Chicago, Ill. (S.) (Lake Street Elevated R. R. Co.) PLANS.—Approv. July 13, 1894, **94**, 429.

CHICAGO R., Wells Street (e. of), Chicago, Ill. (S.) (North Western Elevated R. R. Co.) PLANS.—Submitted Apr. 21, 1894; modified May 24, 1894; approv. June 2, 1894, **94**, 428.

CHICAGO R., N. Branch, near Belmont Avenue, Chicago, Ill. (City br.) PLANS.—Temporary

- br. approv. Apr. 25, 1911, and modified plans approv. May 13, 1911, **11**, 1089.
- CHICAGO R.**, N. Branch, Cherry Street, Chicago, Ill. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Reconstr. approv. Feb. 19, 1901, **01**, 665.
- CHICAGO R.**, N. Branch, at Chicago Avenue, Chicago, Ill. (O.) (S.) (City br.) PLANS.—Alterations to be completed on or before May 31, 1914, **11**, 1091. Temporary br., during reconstr. of existing br., approv. July 10, 1911, **12**, 1299.
- CHICAGO R.**, N. Branch, Clybourne Place (near), Chicago, Ill. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Reconstr. plans approv. Sept. 20, 1898, **99**, 620.
- CHICAGO R.**, N. Branch, Clybourne Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Oct. 23, 1900, **01**, 663.
- CHICAGO R.**, N. Branch, Diversey Avenue, Chicago, Ill. (S.) (Chicago city br.) PLANS.—Approv. June 22, 1895, **95**, 479.
- CHICAGO R.**, N. Branch, Division Street, Chicago, Ill. (S.) (Chicago city br.) PLANS.—Reconstr. approv. July 28, 1900, **01**, 662; May 10, 1901, **01**, 666.
- CHICAGO R.**, N. Branch, Erie Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Aug. 15, 1907, **08**, 869.
- CHICAGO R.**, N. Branch, Fullerton Avenue, Chicago, Ill. (S.) (Chicago city br.) PLANS.—Reconstr. of br. approv. June 19, 1895, **95**, 479.
- CHICAGO R.**, N. Branch, Indiana Street, Chicago, Ill. (O.) (City br.) PLANS.—Alterations to be completed on or before May 30, 1912, **09**, 920; **10**, 1031.
- CHICAGO R.**, N. Branch, near Indiana Street, Chicago, Ill. (S.) (City br.) PLANS.—For foot pontoon br. approv. Sept. 25, 1911, **12**, 1301.
- CHICAGO R.**, N. Branch, Kinzie Street (near), Chicago, Ill. (Sp.) (Chicago & North Western Ry. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and by Chicago, **91**, 432. PLANS.—Approv. Aug. 3, 1891, **91**, 432. Reconstr. approv. Oct. 11, 1906 **07**, 822.
- CHICAGO R.**, N. Branch, near Kinzie Street, Chicago, Ill. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Reconstr. approv. Oct. 11, 1906, **07**, 822.
- CHICAGO R.**, N. Branch, near Kinzie Street, Chicago, Ill. (S.) (City br.) PLANS.—Reconstr. approv. Oct. 12, 1906, **07**, 822.
- CHICAGO R.**, N. Branch, North Avenue, Chicago, Ill. (S.) (City br.) PLANS.—Approv. June 22, 1904, **04**, 719. Temporary br. to be used during constr. of permanent str., approv. Sept. 2, 1905, **06**, 801.
- CHICAGO R.**, N. Branch, N. Halsted Street, Chicago, Ill. (S.) (City br.) PLANS.—Modified reconstr. plans approv. Oct. 3, 1895, **96**, 425.
- CHICAGO R.**, N. Branch, Western Avenue, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Oct. 11, 1902, **03**, 646.
- CHICAGO R.**, N. Branch Canal, N. Halsted Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. June 23, 1905; modified plans approv. Nov. 20, 1906, **05**, 728; **07**, 823.
- CHICAGO R.**, N. Branch Canal, Weed Street, Chicago, Ill. (S.) (Temporary city br. PLANS.—Approv. Dec. 7, 1904, **05**, 725.
- CHICAGO R.**, S. Branch, Chicago, Ill. (S. (Van Buren Street and the West Side Elevator R. R. Co., between Jackson and Van Buren Streets, city brs. at.) PLANS.—Submitted jointly by the city and R. R. company. Hearing given protesting parties, and in accordance with recom. of Capt. Marshall the city br. a Van Buren Street was au. Nov. 16, 1893, to be reconstr. and the R. R. br., upon removal of obstrs. caused by the existing Van Buren Street br., to be constr. Application for a slight change in the approv. location of ps. approv. Mar. 27, 1894, **94**, 427.
- CHICAGO R.**, S. Branch, Archer Avenue, Chicago, Ill. (S.) (City br.) PLANS.—Rebuildings approv. Oct. 30, 1902; modified plans approv. May 10, 1904, **04**, 718.
- CHICAGO R.**, S. Branch, Canal Street, Chicago, Ill. (S.) (City br.) PLANS.—New br. approv. May 18, 1900, **00**, 701.
- CHICAGO R.**, S. Branch, 18th Street and a Loomis Street, Chicago, Ill. (S.) (City br. PLANS.—Reconstr. approv. Mar. 7, 1903, **03** 649.
- CHICAGO R.**, S. Branch, Harrison Street, Chicago, Ill. (S.) (City br.) PLANS.—Modified plans approv. Sept. 13, 1904, **05**, 724.
- CHICAGO R.**, S. Branch, Lake Street, Chicago, Ill. (O.) (City br.) PLANS.—Alterations to be completed before Dec. 31, 1912, **09**, 920; **10** 1031.
- CHICAGO R.**, S. Branch, Loomis Street, Chicago, Ill. (S.) (Sanitary District br.) PLANS.—Plans for br. to replace existing str. approv. June 23, 1902, **02**, 589.
- CHICAGO R.**, S. Branch, near 19th Street, Chicago, Ill. (A.) (Pittsburgh, Fort Wayne & Chicago R. R. Co.—Controlled by the Pennsylvania R. R. Co.) PLANS.—Alteration plan partly meeting requirements, approv. Feb. 11 1893; work to be completed by May 1, 1893, **93** 472.
- CHICAGO R.**, S. Branch, Polk Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Nov. 26 1907, **08**, 871.
- CHICAGO R.**, S. Branch, Randolph Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Oct. 20, 1902, **03**, 646.
- CHICAGO R.**, S. Branch, near 16th Street, Chicago, Ill. (O.) (St. Charles Air Line. PLANS.—Alterations to be completed on or before May 1, 1914, **12**, 1309.
- CHICAGO R.**, S. Branch, S. Halsted Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Jan. 13, 1893, **93**, 467.
- CHICAGO R.**, S. Branch, at Stewart Avenue, Chicago, Ill. (Pennsylvania Co.—Operating

- Pittsburgh, Fort Wayne & Chicago Ry. Co.) Reconstr. approv. Apr. 17, 1907, **07**, 826. PLANS.—Modified plans approv. Dec. 15, 1908. New plans approv. Aug. 21, 1911, and instrument dated Dec. 15, 1908, revoked, **12**, 1301.
- CHICAGO R.**, S. Branch, Taylor Street, Chicago, Ill. (S.) (City br.) PLANS.—Reconstr. plans approv. Mar. 10, 1899, **99**, 622.
- CHICAGO R.**, S. Branch, Taylor Street (s. of), Chicago, Ill. (S.) (Chicago Terminal Transfer Ry. Co.) PLANS.—Reconstr. plans approv. Jan. 13, 1899. Old br. removed to new site and used pending reconstr., **99**, 622.
- CHICAGO R.**, S. Branch, at 12th Street, Chicago, Ill. (O.) (City br.) PLANS.—Alterations to be completed Dec. 31, 1912, **11**, 1091.
- CHICAGO R.**, S. Branch, 22d Street, Chicago, Ill. (S.) (City br.) PLANS.—Permanent br. to replace existing str., approv. July 14, 1904. Plans for temporary br. approv. May 2, 1905. Revised plans approv. May 22, 1905, **05**, 727.
- CHICAGO R.**, S. Branch, at Washington Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Mar. 3, 1911, **11**, 1087.
- CHICAGO R.**, S. Branch (s. fork of), Chicago, Ill. (O.) (Illinois Central R. R. Co., Chicago & Alton R. R. Co., and Atchison, Topeka & Santa Fe Ry. Co.) PLANS.—Alterations to be completed on or before Apr. 1, 1905, **04**, 720.
- CHICAGO R.**, S. Branch (s. fork of), Chicago, Ill. (S.) (City br.) PLANS.—Approv. Sept. 14, 1908, **09**, 915.
- CHICAGO R.**, S. Branch (s. fork of), Archer Avenue, Chicago, Ill. (S.) (City br.) PLANS.—Reconstr. plans approv. Nov. 2, 1897, **98**, 533; and Oct. 30, 1902, **03**, 647.
- CHICAGO R.**, S. Branch (s. fork of), Iron Street and Center Avenue, and temporary br. at W. 39th Street, Chicago, Ill. (S.) (Brs. of Chicago Junction Ry. Co.) PLANS.—Approv. July 20, 1906, **07**, 820.
- CHICAGO R.**, S. Branch (s. fork of), 35th Street, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Sept. 14, 1908, and modified plans approv. Feb. 23, 1911, and plans for temporary br. alongside existing br. approv. May 8, 1911, **11**, 1087, 1089.
- CHICAGO R.**, S. Branch (w. arm of s. fork of), Ashland Avenue, Chicago, Ill. (S.) (City br.) PLANS.—Approv. Mar. 20, 1907, **07**, 826.
- CHICAGO R.**, S. Branch (w. fork of), Southwest Boulevard, Chicago, Ill. (Sp., etc.) (City br.) LEGISLATION.—City au. to constr. br. under act Sept. 19, 1890, sec. 7, and by act Illinois. PLANS.—Approv. June 21, 1892, **92**, 406.
- CHICAGO R.**, S. Branch (w. fork of), Chicago, Ill. (S.) (Chicago & Northern Pacific R. R. Co.) PLANS.—Approv. Feb. 15, 1893, **93**, 467.
- CHICAGO R.**, S. Branch (w. fork of), Chicago, Ill. (S.) (Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Rebuilding approv. Nov. 12, 1900, **01**, 663.
- CHICAGO R.**, S. Branch (w. fork of), Central Park Avenue, Chicago, Ill. (S.) (Illinois & Northern Ry. Co.) PLANS.—Reconstr. approv. Feb. 23, 1907, **07**, 825.
- CHICAGO R.**, S. Branch (w. fork of), Hamlin Avenue, Chicago, Ill. (S.) (Chicago & Illinois Western R. R. Co.) PLANS.—Approv. Apr. 13, 1906, **06**, 805.
- CHICAGO R.**, S. Branch (w. fork of), Southwestern Avenue, Chicago, Ill. (S.) (City br., temporary.) PLANS.—Approv. Mar. 31, 1905, **05**, 726.
- CHICKASAHAY R.**, Avera's Crossing, Miss. (S.) (Green County br.) PLANS.—Approv. Nov. 3, 1906, **07**, 823.
- CHICKASAHAY R.**, near Boice Station, Miss. (S.) (Mobile & Ohio R. R. Co.) PLANS.—Approv. Feb. 9, 1906, **06**, 804.
- CHICKASAHAY R.**, near Leakesville, Miss. (S.) (Green County br.) PLANS.—Approv. Apr. 25, 1902, **02**, 588.
- CHICKASAHAY R.**, at Leakesville, Miss. (S.) (Alabama & Mississippi R. R. Co.) PLANS.—Approv. July 16, 1902, **03**, 645.
- CHICKASAHAY R.**, Millers Ferry, Miss. (S.) (Green County br.) PLANS.—Approv. Mar. 18, 1907, **07**, 826.
- CHICKASAW CREEK**, Ala. (Dr.) **08**, 865.
- CHINCOTEAGUE and DELAWARE BS.** (canal between), Del. (A.) (Sussex County, temporary br.) PLANS.—Au. to constr. temporary br. granted June 20, 1894, by revocable license. License revoked Sept. 8, 1894. **94**, 430.
- CHINOOK R.**, Pacific County, Wash. (S.) (Pacific County br.) PLANS.—Approv. Nov. 5, 1902, **03**, 647.
- CHIPOLA R.**, near Clarksville, Fla. (O.) (Calhoun County br.) PLANS.—Alterations to be completed on or before 12 months from Nov. 7, 1908, **09**, 919.
- CHIPOLA R.**, Peacock's log landing, Fla. (S.) (Jackson County br.) PLANS.—Approv. Jan. 8, 1902, **02**, 586.
- CHIPPEWA R.** (See St. Croix R.)
- CHIPPEWA R.**, Durand, Wis. (A.) (Highway.) Engineer in charge: Maj. C. J. Allen. PLANS.—Maj. Allen reported that sheer booms should be placed to assist vessels in passing the spans, **88**, 2637.
- CHIPPEWA R.**, Durand, Wis. (O.) (Chippewa Valley Br. Co.) PLANS.—Specified alterations to highway br. required on or before June 16, 1892. Time extended to Dec. 15, 1892. **92**, 412.
- CHIPPEWA R.**, Durand, Wis. (S.) (City br.) PLANS.—Approv. Jan. 7, 1902, **02**, 586.
- CHIPPEWA R.**, at Eau Claire, Wis. (S.) (Chicago, St. Paul, Minneapolis & Omaha Ry. Co.) PLANS.—Approv. Oct. 30, 1911, **12**, 1302.
- CHIPPEWA R.**, near Red Cedar, Wis. (Sp., etc.) (Chicago, Milwaukee & St. Paul Ry. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Wisconsin. PLANS.—For new br. approv. Apr. 16, 1892, **92**, 404.

CHITINA R. (See Copper R.)

CHOCOLATE BAYOU, Tex. (S.) (See Bastrop Bayou.) (Galveston, Brazos & Southwestern Ry. Co.) PLANS.—Approv. Nov. 22, 1897, **98**, 534.

CHOCOLATE BAYOU, Tex. (S.) (St. Louis, Brownsville & Mexico Ry. Co.) PLANS.—Approv. Oct. 6, 1905, **06**, 802.

CHOCOLATE BAYOU, near Rowanville, Tex. (S.) (Brazoria County br.) PLANS.—Approv. Aug. 4, 1911, **12**, 1300.

CHOCTAW BAYOU, W. Baton Rouge Parish, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Approv. Aug. 17, 1906, **07**, 821.

CHOCTAWHATCHEE R., near Bellwood, Ala. (O.) (Central of Georgia Ry. Co.) PLANS.—Alterations to be completed by Dec. 31, 1908, **08**, 873.

CHOCTAWHATCHEE R., Geneva, Ala. (Sp.) (Louisville & Nashville R. R. Co.) Au. act Feb. 23, 1901. PLANS.—Approv. July 12, 1901, **02**, 581.

CHOCTAWHATCHEE R., N. J. (Dr.) **06**, 797.

CHOCTAWHATCHEE R., near Geneva and below Newton, Ala. (A.) (Wagon brs.) PLANS.—Both brs. should be removed if R. imps. be carried out, **88**, 2553.

CHOCTAWHATCHEE R., near Martins Ferry, Ala. (Sp.) (Geneva County br.) Au. act Mar. 3, 1903. PLANS.—Approv. July 30, 1903, **04**, 711.

CHOCTAWHATCHEE R., near Newton, Ala. (Sp.) (Dale County br.) LEGISLATION.—County au. to constr. br. by act Feb. 14, 1898. PLANS.—Approv. May 31, 1898, **98**, 532.

CHOCTAWHATCHEE R., near Old Hollis Br., Ala. (Sp.) (Dale County br.) LEGISLATION.—County au. to constr. br. by act Feb. 14, 1898. PLANS.—Approv. May 31, 1898, **98**, 532.

CHOCTAWHATCHEE R., near Trawicks Landing, Ala. (Sp.) (Br. of Houston and Dale Counties.) Au. act Apr. 28, 1904. PLANS.—Approv. June 25, 1904, **04**, 712, 713.

CHOPAWAMSIK CREEK, Va. (Dr.) **07**, 815.

CHOPTANK R., Denton, Md. (S.) (Queen Anne R. R. Co.) PLANS.—Approv. Sept. 23, 1896, **97**, 532.

CHOPTANK R., Md. (S.) (Br. of Caroline and Talbot Counties—Dover Br.) PLANS.—Reconstr. approv. Mar. 19, 1910, **10**, 1030, and modified plans approv. May 27, 1910, **10**, 1030.

CHRISTIANA R., Del. (Dr.) **02**, 581.

CHRISTIANA R., on the line of the R. R. in Newcastle County, Del. (Sp., etc.) (Delaware R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Sept. 19, 1890, **92**, 401. PLANS.—Reconstr. approv. Dec. 8, 1891; modified plan, increasing width of draw span $5\frac{1}{2}$ ft., and modifying the masonry constr., approv.

Jan. 28, 1892. Completion of br. reported or July 5, 1892. **92**, 401.

CHRISTIANA and the **ST. JONES RS.**, Wilmington, Del. (A.) PLANS.—Reported that the draw of the Christiana Br. should be worked by steam or some mechanical power, and that turning machinery should be put in both brs. over the St. Jones R., **88**, 2538, 2660.

CHRISTIANA R., Wilmington, Del.; at Watsons Isld., Md., across the Susquehanna R.; below Pocomoke City, across the Pocomoke R., Md., and across the inland waterway from Chincoteague B., Va., to Delaware, near Lewes, Del. (A.) PLANS.—Description of the brs. and of the interference with navigation caused thereby, **88**, 2617, 2619.

CHRISTIANA R., at 3d Street, Wilmington, Del. (S.) (Newcastle County br.) PLANS.—Approv. Oct. 11, 1911, **12**, 1301, 1302.

CITY ISLD. and **PELHAM B. PARK**, chan. between, N. Y. (S.) (New York City br.) PLANS.—Reconstr. plans approv. Oct. 29, 1897, **98**, 533.

CLARK R. (See Lewis R. and.)

CLATSKANIE CREEK, Ore. (S.) (Astoria & Columbia R. R. Co.) PLANS.—Approv. June 23, 1896, **96**, 426.

CLATSKANIE R., Ore. (Dr.) **02**, 581.

CLEAR CREEK, Tex. (Sp.) (La Porte, Houston & Northern R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 1, 1895. PLANS.—Approv. Mar. 25, 1895, **95**, 475.

CLEAR CREEK, between Harris and Galveston Counties, Tex. (S.) (Galveston-Houston Electric Ry. Co.) PLANS.—Approv. Jan. 14, 1910, **10**, 1026.

CLEAR CREEK, near League City, Tex. (O.) (Br. of Galveston and Harris Counties.) PLANS.—Alterations to be completed on or before June 1, 1909, **09**, 920.

CLEAR CREEK and **DICKINSON BAYOU**, Tex. (S.) (Brs. of Galveston, Harrisburg & San Antonio Ry. Co.) PLANS.—Reconstr. approv. Jan. 31, 1907, **07**, 825.

CLEARWATER R., near Kamiah, Idaho. (S.) (Clearwater Short Line Ry. Co.) PLANS.—Approv. Oct. 25, 1899, **00**, 699.

CLEARWATER R., near Kamiah, Idaho. (S.) Kamiah Br. Co., Ltd.) PLANS.—Approv. Aug. 23, 1908. Modified plans approv. Nov. 12, 1908, **09**, 916.

CLEARWATER R., **LAPWAI CREEK** (near mouth of), Idaho. (S.) (Clearwater Valley R. R. Co.) PLANS.—Approv. Jan. 30, 1900, **00**, 700.

CLEARWATER R., Lewiston (about 11 m. above), Idaho. (Sp.) (Spokane & Palouse Ry. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, and act Idaho. PLANS.—Approv. Mar. 28, 1891, **91**, 431.

- CLEARWATER R.**, Lewiston, Idaho. (S.) (Oregon, Washington & Idaho R. R. Co.) PLANS.—Approv. Sept. 5, 1905, **06**, 802.
- CLEARWATER R.**, Oro Tina, Idaho. (S.) (Farmers Warehouse & Br. Co.) PLANS.—Approv. Dec. 28, 1907, **08**, 871.
- CLINCH R.**, near Dossett, Tenn. (Sp.) (Knoxville, La Follette & Jellico R. R. Co.) Au. act Feb. 3, 1903. PLANS.—Approv. Mar. 14, 1903, **03**, 644.
- CLINCH R.**, Kingston, Tenn. (Sp.) (Roane County br.) LEGISLATION.—County au. to constr. br. by act June 9, 1897. PLANS.—Approv. June 10, 1897, **97**, 530.
- CLINCH R.**, Kingston, Tenn. (Sp.) (Kingston Br. & Terminal Ry. Co.) Au. act Feb. 8, 1901. PLANS.—Approv. June 3, 1901, **01**, 660.
- CLINCH R.**, at Kiser, Va. (Sp.) (Carolina, Clinchfield & Ohio Ry. Co.) Au. act May 12, 1906. PLANS.—As amended, approv. Apr. 22, 1910, and June 7, 1910, **10**, 1022.
- CLINCH R.**, Roane County, Tenn. (S.) (Tennessee Central R. R. Co.) PLANS.—Approv. June 20, 1895, **95**, 479.
- CLINCH R.**, near St. Paul, Va. (Sp.) (South & Western R. R. Co.) Au. act May 12, 1906. PLANS.—Approv. Dec. 4, 1906, **07**, 817.
- CLINCH R.** (near m. post 55.3), Scott County, Va. (Sp.) (South & Western R. R. Co.) Au. act May 12, 1906. PLANS.—Approv. Dec. 5, 1906, **07**, 818.
- CLINCH R.**, near Starnes Bend, Scott County, Va. (Sp.) (South & Western R. R. Co.) Au. act May 12, 1906. PLANS.—Approv. Dec. 5, 1906, **07**, 818.
- COAL BANK SLOUGH**, Coos County, Oreg. (Sp.) (Coos B., Roseburg & Eastern R. R. & Navigation Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 3, 1891. PLANS.—Approv. June 11, 1891. On Aug. 20, 1891, completion of br. reported. **91**, 432.
- COAL BANK SLOUGH**, Pennsylvania Avenue, Marshfield, Oreg. (S.) (Flanagan estate.) PLANS.—Approv. Sept. 12, 1907, **08**, 870.
- COAL CREEK SLOUGH**, near mouth of Coal Creek, Wash. (S.) (Inman-Poulsen Logging Co.) PLANS.—Approv. May 4, 1907, **07**, 827.
- COHANSEY CREEK**, Bridgeton, N. J. (S.) (Cumberland County br.) PLANS.—Approv. Oct. 31, 1895. Modified plans to reduce the draw opening approv. Feb. 7, 1896. **96**, 426.
- COHASSET NARROWS** (so-called), between Wareham and Bourne, Mass. (Sp., etc.) (Plymouth and Barnstable Counties br.) LEGISLATION.—Counties au. to constr. br. under acts Sept. 19, 1890, sec. 7, and act of Massachusetts. PLANS.—Approv. Apr. 14, 1892, **92**, 404.
- COHASSET NARROWS**, at Wareham and Bourne, Mass. (S.) (Old Colony R. R. Co., New York, New Haven & Hartford R. R. Co., lessee.) PLANS.—Reconstr. plans approv. Apr. 29, 1911, **11**, 1088.
- COLDWATER R.**, near Darling, Miss. (S.) (Quitman County br.) PLANS.—Approv. Oct. 2, 1908, and modified plans Aug. 8, 1910, **09**, 915; **11**, 1082.
- COLDWATER R.**, Marks, Miss. (Sp.) (Quitman County br.) Au. act Mar. 8, 1905. PLANS.—Approv. Apr. 26, 1906, **06**, 800.
- COLDWATER R.**, Quitman County, Miss. (S.) (Yazoo & Mississippi Valley R. R. Co.) PLANS.—Approv. Oct. 14, 1901, **02**, 585.
- COLES R.**, at Swansea, Mass. (S.) (Old Colony R. R. Co., New York, New Haven & Hartford R. R. Co., lessee.) PLANS.—Reconstr. plans approv. June 8, 1911, **11**, 1090.
- COLORADO R.**, Parker, Ariz. (Sp.) (Arizona & California Ry. Co.) Au. act Feb. 6, 1908. PLANS.—Approv. Mar. 3, 1908, **08**, 867.
- COLORADO R.**, Topock, Ariz. (Sp.) (Atchison, Topeka & Santa Fe Ry. Co.) Au. act July 21, 1866. PLANS.—For constr. of p. under the middle of the br. approv. May 12, 1910, **10**, 1022.
- COLUMBIA R.**, Wash. (Dr.) **08**, 865.
- COLUMBIA R.**, in Benton and Walla Walla Counties, Wash. (Sp.) (North Coast R. R. Co.) Au. act Jan. 29, 1907. PLANS.—Approv. May 13, 1909, **09**, 913.
- COLUMBIA R.** and **U. S. CANAL**, at Celilo Falls, Oreg. and Wash. (Sp.) (Oregon Trunk Ry. Co.) Au. act Mar. 2, 1910. PLANS.—Approv. Mar. 24, 1910, **10**, 1021.
- COLUMBIA R.**, between Douglas and Kittitas Counties, Wash. (Sp.) (St. Paul, Minneapolis & Manitoba Ry. Co.) LEGISLATION.—Constr. au. by act Jan. 10, 1893. PLANS.—Submitted Sept. 30, 1892; approv. Feb. 14, 1893, **93**, 464.
- COLUMBIA R.**, between Douglas and Kittitas Counties, Wash. (Sp.) (Chicago, Milwaukee & St. Paul Ry. Co.) Au. act Apr. 9, 1906. PLANS.—Approv. Oct. 27, 1906, **07**, 817.
- COLUMBIA R.**, Northport, Wash. (Sp.) (Columbia & Red Mountain Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Jan. 27, 1897. PLANS.—Approv. Sept. 30, 1897, **98**, 531.
- COLUMBIA R.**, near Vancouver, Wash. (Sp.) (Oregon Ry. Extensions Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 29, 1890. PLANS.—Approv. Sept. 29, 1890, **91**, 429.
- COLUMBIA R.**, Wenatchee, Wash. (Sp.) (Washington Br. Co.) Au. act Jan. 20, 1906. PLANS.—Approv. Apr. 13, 1906, **06**, 799.
- COLUMBIA R.**, **COLUMBIA** and **OREGON SLOUGHS**, Oreg. (S.) (Portland, Vancouver & St. Johns R. R. Co.) PLANS.—Approv. Oct. 19, 1905, **06**, 802.
- COLUMBIA R.** and **OREGON SLOUGH** (of Columbia R.), Vancouver, Wash. (Sp.) (Portland & Seattle Ry. Co.) Au. act Dec. 21, 1905. PLANS.—Approv. Feb. 12, 1906, **06**, 799; and slightly modified Nov. 19, 1906, **07**, 817, 824.

OLUMBIA SLOUGH, Multnomah County Oreg. (S.) (Oregon & Washington R. R. Co.) PLANS.—Approv. Dec. 23, 1908, **09**, 916.

OMMENCEMENT B., Tacoma, Wash. (O.) (Northern Pacific R. R. Co.) PLANS.—Specified alterations to R. R. br. required on or before Mar. 1, 1893, **92**, 412.

OMPANY CANAL, La. (Dr.) **08**, 865.

ONDADO B., San Juan, P. R. (Sp.) (Behn Bros.) Au. act Feb. 25, 1909. PLANS.—Approv. Apr. 29, 1909, **09**, 913; and Oct. 21, 1909, **10**, 1020.

ONECUH R., Henleys Ferry, near Brewerton, and at Parkers Ferry, Ala. (Sp.) (Escambia County brs.) LEGISLATION.—County au. to constr. brs. by act Mar. 2, 1899. PLANS.—Approv. Sept. 19, 1899, **00**, 697.

ONECUH R., near Pollard, Ala. (Sp.) (Lindsey Lumber Co.) Au. act Jan. 27, 1905. PLANS.—Approv. May 15, 1905, **05**, 722.

ONEY ISLD. CREEK, from W. 17th Street to W. 18th Street, N. Y. (S.) (Brooklyn city br.) PLANS.—Approv. May 28, 1897, **97**, 534.

ONEY ISLD. CREEK, N. Y. (A.) (Brooklyn Heights R. R. Co.; West End Br.) PLANS.—Reconstr. in accordance with requirements approv. Dec. 20, 1901. Alterations to be completed on or before Apr. 1, 1903. **02**, 590.

ONEY ISLD. CREEK, Coney Isld., N. Y. (S.) (Brs. of Brooklyn Rapid Transit Co.) PLANS.—Reconstr. 2 brs. approv. Oct. 13, 1906, **07**, 822.

ONGAREE R., near Columbia, S. C. (S.) (South Bound R. R. Co.) PLANS.—Approv. Aug. 4, 1899, **99**, 623.

ONNEAUT CREEK, at Conneaut, Ohio. (S.) (Pittsburgh, Bessemer & Lake Erie R. R. Co.) PLANS.—Br. to replace existing str. approv. Apr. 1, 1910, **10**, 1029.

ONNECTICUT R. (See Coscob, etc.)

ONNECTICUT R., between E. Haddam and Haddam, Conn. (Sp.) (State br.) Au. act Jan. 25, 1912. PLANS.—Approv. Mar. 4, 1912, **12**, 1297.

ONNECTICUT R., between Hartford and E. Hartford, Conn. (A. and O.) (State br.) PLANS.—Alteration plans approv. Dec. 28, 1894, **95**, 480. Draw with span 100' in clearance, at the third span from Hartford shore, to be completed on or before Oct. 1, 1895, **95**, 483.

ONNECTICUT R., at Hartford, Conn. (Sp.) (Connecticut R. Br. and Highway District.) Au. act Feb. 13, 1903. PLANS.—Approv. May 21, 1903, **03**, 644.

ONNECTICUT R., Middletown, Conn. (O.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Specified alterations to be completed within 2 months from July 2, 1896, **96**, 423. Reconstr. approv. Sept. 16, 1910, **11**, 1083.

ONNECTICUT R., between Middletown and Portland, Conn. (S.) (Middletown & Portland Br. Co.) PLANS.—Approv. Aug. 6, 1895; modified plans approv. Aug. 28, 1895, **95**, 480.

ONNECTICUT R., at Old Saybrook and Old Lyme, Conn. (Sp.) (New York, New Haven & Hartford R. R. Co.) Au. act Apr. 7, 1904. PLANS.—Approv. Mar. 29, 1905, **05**, 721.

ONNECTICUT R., between Old Saybrook and Old Lyme, Conn. (Sp.) (Saybrook & Lyme, Connecticut Br. Commission.) Au. act Feb. 26, 1910. PLANS.—Approv. Mar. 15, 1910, **10**, 1021.

ONNECTICUT R., between Springfield and Agawam, Mass. (O.) (South End Br.) PLANS.—Alterations to be completed within 6 months from Sept. 15 and 16, 1902, **03**, 652.

ONNECTICUT R., Chicopee and W. Springfield, Mass. (Sp.) (Hampden County br.) Au. act Apr. 28, 1904. PLANS.—Constr. approv. Oct. 29, 1904; approval subsequently modified by instrument dated Aug. 3, 1905, **05**, 720; **06**, 799.

CONTENTNIA CREEK, near Grifton, N. C. (Sp.) (Wilmington & Weldon R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 23, 1894. PLANS.—Approv. Aug. 29, 1894, **94**, 426.

CONTENTNIA CREEK, Hookertown, N. C. (S.) (East Carolina Ry.) PLANS.—Approv. May 11, 1907, **07**, 827.

COOPER CREEK, Baird Avenue, Camden, N. J. (S.) (Camden County br.) PLANS.—Approv. Mar. 26, 1902, **02**, 587.

COOPER CREEK, Browning Road, Camden, N. J. (S.) (Camden County br.) PLANS.—For rebuilding approv. Aug. 17, 1900, **01**, 662.

COOPER CREEK, Federal Street, Camden, N. J. (O.) (City & Camden Horse R. R. Co.) PLANS.—Specified alterations required of city and R. R. company on or before Sept. 30, 1892, **92**, 412.

COOPER CREEK, Federal Street, Camden County, N. J. (S.) (Camden County br.) PLANS.—Approv. Dec. 29, 1905, **06**, 803.

COOPER CREEK, State Street, Camden, N. J. (S.) (Camden County br.) PLANS.—Reconstr. plans approv. June 16, 1898, **98**, 536.

COOPER CREEK, Stoy's Landing, N. J. (S.) (Camden County br.) PLANS.—Approv. Aug. 11, 1903, **04**, 714.

COOSA R., Ga. and Ala. (A.) (Central R. R. of Georgia; Talladega & Coosa Valley R. R.; East & West R. R.; Georgia Pacific R. R.; and Anniston & Cincinnati R. R.—5 brs.) PLANS.—3 of the brs. too low and have no draw; one has a draw that will not work, **89**, 2797.

COOSA R., Gadsden, Ala. (Sp.) (Louisville & Nashville R. R. Co.) PLANS.—Reconstr. approv. June 16, 1909, **09**, 914.

COOSA R., near Look No. 3, Ala. (O.) (Seaboard Air Line Ry. Co.) PLANS.—Alterations to be completed on or before Dec. 1, 1906, **06**, 809.

COOSAW R., WHALE BRANCH, Port Royal Ferry, S. C. (S.) (Beaufort County br.) PLANS.—Approv. Apr. 21, 1908, **08**, 872.

- COOSAWATTEE R.**, Ga. (See Oostenaula R. and —.)
- COOSAWATTEE R.**, Carters, Ga. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Approv. Mar. 30, 1905, 05, 726.
- COOSAWATTEE R.**, near Fields Ferry, Ga. (S.) (Gordon County br.) PLANS.—Approv. Mar. 3, 1908, 08, 872.
- COPPER R.**, near Childs Glacier, Alaska. (Sp.) (Alaska Pacific Ry. & Terminal Co.) Au. act June 30, 1906. PLANS.—Approv. Nov. 16, 1907, 08, 867.
- COPPER R.**, near mouth of Chitina R., Alaska. (Sp.) (Copper R. & Northwestern Ry. Co.) Au. act Mar. 26, 1910. PLANS.—Constr. of a permanent and a temporary br. approv. Aug. 16, 1910, 11, 1079.
- CORDELIA SLOUGH**, Cal. (See Pacheco Slough.)
- CORNEY BAYOU**, near Cobb Landing, La. (S.) (Summit Lumber Co.) PLANS.—Temporary br. approv. July 8, 1911, 12, 1299.
- CORPUS CHRISTI CHAN.** (Morris and Cummings Ship Chan.), Tex. (Sp.) (Arkansas H. Terminal Ry. Co.) LEGISLATION.—Company au. to constr. br. by act May 4, 1896. PLANS.—Approv. Apr. 21, 1897, 97, 530.
- CORTE MADERA CREEK**, Cal. (S.) (Bay Counties Ry. Co.) PLANS.—Approv. Mar. 5, 1906, 06, 804.
- COSCOB, CONN.**; Bridgeport, Conn.; Housatonic R., Conn.; New Haven, on the Quinnipiac R., Conn.; Middletown, on the Connecticut R., Conn.; the city brs. at Bridgeport; the city and the Tomlinson brs. at New Haven, Conn. (A.) (New York, New Haven & Hartford R. R. Co.) COMMERCE.—Protests of C. interests against brs. 2, 4, 5, 7, and 8, 88, 2535, 2537. PLANS.—Lt. Col. McFarland proposed to widen the clear way at brs. 3 and 5 by removal of certain underwater portions of the ps.; to require the introduction of draws at brs. 4 and 7, and the widening of the draw at br. 8, and to secure, with steam power, a more expeditious opening and closing of the draws at brs. 1 and 2, 88, 2532, 2534.
- COSCOB R.**, Greenwich, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Rebuilding existing br. and constr. of temporary trestle approv. Dec. 2, 1903, 04, 715.
- COURTABLEAU BAYOU**, near Port Barre, La. (S.) (Opelousas, Gulf & Northeastern Ry. Co.) PLANS.—Approv. Feb. 27, 1906, 06, 804.
- COURTABLEAU BAYOU**, Port Barre, La. (S.) (St. Landry Parish br.) PLANS.—Reconstr. approv. July 23, 1907, 08, 868.
- COURTABLEAU BAYOU**, St. Landry Parish, La. (S.) (Colorado Southern, New Orleans & Pacific R. R. Co.) PLANS.—Approv. May 25, 1906, 06, 807. Modified plans approv. Feb. 2, 1907, 07, 825.
- COW BAYOU**, about 6 m. above its confluence with Sabine R., Tex. (S.) (Orange County br.) PLANS.—Approv. July 6, 1893, 93, 470. New plans approv. Oct. 6, 1893, 94, 426.
- COWLITZ R.**, Wash. (Dr.) 10, 1019.
- COWLITZ R.**, Castlerock, Wash. (S.) (Br. of D. M. Eddy.) PLANS.—Approv. Feb. 6, 1903, 03, 648.
- COWLITZ R.**, Castlerock, Wash. (S.) (Cowlitz County br.) PLANS.—Br. to replace str. carried away, approv. Jan. 20, 1910; and modified plans approv. June 6, 1910, 10, 1030.
- COWLITZ R.**, at Kelso and Catlin, Wash. (S.) (Kelso Br. Co.) PLANS.—Approv. Dec. 20, 1904, 05, 725.
- COWLITZ R.**, Olequa, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Rebuilding approv. Sept. 30, 1907, 08, 870; and Aug. 9, 1910, 11, 1082.
- COWLITZ R.**, near Olequa, Wash. (S.) (Oregon & Washington R. R. Co.) PLANS.—Approv. May 3, 1907, 07, 827.
- COWLITZ R.**, Toledo, Wash. (Sp., etc.) (Lewis County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—Approv. Nov. 19, 1891, 92, 401.
- COYOTE CREEK**, Cal. (See Warm Spring and Coyote Creeks.)
- CRAVEN THOROUGHFARE**, N. J. (See Leonards Thoroughfare.)
- CROOK HORN THOROUGHFARE**, N. J. (S.) (Atlantic City R. R. Co.) PLANS.—To replace existing br. approv. Feb. 14, 1910, 10, 1027.
- CRUM CREEK**, Delaware County, Pa. (S.) (See Darby Creek, Pa.) (Baltimore & Philadelphia R. R. Co.) PLANS.—Approv. Dec. 2, 1909, 10, 1025.
- CRYSTAL COVE**, Winthrop, Mass. (S.) (Boston, Revere Beach & Lynn R. R. Co.) PLANS.—Reconstr. approv. Nov. 8, 1901, 02, 586.
- CUMBERLAND R.** (See Ohio R.)
- CUMBERLAND R.**, Carthage, Tenn. (Sp.) (Town br.) Au. act Mar. 2, 1901, Mar. 2, 1903, and Apr. 27, 1904. PLANS.—Approv. Mar. 4, 1904, 04, 711.
- CUMBERLAND R.**, Clarksville, Tenn. (S.) (Louisville & Nashville R. R. Co.) PLANS.—For floating cribs between center p. and rest ps. of draw span; approv. June 16, 1898, 98, 536.
- CUMBERLAND R.**, Davidson County, Tenn. (Sp.) (Nashville Terminal Co.) Au. act June 18, 1902. PLANS.—Approv. Aug. 18, 1902, 03, 643.
- CUMBERLAND R.**, Tenn. and Ky. (Dr.) 08, 865.
- CUMBERLAND R.**, between Maplewood and Overtons, near Nashville, Tenn. (Sp.) (Lewisburg & Northern Ry. Co.) Au. act Feb. 9, 1912. PLANS.—Approv. Mar. 20, 1912, 12, 1298.

- CUMBERLAND R.**, Nashville, Tenn. (Sp.) (Wagon br.) LEGISLATION.—Au. act Mar. 3, 1887, **88**, 308, 2438. PLANS.—Description of proposed br., **88**, 2440. Modification made and approv., **88**, 2441. Lt. Col. Barlow did not consider that the br. as proposed would form any obstr. to navigation, **88**, 2441.
- CUMBERLAND R.**, Sparkman and Jefferson Streets, Nashville, Tenn. (Sp.) (Davidson County brs.) Au. act Apr. 24, 1906, and Feb. 25, 1907. PLANS.—Approv. May 8, 1907, **07**, 819.
- CUMBERLAND R.**, S. Fork, near Burnside, Ky. (S.) (Pulaski County br.) PLANS.—Approv. Aug. 19, 1903, **04**, 714.
- CUMBERLAND R.**, S. Fork, near Burnside, Ky. (S.) (Cumberland R. & Nashville R. R. Co.) PLANS.—Approv. May 17, 1906, **06**, 807. Modified plans in lien thereof approv. Oct. 3, 1907, **08**, 870.
- CUMBERLAND R.**, S. Fork, at Yamacraw, Ky. (S.) (Kentucky & Tennessee Ry. Co.) PLANS.—Approv. Mar. 12, 1906, **06**, 804, 805.
- CURRENT R.**, Ark. (Sp.) (Southern Missouri & Arkansas R. R. Co.) Au. act Feb. 11, 1902. PLANS.—Approv. Feb. 28, 1902, **02**, 582.
- CURRENT R.**, near Van Buren Ferry, Mo. (Sp.) (Carter County br.) Au. act Feb. 1, 1909. PLANS.—Approv. Apr. 8, 1909, **09**, 913.
- CURRY CREEK** (Roberts B.), Fla. (See Shakit or Salt Creek.)
- CUYAHOGA R.**, Cleveland, Ohio. (S.) (Cleveland, Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Reconstr. plan approv. Jan. 30, 1899, **99**, 622.
- CUYAHOGA R.**, Cleveland, Ohio. (S.) (Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Rebuilding approv. Sept. 20, 1900, **01**, 663.
- CUYAHOGA R.**, Cleveland, Ohio. (S.) (Newburg & South Shore Ry. Co.) PLANS.—Two brs. approv. June 25, 1903, **03**, 650.
- CUYAHOGA R.**, Cleveland, Ohio. (A.) (Wheeling & Lake Erie R. R. Co.) PLANS.—Reconstr. approv. Oct. 25, 1904, **05**, 728.
- CUYAHOGA R.** (old bed of), Cleveland, Ohio. (O.) (Cleveland Terminal & Valley R. R. Co. of the Baltimore & Ohio system.) PLANS.—Rebuilding approv. Jan. 25, 1905, **05**, 725. Alterations to be completed on or before Apr. 1, 1906, **05**, 729. Approv. Jan. 28, 1909, **09**, 917.
- CUYAHOGA R.**, Cleveland, Ohio. (S.) (New York, Chicago & St. Louis R. R. Co.) PLANS.—Rebuilding approv. May 17, 1906, **06**, 807.
- CUYAHOGA R.**, Jefferson Street, Cleveland, Ohio. (S.) (City brs.) PLANS.—Imp. of R., involving reconstr. of br. and erection of new br., approv. Dec. 16, 1902, **03**, 647.
- CUYAHOGA R.**, near Jefferson Street, Cleveland, Ohio. (S.) (Cleveland & Mahoning Valley R. R. Co., and the Erie R. R. Co.) PLANS.—Approv. Feb. 16, 1910, **10**, 1027.
- CUYAHOGA R.**, Middle Seneca Street, Cleveland, Ohio. (S.) (City br.) PLANS.—Rebuilding approv. Dec. 4, 1901, **02**, 586.
- CUYAHOGA R.**, Cleveland, Ohio. (S.) (Brs. of Wheeling & Lake Erie R. R. Co.) PLANS.—Reconstr. of 2 existing brs. approv. Jan. 29, 1912, **12**, 1305. Modified plans approv. June 10, 1912, and instrument dated Jan. 29, 1912, canceled, **12**, 1308.
- CUYAHOGA R.**, Cleveland, Ohio. (S.) (City br., known as Central Avenue Viaduct.) PLANS.—Reconstr. approv. Apr. 24, 1906, **06**, 806; instrument canceled Aug. 4, 1910. New plans approv. May 5, 1911, **11**, 1088, 1089.
- CUYAHOGA R.**, Detroit-Superior Avenue, Cleveland, Ohio. (S.) (Cuyahoga County br.) PLANS.—Approv. Jan. 11, 1912, **12**, 1304.
- CYPRESS CREEK**, Va. (See Elizabeth R.)

D.

DAMARISCOTTA LAKE (outlet of), between Newcastle and Nobleboro, Me. (S.) (Maine Central R. R. Co.) PLANS.—Rebuilding approv. June 27, 1904, **04**, 719.

DANVERS (Bass) R., at Salem and Beverly, Mass. (S.) (Essex County br.) PLANS.—Approv. June 2, 1906, **06**, 807.

D'ARBONNE BAYOU, La. (S.) (Kinder & North Western R. R. Co.) PLANS.—Approv. June 9, 1910, **10**, 1030.

D'ARBONNE BAYOU, Cox Ferry, La. (S.) (Union Parish br.) PLANS.—Approv. Aug. 10, 1906, **07**, 821.

DARBY CREEK, Media, Pa. (See Schuylkill R.) (S.) (Delaware County br.) PLANS.—Approv. Jan. 31, 1907, **07**, 825.

DARBY CREEK and CRUM CREEKS, Delaware County, Pa. (S.) (Philadelphia & Chester Ry. Co.) PLANS.—Approv. Dec. 11, 1900, **01**, 663.

DARIEN R., Ga. (See Altamaha R.)

DAVIS SLOUGH, Puget Sound, near Stanwood, Wash. (Snohomish County br.) PLANS.—Reconstr. approv. Mar. 9, 1912, **12**, 1305.

DAY ISLD. WATERWAY, near Tacoma, Wash. (S.) (Day Isld. Co.) PLANS.—Approv. July 15, 1908, **09**, 914.

DEAD R., Fla. (Dr.) **04**, 710.

DEAD R., between Leesburg and Fruitland Park, Fla. (O.) (Lake County br.) PLANS.—Alterations to be completed on or before Oct. 1, 1906, **06**, 809.

DECEPTION and CANOE PASSES connecting Whidbey Pass and Fidalgo Islds., Wash. (S.) (Brs. of Highway Commission of Washington.) PLANS.—Approv. Jan. 9, 1909, **09**, 916.

DECKERS COVE, Southport, Me. (S.) (Town br.) PLANS.—Approv. May 10, 1907, **07**, 827.

DEEP R., Wahkiakum County, Wash. (S.) (County br.) PLANS.—Approv. Oct. 11, 1899, **00**, 699.

DELAWARE B. (See Chincoteague B. and —.)

DELAWARE R., near Columbia, N. J., and Slateford, Pa. (Sp.) (Delaware, Lackawanna & Western R. R. Co.) Au. act Jan. 14, 1909. PLANS.—Approv. Mar. 9, 1909, **09**, 913.

DELAWARE R., Philadelphia, Pa. (Sp.) (Pennsylvania and New Jersey R. R. Co. of N. J.) LEGISLATION.—Company au. to constr. br. by act June 14, 1894. PLANS.—Submitted Aug. 30, 1894; modified Oct. 11, 1894; approv. Nov. 3, 1894, **95**, 474.

DELAWARE R., between Philadelphia and Camden. (Sp.) BE. Convened at Philadelphia May 10, 1870. Proceedings, **71**, 709. Reconvened Oct. 15, 1870. **R.**, **71**, 710, 713, 718. Reconvened at Philadelphia, Dec. 7, 1870, and Apr. 29, 1871, **71**, 713, 718. (Lt. Cols. Woodruff and Kurtz, and Capt. King.) LEGISLATION.—Br. au. by act Apr. 6, 1870; requirements of act, **71**, 81. PLANS.—Of Philadelphia & Camden Br. Co. described, **71**, 710. Comments of board, **71**, 710, 711, 718. Approv. by Sec. of War, **71**, 718.

DELAWARE R., Trenton, N. J. (Sp.) (Pennsylvania R. R. Co.) Au. act Feb. 15, 1901. PLANS.—Approv. June 14, 1901, **01**, 661.

DELAWARE R., Yardley, Pa. (Sp.) (Philadelphia & Reading Ry. Co.) Au. act Feb. 27, 1911. PLANS.—Br. to replace existing str. approv. Apr. 24, 1911, **11**, 1081.

DES ALLEMANDS BAYOU, La. (O. and A.) (Southern Pacific Ry., Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Reconstr. approv. July 24, 1903, **04**, 720.

DES ALLEMANDS BAYOU, Lafayette and St. Charles Parishes, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Reconstr. approv. Sept. 10, 1907, **08**, 870.

DESCHUTES R., Olympia, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Rebuilding approv. July 16, 1902, **03**, 645.

DESCHUTES R., Olympia, Wash. (S.) (City br.) PLANS.—Approv. May 7, 1904, **04**, 718.

DES GLAISES BAYOU, La. (Sp.) (St. Louis, Ayoyelles & Southwestern R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 23, 1894. PLANS.—Approv. Oct. 26, 1895; modified plans submitted Dec. 22, 1895, providing for a wooden drawspan in lieu of one of iron required by approv. plans; approv. Jan. 15, 1896, **96**, 423.

DES GLAISES BAYOU, Avoyelles Parish, La. (S.) (Shreveport & Red R. Valley Ry. Co. brs.) PLANS.—Approv. Jan. 23, 1903, **03**, 648.

DES GLAISES BAYOU, Iberville Parish, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Approv. May 25, 1906, **06**, 807.

DES GLAISES BAYOU, near Moreauville, La. (S.) (Avoyelles Parish br.) PLANS.—Approv. Aug. 3, 1903, **04**, 713.

DES MOINES RAPIDS CANAL, Ill. (See Mississippi R.)

DES OURSE BAYOU, St. Martin Parish, La. (S.) (Morgan's Louisiana & Texas R. R. &

- S. S. Co.) PLANS.—Approv. Aug. 17, 1906, **07**, 821.
- DETROIT, MICH.**, chan. between Lakes Huron and Erie—across the. **COMMERCE**.—Waterway fully described, **74**, 588. Tables of t. on the lakes and elsewhere, **74**, 590, et seq.; **74**, 619, R. R. ferry crossing, **74**, 594, et seq.; **74**, 634. High and low brs. discussed, **74**, 630. History of proposed tunnel, **74**, 598, 608, 619, 631. Rates on freight, **74**, 599. Freights, etc., Michigan Central R. R. Co., **74**, 600. Statements of various parties for and against proposed br., **74**, 613, 620-631, 633-636. R. R. interests presented by J. F. Joy, president Michigan Central R. R. Co., **74**, 604. Memorial to Congress for double-track R. R., Chicago to New York, **74**, 610. Memorial to Legislature of Michigan against bridging Detroit R., **74**, 617. Proposals of R. R. companies, **74**, 630. Statistics, **74**, 611; **80**, 1857, 1862. Chief of Engineers. **R.**, **74**, 71; **80**, 199. BE. convened at Detroit, Mich., May 12, 1873, and heard opinions of the opposing interests. Reconvened Nov. 14; reported against a drawbr. and favorably to high br. or tunnel. Conclusions of the board. **74**, 603. **R.**, **74**, 587. (Majs. Warren, Comstock, Weitzel, and Merrill, and Capt. Livermore.) Convened at Detroit Oct. 14, 1879, **80**, 1853. Tunnel under the R. the most satisfactory solution. If br. be built, it should be provided with a draw span of not less than 300'. Fixed spans not less than 450' in the clear, with 60' headway. **80**, 1855. Maj. Wilson did not concur in plan of br. with draw, **80**, 1856. (Lt. Cols. Reynolds and Michler, and Maj. Poe, Houston, and Wilson.) PLANS.—Of brs. described and discussed by BE., **74**, 600. By br. company. (1) Low br. with 2 draws; est., \$2,457,550, **74**, 628. (2) For br. 150' above ordinary water surface; est., \$3,947,000, **74**, 628. (3) For winter br. with 1 draw and 2 movable spans of 400' each, to be removed during the season of navigation; est., \$1,966,500, **74**, 629. Described and discussed by BE., **80**, 1854.
- DETROIT R.** (Belle Isle and the American shore.) **COMMERCE**.—Conservation of navigable waters by the U. S., **85**, 292, 1918.
- DETROIT R.**, across the. (Detroit, Mich.) **90**, 3456. **COMMERCE**.—Shipping interests, **90**, 3457. BE. convened at Detroit, Mich., July 19, 1889, by S. O. No. 15, to report upon the practicability and necessity of a br. over Detroit R. at Detroit. Board reported the constr. of such a br. feasible, and, of the projs. submitted to them, recom. that for a high br. **R.**, **90**, 3456, 3463. (Col. Poe and Maj. Allen and Adams.)
- DETROIT R.** (w. chan.). (Sp.) (Belle Isle Park and the mainland.) **88**, 308; **97**, 529. **LEGISLATION**.—Br. au. act July 20, 1886, **88**, 2456. PLANS.—Proposed location and dimensions of br. and approaches, **88**, 2452. Lt. Col. Poe approv. location and constr. of br. as designed, **88**, 2451. Reconstr. plans approv. Apr. 8, 1897 **97**, 529.
- DETROIT R.**, between Goose Isle and Ston Isld., Mich. (O.) (Michigan Central R. R. Co. PLANS.—Alterations to be completed on or before May 1, 1905, **05**, 729.
- DETROIT R.** (w. chan.) to Grosse Isle, near cit of Wyandotte, Mich. (S.) (Grosse Isle Ry. Co. PLANS.—Reconstr. approv. June 11, 1912, an instrument of approval issued to P. N. Jacobson dated Mar. 12, 1910, canceled, **12**, 1308.
- DETROIT R.**, from Wyandotte to the isld. of Grosse Isle, Mich. (S.) (P. N. Jacobson. PLANS.—Approv. Mar. 12, 1910, **10**, 1028.
- DICKINSON BAYOU**, Tex. (See Clear Creek. (O.) Galveston, Houston & Henderson R. R. Co.) PLANS.—Specified alterations require on or before May 20, 1893, **93**, 473.
- DICKINSON BAYOU**, Tex., about $\frac{1}{2}$ m. above its mouth. (S.) (North Galveston, Houston & Kansas City R. R.) PLANS.—Approv. Oct 13, 1892, **93**, 466.
- DICKINSON BAYOU**, Galveston County, Tex (S.) (Galveston-Houston Electric Ry. Co. PLANS.—Approv. Jan. 14, 1910, **10**, 1026.
- DIVIDING CREEK**, at town of Dividing Creek N. J. (O.) (Cumberland County br.) PLANS.—Specified alterations to be completed within 1 months from Feb. 19, 1902, **02**, 591.
- DOG R.**, Ala. (S.) (Mobile West Shore Traction Co.) PLANS.—Approv. Dec. 13, 1911, **12** 1303.
- DOG R.**, Mobile, Ala. (S.) (Dauphin Island Ry & Harbor Co.) PLANS.—Approv. Dec. 12 1911, **12**, 1303.
- DOG R.**, Mobile County, Ala. (S.) (Rudolph Benz br.) PLANS.—Approv. Feb. 20, 1901, **01** 665.
- DOG R.**, Jackson County, Miss. (Sp.) (W Denny & Co.) Au. act Apr. 11, 1904. PLANS.—Approv. Apr. 22, 1904, **04**, 712.
- DOG AND FOWL RS.**, Ala. (S.) (Mobile & Dauphin Island R. R. & Harbor Co.) PLANS.—Approv. Nov. 3, 1893, **94**, 426.
- DOODLETOWN BIGHT, or CREEK**, N. Y (S.) (New York Central & Hudson R. R. Co. PLANS.—Reconstr. approv. Dec. 13, 1906 **07**, 824.
- DUCK CREEK**, near Duck Creek, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Br. to replace existing str. approv. Nov. 21, 1903 **04**, 715.
- DUCK R.**, Cold Branch Ferry, Tenn. (S.) (Humphreys County br.) PLANS.—Approv. Sept. 12, 1895, **96**, 424.
- DUCK R.**, above the mouth of Buffalo R., near Link Ford, Tenn. (S.) (Humphreys County br.) PLANS.—Approv. Feb. 25, 1910, **10**, 1027.
- DUCK R.**, Lyme, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. approv. Nov. 8, 1906, **07**, 823.
- DULUTH CANAL**, Duluth, Minn. (Sp.) (City br.) Au. act Feb. 7, 1902. PLANS.—Approv. Sept. 14, 1903, **04**, 711.

DULUTH H., canal at, at entrance, Duluth, Minn. (S.) (City br.) BE. constituted by S. O. No. 6, Feb. 1, 1892, to ex. and R. upon the plans of a br. over the entrance to Duluth H., on Lake Avenue, submitted by the board of public works of the city of Duluth, Minn. R., 92, 3315. (Col. O. M. Poe, Majs. W. Ludlow and W. A. Jones.) LEGISLATION.—City au. to constr. br. by Minnesota. PLANS.—For a lift br., referred to BE.; public hearing given interested parties; Chief of Engineers concurred in recom. of BE. and the plans disapprov. Apr. 11, 1892, 92, 410.

DULUTH-SUPERIOR, MINN. and WIS. (Dr.) 10, 1019.

DUNNS CREEK, Putnam County, Fla. (S.) (County br.) PLANS.—Approv. Mar. 10, 1910, 10, 1028.

DURHAMS CREEK, Bonnerston, N. C. (O.) (Beaufort County br.) PLANS.—Alterations to be completed on or before Feb. 1, 1905, 05, 730.

DUTCH KILLS CREEK, Borden Avenue, New York, N. Y. (S.) (City br.) PLANS.—Br. to replace existing str. approv. Mar. 12, 1902, 02, 587. Plans in lieu thereof, and for a temporary br., approv. Oct. 19, 1905, 06, 803.

DUTCH KILLS CREEK, Long Island City, N. Y. (S.) (Long Island R. R. Co.) PLANS.—Reconstr. plans approv. Mar. 27, 1893, 93, 469.

DUWAMISH R., Kings County, Wash. (S.) (County br.) PLANS.—Approv. Mar. 29, 1900, 00, 700. Approv. Oct. 11, 1900, in lieu of plans approv. Mar. 29, 1900, 01, 663. Approv. Sept. 23, 1901, 02, 585.

DUWAMISH R., sec. 29, T. 24 N., R. 4 E., Wash. (Sp., etc.) (Valley Street Ry. Co.) LEGIS-

LATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—Approv. Oct. 17, 1891; completed Mar. 4, 1892, 92, 400.

DUWAMISH R., Bateman Street, Georgetown, Wash. (S.) (King County br.) PLANS.—Approv. Apr. 23, 1906, 06, 806.

DUWAMISH R., King County, Wash. (S.) (Seattle-Tacoma Interurban Ry.) PLANS.—Approv. Aug. 13, 1901, 02, 584.

DUWAMISH R., near Seattle, Wash. (Sp.) (Northern Pacific & Puget Sound Shore R. R. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—Approv. Mar. 6, 1891, 91, 431.

DUWAMISH R., Seattle, Wash. (S.) (City br.) PLANS.—Approv. Dec. 6, 1909, 10, 1025.

DUWAMISH R., near Seattle, Wash. (S.) (Seattle Electric Co.) PLANS.—Approv. Sept. 6, 1901, 02, 584, 585.

DUWAMISH R., near Seattle, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Approv. Mar. 25, 1904, 04, 717.

DUWAMISH R., waterways at entrance, Seattle, Wash. (O.) (Seattle Electric Co.) PLANS.—Alterations to be completed on or before Oct. 31, 1909, 09, 920.

DUWAMISH R., W. waterway, Seattle, Wash. (O.) (City br.) PLANS.—Alterations to be completed on or before Oct. 31, 1909, 09, 920.

DUWAMISH R., W. waterway, Seattle, Wash. (O.) (Northern Pacific Ry. Co.) PLANS.—Alterations to be completed on or before Oct. 31, 1909, 09, 920.

E.

- EAST CHESTER B.**, in Pelham B. Park, N. Y. (See Hutchinson R.) (S.) (New York City br.) PLANS.—Br. to replace existing str. approv. May 18, 1903, **03**, 650.
- EAST HAVEN R.**, Conn. (O.) (Br. of towns of Branford and East Haven, Conn., the Tide Water Traprock Co., and the Stony R. Dike Co.) PLANS.—Alterations to be completed on or before the expiration of 3 months from Feb. 2, 1904, **04**, 721.
- EAST MACHIAS R.**, E. Machias, Me. (S.) (Washington County Ry. Co.) PLANS.—Approv. July 10, 1905, **06**, 800.
- EAST PASCAGOULA R.**, near Scranton, Miss. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Rebuilding approv. Mar. 30, 1904, **04**, 717.
- EAST PEARL R.**, Miss. (Dr.) **08**, 865.
- EAST R.**, at Hell Gate, and over Little Hell Gate and Bronx (or Harlem) Kills, near Astoria, N. Y. (Sp.) (Brs. of New York Connecting R. R. Co.) PLANS.—Constr. of these brs. approv. Jan. 16 and Mar. 2, 1901, **01**, 664. Plans in lieu thereof approv. June 22, 1906, **06**, 800. Approv. Apr. 4, 1912, for modification of 3 brs. in lieu of plans approv. June 22, 1906, **12**, 1307.
- EAST R.**, 60th Street, Manhattan to Long Island City, via Blackwells Isld., N. Y. (S.) (City br.) PLANS.—Approv. Feb. 21, 1901, **01**, 665.
- EAST R.**, between New York City and Long Isld. (Sp.) (New York & Long Island Br. Co.) **88**, 309. LEGISLATION.—Br. au. by act Mar. 3, 1887, **88**, 2471. PLANS.—Plan and location of proposed br. approv. by Sec. of War, **88**, 2472.
- EAST R.** (br. No. 3), New York, N. Y. (S.) (City br.) PLANS.—Approv. Jan. 29, 1900, **00**, 700. Modified plans in lieu of orig. plans were approv. Jan. 5, 1905, **05**, 725.
- EAST R.**, between New York and Brooklyn. (Sp.) (New York Br. Co.) **69**, 56, 395. BE. constituted by S. O. No. 72, convened at New York, May 22, 1869, to ex. and R. upon the proposed br. between New York and Brooklyn. **R.**, **69**, 397. (Lt. Cols. H. G. Wright and J. Newton, and Maj. W. R. King.) LEGISLATION.—Company au. to constr. br. by act Mar. 3, 1869, **69**, 404. PLANS.—Approv. June 19, 1869. Height of center span to be 135' clear, m. l. w., **69**, 405.
- EAST R.**, between New York and Brooklyn, N. Y. (S.) (East River Br. Co., one above and one below the navy yard.) **93**, 467; **97**, 532. PLANS.—Submitted Oct. 15, 1892, provided for a clearance of 135' at the center of the spans and 120' at the ps. above m. l. w.; BE. recom. a clearance of 145' at center of spans, and Sec. of War, Jan. 17, 1893, prescribed a clearance of 140' at m. l. w. under the most unfav. conditions at the center of the span of the upper br. Plans in accordance submitted Jan. 19, 1893; approv. Feb. 16, 1893. **93**, 467. New York City, having acquired the rights and franchises of upper br., submitted new plans Jan. 10, 1896; BE. recom., Feb. 26, 1896, a clearance of 135' at m. l. spring tides, for 200' on each side of the middle point, and h. of 117' at least at the pierhead lines; plans in accordance submitted Sept. 15, 1896, approv. Sept. 24, 1896, **97**, 552.
- EAST R.** (See Stony Creek, Conn.)
- EAST R.**, Green B. City, Wis. (S.) (City br.) PLANS.—Reconstr. plans approv. May 1, 1896, **96**, 426. Modified plans reducing the draw opening approv. Oct. 13, 1896. **97**, 532.
- EAST R.**, Webster Avenue, Green B., Wis. (S.) (City br.) PLANS.—Approv. June 1, 1904, **04**, 719.
- EAST R.**, near Green B., Wis. (S.) (Manitowoc, Green Bay & North Western Ry. Co., Chicago & North Western Ry. Co.) PLANS.—Approv. Mar. 22, 1905, **05**, 726.
- EAST THOROUGHFARE**, N. J. (S.) (Long Beach Turnpike Co.) PLANS.—Approv. Mar. 14, 1912, **12**, 1306. New plans approv. June 18, 1912, and instrument dated Mar. 14, 1912, canceled, **12**, 1308.
- EAST WATERWAY**, at Klickitat Avenue, Seattle, Wash. (S.) (Chicago, Milwaukee & Puget Sound Ry. Co.) PLANS.—For trestle br. approv. Aug. 17, 1911, **12**, 1300, 1301.
- EBEY SLOUGH**, Wash. (See Snohomish R.)
- EBEYS SLOUGH**, near Marysville, Wash. (S.) (Great Northern Ry. Co.) PLANS.—Reconstr. approv. Jan. 30, 1906, **06**, 804.
- EBEY SLOUGH**, Snohomish County (sec. 4, T. 28 N., R. 5 E.), Willamette meridian, Wash. (S.) (Chicago, Milwaukee & Puget Sound Ry. Co.) PLANS.—Approv. Aug. 9, 1910, **11**, 1082.
- EBEY SLOUGH** (sec. 3, T. 28 N., R. 5 E.), Willamette meridian, Wash. (S.) (Snohomish County br.) PLANS.—Approv. Mar. 15, 1912, **12**, 1306.
- EDISTO R.**, near Branchville, S. C. (See Ashley R., etc.) (A.) (State br.) PLANS.—Should be a raft span of at least 60' in the clear, **89**, 2796.

EDISTO R., near Jacksonboro, S. C. (S.) (Atlantic Coast Line R. R. Co.) PLANS.—Reconstr. of existing br. approv. June 11, 1912, **12**, 1308.

ELBOW RIFLE. (See Chehalis R.)

ELDER CREEK, N. J. (See Leonards Thorouglfare.)

ELIZABETH R., South First Street, Elizabeth, N. J. (S.) (Union County br.) PLANS.—Approv. Aug. 15, 1907, **08**, 869.

ELIZABETH R., N. J. (S.) (Central R. R. Co. of N. J.) PLANS.—Reconstr. plans approv. Jan. 31, 1911, **11**, 1086.

ELIZABETH R., E. Branch and S. Branch, Va. (S.) (Brs. of Tidewater Ry. Co.) PLANS.—Approv. July 20, 1905, **06**, 801.

ELIZABETH R., E. Branch, Norfolk, Va. (S.) (Norfolk Viaduct Corp.) PLANS.—Approv. Sept. 30, 1905, **06**, 802.

ELIZABETH R., E. Branch at Norfolk, Va., and S. Branch at Gilmerton, Va. (S.) (Norfolk & Western Ry. Co.) PLANS.—Reconstr. approv. Apr. 27, 1906, **06**, 806.

ELIZABETH R., W. Branch, Va. (Dr.) **02**, 581.

ELIZABETH R., Va., E. and S. Branches. (A.) (Norfolk & Western R. R. Co. at Norfolk, Va.) **88**, 2542, 2543, 2622. PLANS.—Details of modification of br. as proposed by the R. R. Co., **88**, 2623. Correspondence in relation thereto, **88**, 2624-2628. Draw opening too narrow and badly located. Draw openings should be 60' wide and relocated at the deep chan. **88**, 2543.

ELIZABETH R., S. Branch, Va. (S.) (Southern Branch Drawbr. Co.) PLANS.—Approv. Mar. 10, 1899, **99**, 622. Approv. Mar. 14, 1901, in lieu of plans approv. Mar. 10, 1899, **01**, 665.

ELIZABETH R., S. Branch, Norfolk, Va. (S.) (South Eastern & Atlantic R. R. Co.—Location abandoned by the New York, Philadelphia & Norfolk R. R. Co.) **97**, 533; **98**, 534. PLANS.—Grantees' plans approv. Feb. 8, 1897, **97**, 533. Location having been abandoned by grantees, plans of South Eastern & Atlantic R. R. Co., submitted Nov. 12, 1897, approv. Nov. 26, 1897, **98**, 534.

ELIZABETH R., S. Branch, Va. (S.) (Elizabeth R. R. R. Co.) PLANS.—Approv. June 21, 1906, **06**, 808.

ELIZABETH R., W. Branch, between W. Norfolk and Port Norfolk, Va. (S.) (West Norfolk & Port Norfolk Drawbr. Co.) PLANS.—Submitted Feb. 26, 1894; modified June 9, 1894; approv. June 23, 1894, **94**, 429.

ELIZABETH R., W. Branch, Nansemond R. and Cypress Creek, Va. (S.) (Seaboard Traction Co.) PLANS.—Approv. July 7, 1905, **06**, 800.

ELIZABETH R., W. Branch, Norfolk Va. (S.) (Norfolk, Portsmouth & Newport News Ry. Co.) PLANS.—Approv. Feb. 25, 1902, **02**, 587.

ELIZABETH R., W. Branch, near Norfolk, Va. (S.) (Atlantic Coast Line Ry. Co.) PLANS.—Rebuilding approv. Sept. 26, 1905, **06**, 802.

ELK R., Elk R. Mills, Ala. (Sp., etc.) Limestone County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and by act of Alabama, **92**, 402. PLANS.—Approv. Dec. 9, 1891; completion of br. reported in Jan. 27, 1892, **92**, 402.

ELK R., Bedinfield Ferry, near Oliver, Ala. (S.) (Brs. of Limestone and Lauderdale Counties.) PLANS.—Approv. Sept. 1, 1911, **12**, 1301.

ELK R., near mouth of Big Otter Creek, W. Va. (S.) (Clay County br.) PLANS.—Approv. Feb. 5, 1902, **02**, 587.

ELK R., at mouth of Blue Creek, W. Va. (S.) (Imboden & Odell R. R. Co.) PLANS.—Approv. Mar. 16, 1904, **04**, 717.

ELK R. (150' above mouth of Birch R.), W. Va. (Braxton County br.) PLANS.—Approv. July 22, 1910, **11**, 1082.

ELK R., Charleston, W. Va. (A.) (Suspension wagon br. and Ohio Central R. R. br.) **88**, 2570. PLANS.—Description, **88**, 2572. In view of the nature of the navigation and the limited imp. undertaken by the U. S., Lt. Col. Craighill reported action unnecessary, **88**, 2574.

ELK R., Charleston, W. Va. (S.) (Kanawha & Michigan Ry. Co.) PLANS.—Approv. Oct. 18, 1905, **06**, 802.

ELK R., Charleston, W. Va. (S.) (City br.) PLANS.—Reconstr. approv. Sept. 12, 1905, **06**, 802.

ELK R., Virginia Street, Charleston, W. Va. (S.) (City br.) PLANS.—Reconstr. approv. Dec. 3, 1906, **07**, 823.

ELK R., Spring Street, Charleston, W. Va. (S.) (City br.) PLANS.—Approv. July 31, 1907, **08**, 868.

ELK R., Clay County, W. Va. (S.) (County br.) PLANS.—Approv. Dec. 8, 1898, **99**, 621.

ELK R., Clendennin, W. Va. (S.) (Kanawha County br.) PLANS.—Submitted Feb. 12, 1894; modified June 16, 1894; approv. June 23, 1894, **94**, 429.

ELK R., Frametown, W. Va. (S.) (Braxton County br.) PLANS.—Reconstr. approv. July 31, 1906, **07**, 820.

ELK R., at Gassaway, Braxton County, W. Va. (S.) (Town br.) PLANS.—Approv. Nov. 21, 1911, **12**, 1303.

ELK R., at mouth of Little Otter Creek, W. Va. (S.) (Coal & Coke Ry. Co.) PLANS.—Approv. Nov. 11, 1903, **04**, 715.

ELK R., near Yankeedam, W. Va. (S.) (Messrs. Shadle & Auchmuty.) PLANS.—Approv. Jan. 11, 1907, **07**, 824.

ELLIOTT B. and MOUTH OF DUWAMISH R. (waterway between), Wash. (O.) (Seattle & San Francisco R. R. & Navigation Co.)

- PLANS.—Alterations to be completed on or before Jan. 1, 1903, **02**, 590.
- ELLIOTT B.**, e. and w. waterways, Seattle and W. Seattle, Wash. (S.) (Seattle Electric Co.) PLANS.—Approv. Sept. 27, 1906, **07**, 822.
- ELLIOTT SLOUGH**, Aberdeen, Wash. (S.) (City br.) PLANS.—Approv. Oct. 26, 1906, **07**, 822.
- ELLIS SLOUGH**, near Raymond, Wash. (S.) (Pacific County br.) PLANS.—Approv. Mar. 14, 1907, **07**, 826.
- EMBARRASS R.**, New London, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Approv. Jan. 7, 1899, **99**, 621.
- EMORY R.**, Harriman, Tenn. (Sp.) (Tennessee Central R. R. Co.) Au. act June 30, 1902. PLANS.—Approv. July 30, 1902, **03**, 643.
- ENGLISH BAYOU**, Calcasieu Parish, La. (S.) (Calcasieu Parish br.) PLANS.—Approv. Dec. 24, 1902, **03**, 647.
- ENGLISHMAN R.**, Roque Bluffs, Me. (S.) (Roque Bluffs br.) PLANS.—Reconstr. of existing br. approv. July 29, 1911, **12**, 1300.
- ERIE CANAL.** (See Black Rock H.)
- ESCAMBIA B., CHOCTAWHATCHEE R. and APPALACHICOLA R.**, between Pensacola and River Junction, Fla. (Sp.) (Louisville & Nashville R. R. Co.) Au. act Mar. 1, 1910. PLANS.—Reconstr. of 3 brs. across the streams mentioned, approv. Mar. 25, 1910, **10**, 1021.
- ESSEX R.**, Essex, Mass. (S.) (Town br.) PLANS.—Reconstr. approv. June 26, 1902, **02**, 589.
- EUREKA SLOUGH**, Cal. (S.) (Eureka & Klamath R. R. Co.) PLANS.—Approv. Mar. 20, 1901, **01**, 665.
- EUREKA SLOUGH**, Humboldt County, Cal. (S.) (California & Northern Ry. Co.) PLANS.—Approv. June 29, 1900, **00**, 701.
- EXETER R.**, Stratham, N. H. (O. and A. (Town br.) PLANS.—Specified alterations to be completed on or before May 15, 1901, **01**, 668.

F.

FAR ROCKAWAY B., Rockaway Inlet, between Hicks Beach and Shelter Isld., N. Y. (S.) (Ocean Causeway Co.) PLANS.—Submitted Aug. 15, 1894; modified May 9, 1895; approv. July 16, 1895, **95**, 479.

FAR ROCKAWAY B., N. Y. (O.) (Far Rockaway Ferry & Imp. Co.) PLANS.—Alterations requiring a clear draw of 35' to be completed Oct. 15, 1897, **98**, 538.

FARM CREEK, Bell Isld., Norwalk, Conn. (S.) (Town br.) PLANS.—Rebuilding approv. Oct. 19, 1905, **06**, 803.

FARM CREEK, Norwalk, Conn. (S.) (Connecticut County br.) PLANS.—Reconstr. of existing trestle br. approv. Aug. 21, 1911, **12**, 1301.

FISHING CREEK, N. C. (Sp.) (Frank Hitch.) LEGISLATION.—Mr. Hitch au. to constr. br. by act Mar. 1, 1900, **00**, 697. PLANS.—Approv. Apr. 30, 1900, **00**, 697.

FLAMBEAU R. (N. Fork), Park Falls, Wis. (S.) (Park Falls village br.) PLANS.—Approv. June 28 1909, **09**, 919.

FLINT R., Bainbridge, Ga. (Sp.) (Atlantic Coast Line R. R. Co.) Au. act Aug. 6, 1888. PLANS.—Approv. May 24, 1911, **11**, 1081. Modified plans approv. Oct. 24, 1911, and further modification approv. Apr. 24, 1912, **12**, 1298.

FLINT R., near Bainbridge, Ga. (Sp.) (Alabama Midland Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 6, 1888, **89**, 372. PLANS.—Approv. June 12, 1889, **89**, 372.

FLINT R., Drayton, Ga. (A.) (Wagon br.) PLANS.—Capt. Hoxie recom. the insertion of a draw of suitable width, **88**, 2552.

FLINT R., Decatur, Ga. (Sp.) (Georgia, Florida & Alabama Ry. Co.) Au. act Mar. 1, 1899, and Mar. 2, 1901. PLANS.—Approv. May 22, 1901, **01**, 660.

FLORIDA KEYS (waterways along), from mainland to Key West, including Jew Fish Creek, Bahia Honda, and Indian Key Chans. (S.) (Florida East Coast Ry. Co.) PLANS.—Approv. July 15, 1905, and detailed plans for the localities specified approv. Apr. 4, 1906, **06**, 805.

FLORIDA WATERWAYS, Fla. (Dr.) **11**, 1078.

FLUSHING CREEK, N. Y., near the Bridge Street station on the Whitestone Branch of the Long Island R. R. (O.) (Long Island R. R. Co.) PLANS.—Required a straight chan. prac-

tically in direction of the axis of the stream, with a clear width of 40' in the draw and between the guard piling; to be completed on or before Mar. 1, 1896, **95**, 483.

FLUSHING CREEK, between Newtown and Flushing, Borough of Queens, New York, N. Y. (S.) (City br.) PLANS.—Approv. July 10, 1903, **04**, 713.

FORE R., Me. (Dr.) **02**, 581.

FORE R. MOUTH, Portland H., Me. ("Portland Bridge"). (A. and O.) (Cumberland County br.) PLANS.—Alteration plans, required under act Sept. 19, 1890, approv. Apr. 10, 1893, **93**, 472, 474.

FORE R., Portland H., Me. (Dr.) **10**, 1019.

FORE R., Portland, Me.; Vaughan Br. (O. and A.) (City br.) PLANS.—Specified alterations to be completed on or before Sept. 1, 1902, **01**, 668. Rebuilding approv. Nov. 16, 1905, **06**, 808.

FORE R., Portland, Me. (O. and A.) (Boston & Maine R. R. Co.) **01**, 668. PLANS.—Specified alterations to be completed on or before Sept. 1, 1902, **01**, 668.

FORKED DEER R., Chestnut Bluff, Tenn. (S.) (Br. of Lauderdale and Crockett Counties.) PLANS.—Approv. Oct. 25, 1904, **05**, 724.

FORKED DEER R. (S. Fork of), at S. Fork, Tenn. (S.) (Illinois Central R. R. Co.) PLANS.—Reconstr. approv. Apr. 16, 1906, **06**, 806.

FORKED DEER R., S. Fork, Yellow Bluff, Tenn. (S.) (Dyer County br.) PLANS.—Approv. Sept. 12, 1898, **99**, 620.

FORT BAYOU, Franco Ferry, Miss. (S.) (Jackson County br.) PLANS.—Approv. May 21, 1901, **01**, 666.

FORT BAYOU, main chan., Ocean Springs, Miss. (Sp., etc.) (Ocean Springs Br. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Mississippi. PLANS.—Approv. Dec. 14, 1891, **92**, 402.

FORT PT. CHAN., Boston, Mass. (S.) (City br.) PLANS.—Approv. Sept. 23, 1897, **98**, 533. Reconstr. approv. July 13, 1911, **12**, 1299.

FORT PT. CHAN., Boston, Mass. (A.) (New York & New England R. R. Co.) PLANS.—Maj. Raymond proposed to widen the draw openings to a least width of 42½' and to change the direction of the draw p., **88**, 2527. Lt. Col. Gillespie reported that to provide for the proj. increase in chan. depth the existing pivot p. would have to be reconstr. with draw openings of 43', **88**, 2608, 2609.

- FORT PT. CHAN.** (Broadway Br.), Boston, Mass. (S.) (City br.) PLANS.—Reconstr. plans for part of p. approv. June 14, 1900, **00**, 701. Rebuilding approv. Mar. 7, 1902, **02**, 587.
- FORT PT. CHAN.**, Boston H., Mass. (S.) (Br. of the Boston & Providence R. R. Corp., the Old Colony R. R. Co., and the New York, New Haven & Hartford R. R. Co.) PLANS.—For 2 brs. approv. Mar. 28, 1898, **98**, 535.
- FORT PT. CHAN.**, Cove Street, Boston, Mass. (S.) (City br.) PLANS.—Approv. July 10, 1900, **01**, 661. Modified plans approv. Apr. 18, 1902, **02**, 588.
- FORT PT. CHAN.**, Dover Street, Boston, Mass. (S. and O.) (City br.) PLANS.—Reconstr. plans approv. July 12, 1893, **93**, 470. Alterations required by Nov. 30, 1905, **05**, 730.
- FORT PT. CHAN.**, Northern Avenue and Oliver Street, Boston, Mass. (S.) (City br.) PLANS.—Approv. Apr. 11, 1905, **05**, 726.
- FORT PT. CHAN.** (Across.) (Br. of the Old Colony R. R. Co. at Boston, Mass.) PLANS.—Maj. Raymond reported that the interference with free navigation is caused by delay in opening the draws, due to the great number of passing trains; no alteration of the br. is necessary, **88**, 2527.
- FOSTERS MEADOW** (Hook Creek) **CANAL**, N. Y. (See Hook Creek.) (S.) (Long Island R. R. Co.) PLANS.—Approv. Sept. 8, 1906, **07**, 822. Approv. Feb. 26, 1907, **07**, 825.
- FOUR MILE** (Cedar) **CREEK**, at Freeport, Fla. (S.) (Walton County br.) PLANS.—Approv. Mar. 16, 1910, **10**, 1028.
- FOURCHE LE FEVRE R.**, Ark. (Sp.) (Choctaw & Memphis R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Jan. 10, 1899. PLANS.—Approv. Mar. 13, 1899, **99**, 619.
- FOURCHE LE FEVRE R.**, near Esaw, Ark. (S.) (Fourche River Lumber Co.) PLANS.—Approv. Feb. 2, 1904, **04**, 716.
- FOURCHE LE FEVRE R.**, near Houston, Tex. (S.) (Perry County br.) PLANS.—Approv. Aug. 17, 1908, **09**, 914.
- FOWL R.**, Mobile, Ala. (See Dog R.) (S.) (Dauphin Island Ry. & Harbor Co.) PLANS.—Approv. Dec. 12, 1911, **12**, 1303.
- FOWL R.**, Mobile, Ala. (S.) (Mobile West Shore Traction Co.) PLANS.—Approv. Dec. 13, 1911, **12**, 1303.
- FOX R.**, John Street, Appleton, Wis. (See Buffalo Lake.) (S.) (City br.) PLANS.—Rebuilding approv. Sept. 24, 1902, **03**, 646.
- FOX R.**, U. S. Canal, Lake Street, Appleton, Wis. (S.) (City br.) PLANS.—Reconstr. plans of superstr. approv. Oct. 12, 1897, **98**, 533.
- FOX R. CANAL**, South Division Street, Appleton, Wis. (S.) (City br.) PLANS.—Approv. Jan. 24, 1901, **01**, 664.
- FOX R.**, U. S. Canal, Appleton, Wis. (S.) (City br.) PLANS.—Reconstr. approv. Nov. 3, 1906, **07**, 823.
- FOX R.**, Buffalo, Moundville, and Douglas, Wis. (See below.) (S.) (Marquette County brs. PLANS.—Approv. Jan. 30, 1901, **01**, 664.
- FOX R.**, near Governors Bend Lock, Wis. (S.) (Fort Winnebago br.) PLANS.—Submitted Aug. 25, 1894; approv. Sept. 15, 1894; modified plans approv. Feb. 6, 1895; br. completed, **95** 476.
- FOX R.**, Main Street, Green Bay, Wis. (S.) (City br.) PLANS.—Reconstr. plans approv. Oct. 14, 1896, **97**, 532.
- FOX R.**, at Green Bay, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Approv. Mar. 26, 1902, **02**, 588.
- FOX R.**, at Green Bay, Wis. (S.) (Manitowoc Green Bay & Northwestern Ry. Co.—Chicago & North Western Ry. Co.) PLANS.—Approv. Mar. 27, 1905, **05**, 726.
- FOX R.**, Green Bay, Wis. (S.) (Manitowoc Green Bay & Northwestern Ry. Co.) PLANS.—Approv. Mar. 27, 1905. Plans in lieu thereof approv. Apr. 25, 1906, **06**, 806.
- FOX R.**, Mason Street, Green Bay, Wis. (O.) (City br.) PLANS.—Approv. Oct. 26, 1908; **09** 915. Alterations to be completed on or before Mar. 15, 1910, **07**, 829.
- FOX R.**, between Green Bay and Fort Howard Wis. (S.) (Chicago & North Western Ry. Co. and the Kewaunee, Green Bay & Western R. R. Co.) PLANS.—Approv. Feb. 5, 1895, **95**, 478.
- FOX R.**, at Kimberly, Wis. (S.) (Br. of Outagamie County and village of Kimberly.) PLANS.—Approv. Jan. 29, 1912, **12**, 1305. New plans approv. Mar. 20, 1912, and instrument dated Jan. 29, 1912, canceled, **12**, 1306.
- FOX R.**, at Little Chute, Wis. (S.) (Outagamie County br.) PLANS.—Approv. July 14, 1903, **04**, 713.
- FOX R.**, Menasha, Wis. (S.) (City br.) PLANS.—Reconstr. plans approv. Dec. 29, 1896, **97**, 533.
- FOX R.**, Menasha, Wis. (S.) (City br.) PLANS.—Reconstr. approv. Mar. 20, 1908, **08**, 872.
- FOX R.**, Menasha, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Reconstr. approv. June 16, 1909, **09**, 918.
- FOX R.**, between towns of Moundville and Buffalo, Marquette County, Wis. (Wisconsin Highway Commission.) (See above.) PLANS.—Reconstr. of existing br. approv. Nov. 28, 1911, **12**, 1303.
- FOX R.** (Little Lake Butte Des Norts), Neenah, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Rebuilding approv. June 16, 1909, **09**, 918.
- FOX R.**, OMRO, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Reconstr. plans approv. Jan. 10, 1899, **99**, 621.
- FOX R.**, Oshkosh, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Reconstr. of plans approv. Sept. 9, 1898, **99**, 620.
- FOX R.**, Wisconsin Avenue, Oshkosh, Wis. (Sp., etc.) (City br.) LEGISLATION.—City

- au. to constr. bf. under act Sept. 19, 1890, sec. 7 and act of Wisconsin. PLANS.—Approv. Feb. 1, 1892, **92**, 403.
- FOX R.**, at Oshkosh, Wis. (S.) (Wisconsin Central Ry. Co.) PLANS.—For br. to replace existing str. approv. July 2, 1902, **03**, 645.
- FOX R.**, Main Street, Oshkosh, Wis. (S.) (City br.) PLANS.—Rebuilding approv. July 7, 1904, **05**, 722.
- FOX R.**, Portage (about 4 m. below), Wis. (S.) (Minneapolis, St. Paul & Sault Ste. Marie Ry. Co.) PLANS.—Reconstr. approv. Jan. 22, 1910, **10**, 1026.
- FOX R.**, Princeton, Wis. (S.) (Princeton & Northwestern Ry. Co.) PLANS.—Approv. Sept. 14, 1900, **01**, 663.
- FOX R.**, Wrightstown, Wis. (S.) (Brown County br.) PLANS.—Partial rebuilding approv. July 25, 1900, **01**, 662.
- FOX R.** and **CANAL**, De Pere, Wis. (S.) (De Pere City br.) PLANS.—New br. approv. Feb. 1, 1894, **94**, 427.
- FOX R.** and **U. S. CANAL**, De Pere, Wis. (Sp., etc.) (Chicago & North Western Ry. Co.) LEGISLATION.—Company au. to constr. br. under act July 13, 1892, sec. 3, and act of Wisconsin, **92**, 409. PLANS.—Modified plan approv. Aug. 30, 1892, **92**, 409. New br. approv. Nov. 21, 1903, **04**, 715.
- FOX R. CANAL**, Main Street, De Pere, Wis. (O. and A.) (City br.) PLANS.—Specified alterations to be completed on or before May 1 1901, **01**, 668.
- FOX R.** and **CANAL**, Kaukauna, Wis. (S.) (City br.) PLANS.—Approv. Dec. 11, 1893. Reported completed. **94**, 427.
- FOX R. CANAL**, Lock No. 2, Kaukauna, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Reconstr. approv. Sept. 7, 1900, **01**, 662.
- FOX R. CANAL**, Lawe Street and Wisconsin Avenue, Kaukauna, Wis. (O. and A.) (City brs.) PLANS.—Specified alterations to be completed on or before May 1, 1901, **01**, 668.
- FOX R.** (U. S. Canal along), Menasha, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Reconstr. approv. Jan. 25, 1905, **05**, 725.
- FOX R. CANAL**, Mill Street and Taco Street, Menasha, Wis. (O. and A.) (City brs.) PLANS.—Specified alterations to be completed on or before May 1, 1901, **01**, 668.
- FOX R. CANAL**, Montello, Wis. (S.) (Montello village br.) PLANS.—Approv. Jan. 27, 1905, **05**, 725.
- FOX R.** and the **PORTAGE CANAL**, Wis. (A.) PLANS.—List of brs. obstr. the R. and the canal; remedies or modifications proposed by Capt. Marshall, **88**, 2578, 2579.
- FRANKFORD CREEK**, Pa. (See Schuylkill R., etc.) (O.) (Kensington & Tacony R. R.—Pennsylvania R. R. Co.) PLANS.—Required a clear chan. width of 24' and h. w. clearance of 10' on or before Oct. 31, 1900, **00**, 703.
- FRANKFORD CREEK**, Philadelphia, Pa. (S.) (Philadelphia Belt Line R. R. Co.) PLANS.—Approv. Sept. 30, 1892, **93**, 466.
- FRANKFORD CREEK**, Bridge Street, Philadelphia, Pa. (S.) (City br.) PLANS.—Reconstr. of br. approv. Jan. 7, 1895, **95**, 477.
- FRENCH CREEK**, W. Va. (S.) (Baltimore & Ohio R. R. Co.) PLANS.—Rebuilding approv. Dec. 3, 1909, **10**, 1025.

G.

- GALENA R.**, at Galena Junction, Ill. (S.) (Chicago, Burlington & Quincy Ry. Co.) PLANS.—Reconstr. plans approv. Sept. 13, 1910, **11**, 1083.
- GALENA R.**, Ill. (Dr.) **02**, 581; **09**, 912.
- GALLINAS CREEK**, Marin County, Cal. (S.) (Bay Counties Ry. Co.) PLANS.—Approv. July 14, 1906, **07**, 820.
- GALVESTON B.** (See West Galveston B.)
- GALVESTON B.**, Tex., between Galveston Isld. and Virginia Pt. (Sp.) (La Port, Houston & Northern R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 1, 1895. PLANS.—Approv. Mar. 27, 1895; draw opening required to be 85' in the clear, **95**, 475.
- GALVESTON B.**, Tex., between Galveston Isld. and Virginia Pt. (S.) (Port Bolivar, Galveston & Virginia Point Terminal R. R. Co.) PLANS.—Approv. Mar. 25, 1895, **95**, 478.
- GASCONADE R.**, Mo. (A.) (Missouri Pacific R. R. Co.) PLANS.—Description of the br. Maj. Miller reported that the draw span should be made operative, and that a guide p. should be built above and below the pivot p. **88**, 2559.
- GASCONADE R.**, Mo. (S.) (St. Louis, Kansas City & Colorado R. R. Co.) PLANS.—Approv. July 13, 1901, **02**, 583.
- GASCONADE R.**, Rollins Ferry Mo. (S.) (Osage County br.) PLANS.—Modified plans approv. Oct. 19, 1897, **98**, 533.
- GASPARILLA SOUND**, at Gasparilla Isld., Fla. (S.) (Alafia, Manatee & Gulf Coast Ry. Co.) PLANS.—Approv. May 4, 1906, **06**, 806.
- GAULEY R.**, W. Va. (S.) (Chesapeake & Ohio R. R. Co.) PLANS.—Approv. Dec. 21, 1892, **93**, 467.
- GAULEY R.**, Fayette County, W. Va. (Sp., etc.) (Kanawha & Michigan (Ohio) Ry. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of West Virginia. PLANS.—Modified plans approv. Aug. 11, 1892, **92**, 408.
- GENESEE R.**, Charlotte, N. Y. (Sp.) **74**, 71, 583. BE. convened at Charlotte, N. Y., Aug. 26, 1873, approv. location and plan, with certain modifications. **R.**, **74**, 584. Approv. by Chief of Engineers, except regulations for government of operating draw, **74**, 583. Approv. by Sec. of War, **74**, 584. (Majs. Merrill, Wilson, and Harwood.) LEGISLATION.—Br. au. by act Mar. 3, 1873, **74**, 583. PLANS.—Submitted by Lake Ontario Shore R. R. Co., referred to BE., **74**, 583.
- GENESEE R.**, Charlotte, N. Y. (S.) (New York Central & Hudson R. R. Co.) PLANS.—Rebuilding approv. Apr. 12, 1904, **04**, 717.
- GEORGIANA SLOUGH**, Walnut Grove, Cal. (S.) (Sacramento County br.) PLANS.—Approv. Oct. 17, 1899, **00**, 699.
- GILPATRICKS COVE**, Northeast Harbor, Me. (S.) (W. W. Vaughan.) PLANS.—Approv. Sept. 13, 1895, **96**, 424.
- GLOUCESTER H.** (canal at entrance of) to **ANNISQUAM R.**, Gloucester, Mass. (S.) (Essex County brs.) PLANS.—Temporary and permanent brs. approv. Sept. 14 and Dec. 6, 1905, respectively, **06**, 803.
- GOODBYS LAKE** (Creek), Duval County, 8 m. above Jacksonville, Fla. (S.) (County br.) PLANS.—Approv. Nov. 3, 1911, **12**, 1302.
- GOWANUS CANAL**, Hamilton Avenue, 9th Street, 3d Street, and Union Street, Borough of Brooklyn, New York, N. Y. (S.) (City brs.) PLANS.—Rebuilding existing strs. approv. May 5, 1904, **04**, 718.
- GRAND BAYOU**, on line of logging road in Louisiana. (Bowie Lumber Co., Ltd.) PLANS.—Approv. Aug. 19, 1910, **11**, 1083.
- GRAND R.**, Mich. (Dr.) **07**, 815; **10**, 1019.
- GRAND R.**, Ohio. (S.) (Lake County br.) PLANS.—For new br. approv. Apr. 14, 1899, **99**, 622.
- GRAND R.**, near Bass R., Mich. (S.) (Riverside Ry. Co.) PLANS.—Approv. Nov. 19, 1904, **05**, 725.
- GRAND R.**, Brunswick Mo. (S.) (Chariton County br.) PLANS.—Approv. Nov. 30, 1907, **08**, 871.
- GRAND R.**, near Grand Haven, Mich. (S.) (Detroit, Grand Haven & Milwaukee Ry. Co.) PLANS.—Reconstr. approv. Sept. 30, 1907, **08**, 870.
- GRAND R.**, Wealthy Avenue, Grand Rapids, Mich. (A.) (Pere Marquette R. R. Co.) PLANS.—Reconstr. approv. Aug. 31, 1901, **02**, 590.
- GRAND R.**, Wealthy Avenue, Grand Rapids, Mich. (S.) (City br.) PLANS.—Approv. Oct. 16, 1902, **03**, 646.
- GRAND R.**, Painesville, Ohio. (S.) (Baltimore & Ohio R. R. Co.) PLANS.—Reconstr. approv. Dec. 22, 1906, **07**, 824.
- GRAND R.**, between Spring Lake and Grand Haven, Mich. (S.) (Grand River Toll Bridge

- Co.) PLANS.—To replace existing str. approv. Mar. 25, 1903, 03, 649.
- GRAND CALUMET R.**, at Hohman Avenue, Hammond, Ind. (Sp.) (Lake County br.) Au. act Apr. 8, 1910. PLANS.—Approv. May 10, 1910, 10, 1022.
- GRANDE BAYOU**, arm of Pensacola B., Fla. (S.) (Pensacola Electric Ry. Co.) PLANS.—Reconstr. approv. Sept. 23, 1905, 06, 802.
- GRASSE R.**, at Messina Center, N. Y. (S.) (Town br.) PLANS.—Approv. Aug. 4, 1909, 10, 1023.
- GRASSY SOUND CHAN.**, in line of road to Holly Beach, N. J. (S.) (Cape May County br.) PLANS.—Approv. Mar. 28, 1911, 11, 1088.
- GRAVENS THOROUGHFARE**, N. J. (S.) (Cape May County br.) PLANS.—Approv. Mar. 4, 1912, 12, 1305.
- GREAT CHAN. and SCOTCH BONNET THOROUGHFARE**, N. J. (S.) (Brs. of Stone Harbor Turnpike Co.) PLANS.—Approv. Aug. 10, 1910, and modified plans extending sand fill at br. across Great Chan. approv. Aug. 29, 1910, 11, 1082.
- GREAT EGG H.**, between Somers Pt. and Ocean City, N. J. (S.) (Atlantic City & Ocean City R. R. Co.) PLANS.—Approv. Nov. 3, 1906, 07, 823.
- GREAT KANAWHA R.**, Charleston, W. Va. (A.) 83, 271, 1591; 84, 271, 1796. COMMERCE.—Requirements of C., 83, 1593; 84, 1804. BE. recom. chan. span with clear opening of 400' and its lowest part at least 29' above the h. w. and 75' above l. w., 84, 1798. (Lt. Cols. Craighill and Merrill and Capt. Post.) LEGISLATION.—Changes recom. by BE., 84, 1798, 1802. PLANS.—Col. W. P. Craighill reported chan. span should not be less than 250' clear opening, height of spans not less than 70', 83, 1592. Dimensions of spans referred to BE., 84, 1797. Recom. of board, 84, 1797.
- GREAT KANAWHA R.**, Charleston, W. Va. (Sp.) (Charleston & South Side Bridge Co.) BE. constituted by S. O. No. 28, May 31, 1890. (Col. W. P. Craighill, Maj. D. W. Lockwood, and Capt. E. Maguire.) LEGISLATION.—Company au. to constr. br. under act Mar. 3, 1887. PLANS.—Revised plans conforming to the recom. of the BE. approv. Sept. 26, 1890. Apr. 20, 1891, Col. Craighill reported br. completed as required, except that the main span was $\frac{1}{8}$ " too low at Charleston end. 91, 429.
- GREAT KANAWHA R.**, Ft. Pleasant, W. Va. (Sp.) (Ohio River R. R. Co.) 88, 308. BE. Board of 1887 recom. location of br. with a clear opening of 460', as proposed by the Ohio River R. R. Co., 88, 2448. (Col. Craighill, Lt. Col. Merrill, and Maj. Post.) LEGISLATION.—Act au. constr. of br., Mar. 3, 1887, 88, 2447.
- GREAT PEDEE R.**, 125 m. above Georgetown, S. C. (A.) (Wilmington, Columbia & Augusta R. R. Co.) PLANS.—Capt. Bixby recom. suitable fenders at both ends of the draw openings of the br., extending 100' above and below the br., 88, 2547.
- GREAT PEDEE R.**, at Savage and Allison's Landing, S. C. (S.) (Pee Dee Br. Co.) PLANS.—Approv. Oct. 5, 1911, 12, 1301.
- GREAT PEDEE R.**, near Society Hill, S. C. (O.) (Society Hill & Marlborough Br. Co.) PLANS.—Specified alterations required on or before Sept. 1, 1892, 92, 411. Alterations to be completed on or before 60 days from Feb. 26, 1908, 08, 874.
- GREAT BIGOLETS, La.**, br. (R. R.) 70, 63, 377. LEGISLATION.—Committee on C. (of U. S. Senate) requested, May 5, 1870, the views of Sec. of War, 70, 377. PLANS.—New Orleans, Mobile & Chattanooga R. R. Co.'s plan discussed, 70, 379. Objections to the br. stated by Maj. Reese, 70, 379. By Chief of Engineers, 70, 378. Suggestions for the imp. of the plan in interests of navigation, 70, 380.
- GREEN R.**, Munfordville, Ky. (S.) (Munfordville Br. Co.) PLANS.—Approv. Oct. 25, 1906, 07, 822.
- GREEN R.**, at Smallhouse, Ky. (S.) (Madisonville, Hartford & Eastern R. R. Co.) PLANS.—Approv. Feb. 19, 1906, 06, 804.
- GREEN R.** (below Lock No. 1), Spottsville, Ky. (O.) (Louisville, St. Louis & Texas R. R. Co.) PLANS.—Widening w. draw opening to 160' and placing w. p. 52' w. of position; to be completed on or before July 31, 1891; time extended to Oct. 31, 1891, 91, 434.
- GROSSETETE BAYOU**, between Grosse Tete and Rosedale, La. (S.) (Iberville Parish Br.) PLANS.—Approv. Sept. 3, 1909, 10, 1024.
- GROSSETETE BAYOU**, near Grosse Tete, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Approv. Apr. 4, 1906, 06, 805.
- GUADALUPE R.**, Kemper City, Tex. (S.) (St. Louis, Brownsville & Mexico Ry. Co.) PLANS.—Approv. May 3, 1905, 05, 727.
- GUNPOWDER R.**, Md. (S.) (Philadelphia, Baltimore & Washington R. R. Co.) PLANS.—Reconstr. of existing br. approv. Mar. 19, 1912, 12, 1306.
- GUT**, at South Bristol, Me. (O.) (Bristol town br.) PLANS.—Alterations to be completed on or before July 30, 1903, 03, 652.
- GUYANDOT R.**, W. Va. (See Ohio R., etc.) (S.) (Guyandot Valley Ry. Co.) PLANS.—For 2 brs., 14½ m. and 20½ m., respectively, above the mouth of the Guyandot, approv. Mar. 24, 1900, 00, 700.
- GUYANDOT R.**, at Baileysville; W. Va. (S.) (Wyoming County br.) PLANS.—Approv. June 19, 1912, 12, 1308.
- GUYANDOT R.**, Barboursville, W. Va. (S.) (Cabell County br.) PLANS.—Approv. Nov. 17, 1908, 09, 816.

GUYANDOT R., Branchland, W. Va. (S.) (Guyan Br. Co.) PLANS.—Approv. Mar. 31, 1908, **08**, 872.

GUYANDOT R., Guyandot and Huntington, W. Va. (S.) (Cabell County br.) PLANS.—Approv. Mar. 15, 1905, **05**, 726.

GUYANDOT R., Lincoln County, W. Va. (S.) (Lincoln County br.) PLANS.—Approv. Oct. 13, 1902, **03**, 646.

GUYANDOT R., Logan, W. Va. (S.) (Logan & Southern Ry. Co.) PLANS.—Approv. Sept. 1, 1908, **09**, 915.

GUYANDOT R., near Logan Courthouse, W. Va. (S.) (Manley Coal Co.) PLANS.—Approv. Sept. 21, 1900, **10**, 1024.

GUYANDOT R., above mouth of Russell Creek, W. Va. (S.) (Cabell County br.) PLANS.—Approv. Oct. 3, 1911, **12**, 1301.

GUYANDOT R., Salt Rock, W. Va. (S.) (Cabell County br.) PLANS.—Approv. Nov. 1, 1897, **98**, 533.

H.

HACKENSACK R., N. J. (S.) (Pennsylvania R. R. Co.) PLANS.—Submitted Sept. 22, 1892, for replacing old with new br.; approv. Oct. 20, 1892, **93**, 466.

HACKENSACK R., N. J. (S.) (Morris & Essex R. R. Co.) PLANS.—For new br. approv. May 21, 1900, **00**, 701.

HACKENSACK R., N. J. (Dr.) **02**, 581; **10**, 1019.

HACKENSACK R., N. J. (S.) (County br.) PLANS.—Approv. Feb. 18, 1901, **01**, 665.

HACKENSACK R., N. J. (S.) (Hudson County br.) PLANS.—To replace existing str. approv. Aug. 10, 1903, **04**, 713.

HACKENSACK R., N. J. (S.) (Central R. R. of N. J.) PLANS.—Temporary br. for use during reconstr. of existing br. approv. July 7, 1911, **12**, 1299.

HACKENSACK R., N. J. (S.) (Central R. R. of N. J.) PLANS.—Approv. June 19, 1911; instrument canceled Mar. 22, 1912, and new plans approv. Mar. 22, 1912, **12**, 1306.

HACKENSACK R., Hackensack, N. J. (S.) (Bergen County Traction Co.) PLANS.—Approv. Jan. 4, 1900, **00**, 700.

HACKENSACK R., Anderson Street, Hackensack N. J. (S.) (Bergen County br.) PLANS.—Reconstr. plans approv. Mar. 14, 1898, **98**, 534.

HACKENSACK R., Court Street, Hackensack, N. J. (S.) (Bergen County br.) PLANS.—Rebuilding approv. July 24, 1908, **08**, 868.

HACKENSACK R., Hackensack and Ridgefield Park, N. J. (S.) (Bergen County br.) PLANS.—Approv. Dec. 12, 1908, **09**, 916. Modified plans approv. Dec. 18, 1911, **12**, 1303.

HACKENSACK R., Newark Avenue, Jersey City, N. J. (S.) (Hudson County br.) PLANS.—Rebuilding approv. July 20, 1906, **07**, 820; and plans supple. thereto approv. Aug. 22, 1908, **09**, 915.

HACKENSACK R., Little Ferry, N. J. (S.) (Bergen Turnpike Co.) PLANS.—Approv. Aug. 29, 1901, **02**, 584.

HACKENSACK R., Marlon, N. J. (S.) (Pennsylvania, New Jersey & New York R. R. Co.) PLANS.—Approv. June 29, 1905, **05**, 728.

HACKENSACK R., Secaucus, N. J. (S.) (Erie Terminals R. R. Co.) PLANS.—Approv. Mar. 16, 1910, **10**, 1028.

HACKENSACK R., near Snake Hill, N. J. (S.) (Erie R. R. Co.—New York & Greenwood Lake Ry. Co.) PLANS.—Reconstr. approv. May 15, 1907, **07**, 827.

HACKENSACK and PASSAIC RS., N. J. (S.) (Central R. R. of N. J.) PLANS.—Reconstr. plans for 2 brs. approv. June 19, 1911, and plans for 2 temporary brs. alongside approv. July 7, 1911, **11**, 1090.

HALIFAX R., Daton, Fla. (S.) (J. P. Vining et al.) PLANS.—Approv. May 15, 1901, **01**, 666.

HALIFAX R., Fla., to connect Daytona with Daytona Beach and Seabreeze. (S.) (Michael Sholtz.) PLANS.—Approv. May 4, 1912, **12**, 1307.

HALIFAX R., at Ormond, Fla. (S.) (Florida East Coast Ry. Co.) PLANS.—Approv. Aug. 3, 1904, **05**, 723.

HALIFAX R., Port Orange, Fla. (S.) (Port Orange Br. Co.) PLANS.—Approv. Aug. 7, 1905, **06**, 801.

HAMMONASSET R. (See Stony Creek, Conn.)

HAMPTON CREEK (arm of), Hampton, Va. (S.) (City br.) PLANS.—Approv. Aug. 23, 1910, **11**, 1083.

HAMPTON R., Seabrook Beach to Hampton Beach, Me. (S.) (Granite State Land Co.) PLANS.—Approv. Apr. 15, 1901, **01**, 666.

HARLEM KILLS. (See East R.)

HARLEM R., Broadway crossing, N. Y. (S.) (New York City br.) LEGISLATION.—Congress, act Sept. 19, 1890, required submission of plans. PLANS.—Submitted Apr. 28, 1892; modified plans Jan. 31, 1893; approv. Feb. 11, 1893, **93**, 467. Reconstr. approv. Apr. 20, 1905, **05**, 727.

HARLEM R., Broadway extended, New York City, N. Y. (Sp., etc.) (Hugh N. Camp and D. E. Seybel.) PLANS.—Permission to build temporary footbr. granted June 24, 1892, by revocable license, **92**, 406.

HARLEM R., 1st Avenue, New York, N. Y. (S.) (City br.) PLANS.—Approv. Jan. 11, 1895, **95**, 477.

HARLEM R., 4th Avenue, New York, N. Y. (Sp., etc.) (New York Central & Hudson River R. R. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, and act of New York, **92**, 406. PLANS.—Reconstr. plans for a temporary br., approv. May 27, 1892, and for a permanent br., approv. Aug. 5, 1892, **92**, 406.

HARLEM R., N. Y. (Dr.) **02**, 581.

HARLEM R., New York City. (A.) **90**, 344. COMMERCE.—Interest involved, **90**, 3486. BE. convened at New York City, June 19, 1890, by S. O. No. 25, to report upon alleged obstr. of navigation by certain brs. over the Harlem

- R. Board recom. increasing the clear headway of the 3d and 4th Avenue bns. to 24' above h.-w. level. **90**, 3487. (Cols. Abbot and Comstock and Lt. Col. Gillespie.) LEGISLATION.—Notice served as to alterations required, **90**, 344.
- HARLEM R.**, between 145th and 149th Streets, New York. (S.) (New York City br.) PLANS.—Approv. Nov. 11, 1897, **98**, 533.
- HARLEM R.**, 155th Street, and McComb Dam Road, New York. (Sp.) (New York City Commissioners of Public Parks.) LEGISLATION.—Commissioners au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of New York. PLANS.—To replace the McComb Dam br. approv. Sept. 7, 1891, **91**, 433.
- HARLEM R.**, 156th Street, New York City, N. Y. (O.) (City br.) PLANS.—Permission for temporary br. granted by revocable license, July 5, 1892; this temporary br. to be removed upon completion of permanent br. at 155th Street, **92**, 406. Br. at 155th Street completed; notice served, Apr. 13, 1897, requiring removal of temporary br. at 156th Street within 90 days, **97**, 536.
- HARLEM R.**, 3d Avenue, New York, N. Y. (S.) (City br.) PLANS.—Br. obstr. navigation; city notified, July 2, 1890, to alter it; alteration plans approv. Mar. 24, 1893, **93**, 469.
- HARLEM R.**, between 145th Street and 149th Street, New York, N. Y. (S.) (City br.) PLANS.—Approv. Oct. 6, 1900, in lieu of plans approv. Nov. 11, 1897, **01**, 663.
- HARLEM R.**, between Boroughs of Manhattan and The Bronx, New York, N. Y. (S.) (City br.) PLANS.—Approv. Aug. 22, 1907, **08**, 869.
- HARLEM R.**, 138th Street, New York, N. Y. (S.) (City br.) PLANS.—Reconstr. and temporary br. during progress of work, approv. Aug. 28, 1905, **06**, 801.
- HARLEM R.**, 207th Street, New York, N. Y. (S.) (City br.) PLANS.—Approv. Sept. 4, 1903, **04**, 714.
- HARVEY CANAL**, La. (Dr.) **08**, 865.
- HARTCHEE R.**, Lauderdale County, Tenn. (S.) (Illinois Central R. R. Co., lessee of Chicago, St. Louis & New Orleans R. R. Co.) PLANS.—Reconstr. approv. Nov. 18, 1903, **04**, 715.
- HELL GATE** (Little Hell Gate) and **BRONX KILLS**, N. Y. (S.) (New York Connecting R. R. Co.) PLANS.—Approv. Mar. 2, 1901, **01**, 665.
- HELL GATE**. (See East R.)
- HENDERSON B.** (arm of), Purdy, Wash. (S.) (Pierce County br.) PLANS.—Approv. Oct. 28, 1904, **05**, 724.
- HERRING B.**, Md. (See Traceys Creek.)
- HIGGINS SLOUGH**, Wash. (S.) (Chehalis County br.) PLANS.—Approv. Apr. 3, 1907, **07**, 826.
- HILLEBRANDT BAYOU**, Tex. (S.) (Jefferson County br.) PLANS.—Approv. Mar. 30, 1897, **97**, 533.
- HILLSBORO B.**, Tampa, Fla. (S.) (Tampa Terminal Co.) PLANS.—Approv. Oct. 26, 1906, **07**, 822.
- HILLSBORO B.** (inlet of), near Tampa, Fla. (S.) (Tampa Northern R. R. Co.) PLANS.—Approv. Jan. 28, 1907, **07**, 824.
- HILLSBORO R.**, 11 m. above mouth, Fla. (S.) (Tampa Northern R. R. Co.) PLANS.—Approv. Jan. 25, 1907, **07**, 824.
- HILLSBORO R.**, Fla. (Dr.) **05**, 719.
- HILLSBORO R.**, near Nebraska Avenue Road, Hillsboro County, Fla. (S.) (Tampa & Sulphur Springs Traction Co.) PLANS.—Approv. July 31, 1907, **08**, 868.
- HILLSBORO R.**, Tampa, Fla. (S.) (City br.) PLANS.—Rebuilding br. approv. June 22, 1895, **95**, 479. Reconstr. approv. Oct. 26, 1911, **12**, 1302.
- HILLSBORO R.**, at Tampa, Fla. (S.) (Atlantic Coast Line R. R. Co.) PLANS.—Repairs approv. July 15, 1909, **10**, 1023. False-work plans approv. Jan. 6, 1912, **12**, 1304.
- HILLSBORO R.**, above Tampa, Fla. (S.) (Hillsboro County br.) PLANS.—Approv. May 14, 1910, **10**, 1030.
- HILLSBORO R.**, Tampa, Fla. (S.) (Savannah, Florida & Western Ry. Co.) PLANS.—Approv. Oct. 23, 1893, **94**, 426.
- HILLSBORO R.**, W. 9th Street, Tampa, Fla. (S.) (Tampa & Sulphur Springs Traction Co.) PLANS.—Approv. May 22, 1908, **08**, 872.
- HIWASSEE R.**, Charleston, Tenn. (S.) (Brs. of Bradley and McMinn Counties, Tenn.) PLANS.—Approv. Aug. 3, 1911, **12**, 1300.
- HIWASSEE R.**, near mouth of Ocoee R., Tenn. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Approv. Dec. 30, 1904, **05**, 725.
- HIWASSEE R.**, above mouth of Ocoee R., Tenn. (S.) (Polk County br.) PLANS.—Approv. June 13, 1911, **11**, 1090. Modified plans approv. Oct. 5, 1911, **12**, 1301.
- HIWASSEE R.**, Gamble Shoal, Tenn. (S.) (Polk County br.) PLANS.—Approv. Jan. 26, 1906, **06**, 804.
- HOGANS CREEK**, near Jacksonville, Fla. (S.) (Seaboard Air Line Ry. Co.) PLANS.—Rebuilding an existing br. (Upper Hunter Terminal Br.) and plans of new br. (Corse Br.) approv. July 13, 1909, **10**, 1023.
- HOLSTON R.** (Boyd's Ferry), near Knoxville, Tenn. (Knoxville County br.) PLANS.—Approv. Aug. 2, 1893, **93**, 470. Modified plan approv. Nov. 29, 1893, **94**, 427.
- HOLSTON R.**, Brabsons Ferry, Tenn. (S.) (Southern Ry. Co.) PLANS.—Approv. Aug. 10, 1906, **07**, 821.
- HOLSTON R.**, near Millers Isld., 3 m. below Surgoinsville, Tenn. (S.) (Holston River Ry. Co.) PLANS.—Approv. Nov. 28, 1906, **07**, 823.
- HOLSTON R.**, N. Fork, near Kingsport, Tenn. (Sp.) (South & Western R. R. Co.) Au. est

May 12, 1906. PLANS.—Approv. Dec. 4, 1906, 07, 817.

HOLSTON R., near Rogersville and Churchill, Tenn. (S.) (Hawkins County br.) PLANS.—Approv. Aug. 10, 1909, 10, 1024.

HOLSTON R., S. Fork, near Kingsport, Tenn. (Sp.) (South & Western R. R. Co.) Au. act May 12, 1906. PLANS.—Approv. Dec. 4, 1906, 07, 817.

HOLSTON R., near Straw (Strawberry) Plains, Tenn. (S.) (Southern Ry. Co.) PLANS.—Approv. June 27, 1906, 06, 808.

HOOK CANAL, mouth of Hook Creek, N. Y. (O.) (Jamaica & Rockaway Turnpike Co.) PLANS.—Alterations to be completed on or before Dec. 1, 1904, 05, 730.

HOOK CREEK, Long Isl., N. Y. (S.) (W. C. Baker.) PLANS.—Approv. May 10, 1902, 02, 588.

HOOK CREEK, Meadowmere, N. Y. (S.) (W. C. Baker.) PLANS.—Br. to replace existing str. approv. May 10, 1905, 05, 727.

HOOK CREEK, between the City of New York and Hempstead, N. Y. (S.) (Margaret A. Hill.) PLANS.—Approv. May 6, 1909, 09, 918.

HOOK CREEK (Fosters Meadow Canal), on Jamaica and South Shore R. R. (S.) (Long Island R. R. Co.) PLANS.—Approv. Mar. 21, 1911, 11, 1087.

HOQUIAM R., Wash. (S.) (United railroads of Washington.) PLANS.—Approv. Oct. 2, 1897, 98, 533.

HOQUIAM R., Chehalis County, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Approv. Apr. 20, 1907; modified plans in lieu thereof approv. Sept. 10, 1907, 08, 869, 870.

HOQUIAM R., Hoquiam, Wash. (S.) (City br.) PLANS.—Approv. Dec. 19, 1899, 00, 700.

HOQUIAM R., Hoquiam, Wash., and **WISHKA R.**, Aberdeen, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Reconstr. approv. Apr. 20, 1907, 07, 826.

HOQUIAM R., Hoquiam, Wash. (S.) (Grays Harbor & Puget Sound Ry. Co.) PLANS.—Approv. Dec. 12, 1908, 09, 916.

HOQUIAM R., Hoquiam, Wash. (S.) (City br.) PLANS.—Reconstr. approv. Oct. 16, 1909, 10, 1024.

HOQUIAM R., at Ramer Avenue, Hoquiam, Wash. (S.) (City br.) PLANS.—Approv. June 17, 1910, 10, 1030.

HOUSATONIC R. (See Coscob, etc.)

HOUSATONIC R., Stratford, Conn. (A.) (Highway.) 88, 2611. PLANS.—Description. Lt. Col. Houston recom. fifth and sixth spans be made draw spans. 88, 2612.

HOUSATONIC R., between Stratford and Milford, Conn. (O.) (Washington Br., Fairfield and New Haven Counties.) PLANS.—Specified alterations required on or before Dec. 1, 1893. Board of commissioners decided to build new br. 93, 474.

HOUSATONIC R., between Milford and Stratford, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Rebuilding approv. May 12, 1904, 04, 718.

HOUSTON R., Calcasieu Parish, La. (S.) (Kansas City, Shreveport & Gulf Ry. Co.) PLANS.—For new br. approv. Oct. 18, 1899, 00, 699.

HUDSON R., Albany, N. Y. (Dr.) 05, 719.

HUDSON R., at New York City. (Sp.) 91, 433. BE. convened to consider and report upon plan of br., 91, 3853. Recom. clear headway at the middle of the span above h. w. of spring tides be increased in the plans to not less than 150', 91, 3859. (Cols. Abbot, Comstock, and Houston, and Lt. Col. Gillespie.) LEGISLATION.—Br. au. by act July 11, 1890; requirements of the act, 91, 3853.

HUDSON R., N. Y. (Dr.) 11, 1078.

HUDSON R., New York City, N. Y. (Sp.) (New York & New Jersey Br. Co.) LEGISLATION.—Companies au. to constr. br. by act June 7, 1894, 96, 423. PLANS.—Submitted June 4, 1895; approv. without date, contingent upon report of board of harbor lines, 1896, which recom., Feb. 28, 1896, revised plans of approaches and map of location; approv. Mar. 13, 1896, 96, 423. Detailed plans submitted Mar. 10, 1897; approv. May 24, 1899, 99, 619.

HUDSON R., near 23d Street, New York City, N. Y. (Sp., etc.) (North River Br. Co.) PLANS.—Modified plans, conforming to the requirements as to height fixed by the War Dept., approv. Dec. 29, 1891, 92, 403.

HUDSON R., New York, N. Y. (Sp.) (New York & New Jersey Br. Co.) Au. act May 24, 1899. PLANS.—Modification of detailed plans approv. July 3, 1900, 01, 659.

HUDSON R., Poughkeepsie, N. Y. (S.) (Central New England Ry. Co.) PLANS.—Reconstr. approv. Aug. 17, 1906, 07, 821.

HUDSON R., Troy, N. Y. (O. and A.) (Delaware & Hudson Co.—Rensselaer & Saratoga R. R. br.) PLANS.—Alterations to be completed on or before 1 year from date of service of notice, Apr. 29, 1901, 01, 669.

HUMPTULIPS R., Wash. (A.) (Northern Pacific Ry. Co.) PLANS.—Reconstr. approv. Mar. 30, 1903, 03, 651.

HUMPTULIPS R., Chehalis County, Wash. (S.) (Chehalis County br.) PLANS.—Approv. Sept. 28, 1903, 04, 714; and Apr. 3, 1907, 07, 826.

HUNTING CREEK, Alexandria, Va. (Sp., etc.) (Washington, Alexandria & Mount Vernon Electric Ry. Co.) LEGISLATION.—Company au. to constr. br. under act July 13, 1892, sec. 3, and act of Virginia. PLANS.—Approv. Aug. 20, 1892, on condition that the width of draw opening be increased to 40' when so desired by the Sec. of War, 92, 409.

HURON R., Huron, Ohio. (Sp., etc.) (Lake Shore & Michigan Southern Ry. Co.) LEGISLATION.—Company au. to constr. br. under

act Sept. 19, 1890, sec. 7, and act of Ohio.
PLANS.—Approv. Dec. 18, 1891, **92**, 402.

HURON R., at Van Ransselaer Street, Huron,
Ohio. (S.) (Br. of Erie County, Ohio.)
PLANS.—Br. to replace existing one approv.
Feb. 17, 1911, **11**, 1087.

HUTCHINSON R. (East Chester Creek), Pel-
ham B. Park, New York, N. Y. (S.) (Harlem
River & Portchester R. R. Co.—New York,
New Haven & Hartford system.) PLANS.—
Rebuilding approv. July 12, 1905, **06**, 800.

HUTCHINSON R. (East Chester Creek) Boston
Post Road, Borough of The Bronx, New York,
N. Y. (S.) (City br.) PLANS.—Temporary
and permanent br. to replace existing str. approv.
Jan. 15, 1909, **09**, 917.

HYLBOS CREEK, Lincoln Avenue, Tacoma,
Wash. (S.) (Pierce County br.) PLANS.—
Approv. Oct. 19, 1905, **06**, 803.

I.

ILLINOIS R. (See Ohio R.)

ILLINOIS R., Beardstown, Ill. (O.) (Chicago, Burlington & Quincy Ry. Co.) PLANS.—Alterations to be completed on or before 3 months from Mar. 8, 1904, **04**, 722.

ILLINOIS R., Beardstown, Ill. (O.) (City br.) PLANS.—Alterations to be completed on or before 3 months from Mar. 14, 1904, **04**, 722.

ILLINOIS R., Ill. (Dr.) **02**, 581.

ILLINOIS R., near Chillicothe, Ill. (O.) (Atchison, Topeka & Santa Fe Ry. Co.) PLANS.—Rebuilding approv. Jan. 7, 1903, **03**, 647. Alterations to be completed on or before 3 months from Mar. 8, 1904, **04**, 722.

ILLINOIS R., between Columbiana and Kamps-ville, Ill. (Sp., etc.) (Litchfield, Carrollton & Western R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 3, 1883; amend- ing act Oct. 1, 1890, **92**, 401. PLANS.—Modi- fied plan approv. Nov. 4, 1891, and May 9, 1893, **92**, 401; **93**, 465.

ILLINOIS R., Griggsville, Ill. (O.) (Wabash R. R. Co.) PLANS.—Alterations to be com- pleted on or before 3 months from Mar. 28, 1904 subsequently extended 3 months, **04**, 723.

ILLINOIS R., Havana, Ill. (Sp., etc.) (Chicago, Peoria & St. Louis Ry. Co.) LEGISLATION.— Company au. to constr. br. by act June 6, 1892. PLANS.—Approv. Aug. 27, 1892, **92**, 409.

ILLINOIS R., Havana, Ill. (O.) (Chicago, Peoria & St. Louis Ry. Co.) PLANS.—Al- terations to be completed on or before 3 months from Mar. 12, 1904, subsequently extended to Sept. 1, 1904, **04**, 722.

ILLINOIS R., Havana, Ill. (O.) (City br.) PLANS.—Alterations to be completed on or before 3 months from Mar. 18, 1904, subsequently extended 60 days, **04**, 722.

ILLINOIS R., Havana, Ill. (O.) (Illinois Cen- tral R. R. Co.) PLANS.—Alterations to be completed on or before 3 months from Mar. 8, 1904 subsequently extended to July 15, 1904, **04**, 722.

ILLINOIS R., Henry, Ill. (O.) (Henry City Br. Co.) PLANS.—Alterations to be com- pleted on or before 3 months from Mar. 16 1904 subsequently extended 2 months, **04**, 722.

ILLINOIS R., at the city of Lacon, Ill. (S.) (City br.) PLANS.—Approv. Dec. 24, 1909, **10**, 1026.

ILLINOIS R., near Marquette, Ill. (S.) (Streator & Clinton R. R. Co.) PLANS.—Approv. Aug. 11, 1899, **99**, 623.

ILLINOIS R., near Marquette, Ill. (O.) (Lake Shore & Michigan Southern Ry. Co.) PLANS.— Alterations to be completed on or before 3 months from Mar. 8, 1904, **04**, 722.

ILLINOIS R., Meredosia, Ill. (O.) (Wabash R. R. Co.) PLANS.—Alterations to be com- pleted on or before 3 months from Mar. 28, 1904 subsequently extended 3 months, **04**, 722, 723.

ILLINOIS R., Ottawa, Ill. (S.) (City br.) PLANS.—Approv. Sept. 22, 1903, **09**, 915.

ILLINOIS R., near Pearl Landing, Ill. (O.) (Chicago & Alton Ry. Co.) PLANS.—Altera- tions to be completed on or before 3 months from Mar. 8, 1904, **04**, 722.

ILLINOIS R., Pekin, Ill. (S.) (Peoria & Pekin Traction Co.) PLANS.—Modified plans approv. Feb. 8, 1898, **98**, 534.

ILLINOIS R., Pekin, Ill. (O.) (City br.) PLANS.—Alterations to be completed on or before 3 months from Mar. 15, 1904, subsequently extended 60 days, **04**, 721.

ILLINOIS R., Pekin, Ill. (O.) (Peoria & Pekin Union Ry. Co.) PLANS.—Alterations to be completed on or before 3 months from Mar. 15, 1904, **04**, 721.

ILLINOIS R., Pekin, Ill. (O.) (Peoria & Pekin Terminal Ry. Co.) PLANS.—Alterations to be completed on or before 3 months from Mar. 15, 1904, subsequently extended to July 15, 1904, **04**, 721.

ILLINOIS R., near Pekin, Ill. (S.) (St. Louis, Peoria & Northwestern Ry. Co.) PLANS.— Approv. Aug. 8, 1911, **12**, 1300.

ILLINOIS R., Peoria, Ill. (O.) (City br., upper free wagon br.) PLANS.—Alterations to be completed on or before 3 months from Mar. 15, 1904, subsequently extended 2 months, **04**, 721.

ILLINOIS R., Peoria, Ill. (O. and S.) (City br., lower free wagon br.) PLANS.—Altera- tions to be completed on or before 3 months from Mar. 15, 1904, **04**, 721. Approv., **07**, 821. Reconstr. approv. Jan. 26, 1911, **11**, 1086.

ILLINOIS R., Peoria, Ill. (O.) (Toledo, Peoria & Western Ry. Co.) PLANS.—Alterations to be completed on or before 3 months from Mar. 15, 1904, subsequently extended 60 days, **04**, 721.

ILLINOIS R., Peoria, Ill. (O. and S.) (Peoria & Pekin Union Ry. Co.) PLANS.—Altera- tions to be completed on or before 3 months from Mar. 15, 1904, **04**, 721. Approv. Apr. 29, 1909, **09**, 918.

ILLINOIS R., Peoria, Ill. (S.) (City br.) PLANS.—For replacing br. by an entirely new str. approv. Aug. 3, 1904, **05**, 723.

ILLINOIS R., Peoria, Ill. (S.) (Peoria, Bloomington & Champaign Traction Co.) PLANS.—
 Approv. Mar. 23, 1906, **06**, 805.

ILLINOIS R., Peru, Ill. (A. and O.) (City br.)
 PLANS.—Alterations to be completed on or
 before 3 months from Mar. 16, 1904, subsequently
 extended to Sept. 1 1904, **04**, 722.

ILLINOIS R., Springvalley, Ill. (O.) (City br.)
 PLANS.—Alterations to be completed on or
 before 3 months from Mar. 16, 1904, subsequently
 extended to Sept. 1 1904, **04**, 722.

ILLINOIS R., Utica, Ill. (S.) (Br. of county of
 La Salle and towns of Deer Park and Utica, Ill.)
 PLANS.—Approv. Feb. 16, 1907, **07**, 825.

ILLINOIS R., near Valley City, Ill. (S.) (Wa-
 bash R. R. Co.) PLANS.—For reconstr. of
 existing br. approv. May 17, 1912, **12**, 1307.

ILLINOIS and MISSISSIPPI CANAL, Bu-
 reau County, Ill. (S.) (Chicago & North
 Western Ry. Co.) PLANS.—Approv. Oct. 9,
 1901, **02**, 585. Approv. May 16, 1904, **04**, 718, 719.

INDIAN KEY. (See Florida Keys.)

INDIANA H. CANAL, at Chicago Avenue, East
 Chicago, Ind. (S.) (Lake County br.) PLANS.—
 Approv. Mar. 6, 1912, **12**, 1305.

INDIANA H. CANAL, at Canal Street, East
 Chicago, Ind. (S.) (Lake County br.) PLANS.—
 Approv. Mar. 7, 1912, **12**, 1305.

INDIAN R., at Jupiter Narrows, half m. north of
 Hobe, Fla. (Palm Beach County br.) PLANS.—
 Approv. Feb. 15, 1911, **11**, 1087.

INDIAN R., Mich. (S.) (Jackson, Lansing &
 Saginaw R. R. Co.—Michigan Central R. R.)
 PLANS.—Rebuilding approv. Jan. 30, 1903, **03**,
 648.

INGRAMS THOROUGHFARE, N. J. (See
 Leonards Thoroughfare.)

INGRAMS THOROUGHFARE, N. J. (S.)
 (Cape May County br.) PLANS.—Approv.
 Mar. 4, 1912, **12**, 1305.

INLAND WATERWAYS. (See Christiana R.
 Wilmington, Del., etc.)

J.

JAMAICA B., beach chan., Rockaway Beach, N. Y. (S.) (Brooklyn & Jamaica Bay Turnpike Co.) PLANS.—Approv. Dec. 21, 1898, **99**, 621.

JAMAICA B., N. Y. (S.) (Brooklyn & Jamaica Bay Turnpike Co.) PLANS.—Modifications in orig. plans (Dec. 21, 1898) approv. Oct. 26, 1900, **01**, 663.

JAMES R., Richmond, Va. (S.) (Richmond, Petersburg & Carolina R. R. Co.) PLANS.—Approv. July 28, 1899, **99**, 623.

JARNIGAN SLOUGH, Cal. (S.) (Eureka & Fresh Water Ry. Co.) PLANS.—Approv. Mar. 26, 1902, **02**, 587, 588.

JEW FISH CREEK. (See Florida Keys.)

JOHN DAY R., Oreg. (Dr.) **02**, 581.

JOHN DAY R., Oreg. (S.) (Astoria & Columbia River R. R. Co.) PLANS.—Approv. Nov. 18, 1895, **96**, 425.

JOHNS R. (See Chehalis R.)

JOHNS R., Chehalis County (sec. 2, T. 16 N., R. 11 W., Willamette meridian), Wash. (S.) PLANS.—Approv. Oct. 5, 1910, **11**, 1083.

JOHNSON CREEK. (See Albemarle Sound.)

JONES, or **WELSEMAN'S, CREEK, N. PT. CREEK**, and **SHALLOW CREEK**, Md. (S.) (Baltimore, Sparrows Point & Chesapeake Ry. Co.) PLANS.—Approv. Dec. 20, 1904, **05**, 725.

JUPITER NARROWS, Fla. (See Indian R.)

JUPITER R., Fla. (Dr.) **03**, 642.

JUPITER R., Fla. (S.) (Jacksonville, St. Augustine & Indian River Ry. Co.) PLANS.—Approv. Aug. 15, 1893, **93**, 471.

K.

- KABEKONA NARROWS**, Minn. (S.) (St. Paul, Minneapolis & Manitoba Ry. Co.) PLANS.—Approv. Mar. 14, 1898, **98**, 534.
- KALAMAZOO R.**, Allegan, Mich. (S.) (Pere Marquette R. R. Co.) PLANS.—Approv. Oct. 1, 1901, **02**, 585. Reconstr. approv. Mar. 23, 1908, **08**, 872.
- KALAMAZOO R.**, Mich. (Dr.) **09**, 912.
- KALAMAZOO R.**, New Richmond, Mich. (A. and O.) (Chicago & West Michigan Ry. Co.) PLANS.—Approv. June 13, 1899, for a 40' draw over main chan. before Aug. 26, 1899. On July 31, 1899, previous action modified, at option of company, as specified. **99**, 624. Company failed to alter br. within time specified. Alteration plans as required by the department accepted Mar. 13, 1900, as satisfactory. Time extended to July 15, 1902. **00**, 702.
- KANAWHA R.** (See Ohio R.)
- KANAWHA R.**, Charleston, W. Va. (Sp.) (Kanawha Br. & Terminal Co.) Au. act Mar. 3, 1887. PLANS.—Approv. Apr. 5, 1907, **07**, 819.
- KANAWHA** (Little) **R.**, Main Street, Glenville, W. Va. (S.) (Gilmer County br.) PLANS.—Approv. Aug. 23, 1910, **11**, 1083.
- KANAWHA R.**, Montgomery, W. Va. (S.) (Penn Br. Co.) PLANS.—Approv. July 25, 1905, **06**, 801.
- KANAWHA R.**, Montgomery, W. Va. (S.) (Montgomery Br. Co.) PLANS.—Approv. Sept. 5, 1907, **08**, 869. Map of new location approv. Sept. 8, 1908; new approv. in name of Montgomery & Cannelton Br. Co., and former approv. canceled Feb. 16, 1909, **09**, 915.
- KANAWHA R.**, at Montgomery and Cannelton, W. Va. (S.) (Montgomery Br. Co.) PLANS.—Approv. Sept. 8, 1908; supple. plans approv. Feb. 16, 1909, and plans for false work approv. Nov. 13, 1909, **10**, 1025.
- KANSAS R.**, Kansas City, Kans. (S.) (Chicago, Rock Island & Pacific Ry. Co.) PLANS.—Rebuilding approv. Apr. 14, 1905, **05**, 726.
- KANSAS R.**, Kansas City, Kans. (S.) (Kansas City Viaduct & Terminal Ry. Co.) PLANS.—Approv. June 1, 1905, **05**, 727.
- KAW** (Kansas) **R.**, Kansas City, Kans. (S.) (Kansas City Belt Ry. Co.) PLANS.—Reconstr. approv. Sept. 19, 1905; approv. amended by instrument dated Dec. 2, 1905, and modified plans approv. Jan. 11, 1907, **06**, 803; **07**, 824.
- KANSAS R.**, Kansas City, Kans. (S.) (Missouri Pacific Ry. Co.) PLANS.—New br. to replace existing br. approv. Dec. 31, 1909, **10**, 1026. Reconstr. approv. July 18, 1911, **11**, 1299.
- KANSAS R.**, Kansas City, Kans. (S.) (Union Pacific R. R. Co.) PLANS.—Rebuilding approv. Jan. 7, 1909, **09**, 916. Reconstr. approv. May 28, 1910, **10**, 1030.
- KANSAS R.**, Kansas City, Kans. (1,300' above mouth). (Sp.) (Edgewater Connecting Ry. Co.) Au. act Feb. 6, 1909, and Feb. 3, 1910. PLANS.—Approv. Jan. 30, 1911, **11**, 1080.
- KANSAS R.**, James Street, Kansas City, Kans. (S.) (Wyandotte County br.) PLANS.—Reconstr. plans approv. May 12, 1911, **11**, 1089.
- KANSAS R.**, West Kansas Avenue, Kansas City, Kans. (S.) (Wyandotte County br.) PLANS.—Reconstr. of existing br. approv. Mar. 4, 1912, **12**, 1305.
- KANSAS R.**, Topeka Kans. (S.) (Topeka Ry. Co.) PLANS.—Rebuilding approv. Nov. 4, 1904, **05**, 724.
- KASKASKIA** (Okaw) **R.**, near Baldwin, Ill. (S.) (Mobile & Ohio R. R. Co.) PLANS.—Rebuilding approv. May 17, 1906, **06**, 807.
- KASKASKIA R.**, near Missouri Junction, Ill. (S.) (St. Louis & Southern Illinois Ry. Co.) PLANS.—Approv. June 14, 1901, **01**, 667.
- KASKASKIA R.**, Randolph County, Ill. (S.) (St. Louis Valley Ry.) PLANS.—Approv. Aug. 5, 1901, **02**, 583.
- KAWKAWLIN R.**, Bay County, Mich. (S.) (Detroit & Mackinac Ry. Co.) PLANS.—Approv. June 29, 1896, **96**, 427.
- KENDUSKEAG R.**, Bangor, Me. (S.) (Maine Central R. R. Co., lessee of European & North America Ry.) PLANS.—Reconstr. approv. May 25, 1905, **05**, 727.
- KENNEBEC R.** (See Atkins B.)
- KENT ISLD. NARROWS**, Md. (S.) (Queen Anne County br.) PLANS.—Approv. June 22, 1904, **04**, 719.
- KENT ISLD. NARROWS**, Kent Isld., Md. (S.) (Queen Annes R. R. Co.) PLANS.—Approv. Mar. 13, 1901, **01**, 665.
- KENT ISLD. NARROWS**, Md. (Dr.) **02**, 581; **07**, 815.
- KENT NARROWS**, Md. (S.) (Maryland, Delaware & Virginia Co.) PLANS.—Reconstr. of existing br. approv. Sept. 12, 1911, **12**, 1301.
- KENTUCKY R.**, Ky. (A.) **88**, 2574. LEGISLATION.—Notice served as to alterations required, **90**, 342. PLANS.—Location and dimensions of brs. crossing the imp. portion of

the Kentucky R., 88, 2574. Br. at Worthville and 2 at Frankfort restrict navigation, and Capt. Post recom. that they be raised or rebuilt, 88, 2575, 2576.

KENTUCKY R., Carrollton, Ky. (S.) (Carrollton & Prestonville Br. Co.) PLANS.—Approv. Nov. 10, 1899, 00, 699. Former approv. of plans of Carrollton Electric Co., Nov. 10, 1899, canceled. Rights transferred to Carrollton & Prestonville Br. Co., and plans approv. in latter name July 25, 1900, 01, 662.

KENTUCKY R., Ford, Ky. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Rebuilding approv. Apr. 14, 1906, 06, 806.

KENTUCKY R., Frankfort, Ky. (O.) (Louisville & Nashville R. R. Co.) PLANS.—Alterations required by Jan. 1, 1890; time extended to Jan. 9, 1891, 89, 376. Required to raise br. 10', on or before Sept. 1, 1892, 91, 436. Plans for raising br. 43' 4" in all, required under act Sept. 19, 1890; approv. Oct. 24, 1892, 93, 471.

KENTUCKY R., Ky. (S.) (City of Frankfort and County of Franklin br.) PLANS.—Under act Sept. 19, 1890, raising of br. to 48' 4" above normal pool level an. Sept. 8, 1891, 92, 411. Plans for elevating br. 43' 4" approv. May 22 1893, 93, 473.

KENTUCKY R., St. Clair Street, Frankfort, Ky. (O.) (Frankfort County br.) PLANS.—Specified alterations to be made on or before Sept. 1, 1892, 92, 411.

KENTUCKY R., St. Clair Street, Frankfort, Ky. (O.) (City br.) PLANS.—Alterations required by Jan. 1, 1890; time extended to Jan. 1, 1891, 89, 376.

KENTUCKY R., near Irvine, Ky. (S.) (Irvine Fall Br. Co.) PLANS.—Approv. Sept. 17, 1909, 10, 1024.

KENTUCKY R., near mouth of Sturgeon Creek, Ky. (S.) (Louisville & Atlantic R. R. Co.) PLANS.—Approv. Apr. 7, 1906, 06, 805.

KENTUCKY R., near Tyrone, Ky. (Sp.) (Louisville Southern Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Oct. 9, 1888, 89, 371. PLANS.—Approv. Mar. 30, 1889, 89, 371.

KENTUCKY R., Worthville, Ky. (O.) (Louisville & Nashville R. R. Co.) PLANS.—Alterations required by Jan. 1, 1890; time extended to Jan. 9, 1891, 89, 376.

KENTUCKY R., N. Fork. (S.) (Ohio & Kentucky Ry. Co.) PLANS.—Approv. Oct. 27, 1899, 00, 699.

KENTUCKY R. (N. Fork), below Jackson, Ky. (S.) (Kentucky Lumber & Veneer Co.) PLANS.—Approv. June 5, 1902, 02, 589. Modified plans for changes in substr. approv. July 25, 1902, 03, 645.

KENTUCKY R. (N. Fork), Breathitt County, Ky. (S.) (Kentucky R. Hardwood Co.) PLANS.—Approv. May 9, 1910, 10, 1030.

KENTUCKY R., N. Fork, mouth of Walkers Creek, Ky. (Sp.) (Kentucky Union Ry. Co.)

LEGISLATION.—Company au. to constr. br. by act Mar. 1, 1889. PLANS.—Approv. June 19, 1889, 89, 372.

KENTUCKY R. (N. Fork), Ky. (S.) (Lexington & Eastern Ry. Co.—Crossing No. 2.) PLANS.—Approv. Jan. 25, 1911, 11, 1085.

KENTUCKY R. (N. Fork), Ky. (S.) (Lexington & Eastern Ry. Co.—Crossing No. 3.) PLANS.—Approv. Jan. 26, 1911, 11, 1086.

KENTUCKY R. (N. Fork), Ky. (S.) (Lexington & Eastern Ry. Co.—Crossing No. 4.) PLANS.—Approv. Jan. 26, 1911, 11, 1086.

KENTUCKY R. (N. Fork), Ky. (S.) (Lexington & Eastern Ry. Co.—Crossing No. 5.) PLANS.—Approv. Jan. 25, 1911, 11, 1085.

KENTUCKY R. (N. Fork), Ky. (S.) (Lexington & Eastern Ry. Co.—Crossing No. 6.) PLANS.—Approv. Jan. 25, 1911, 11, 1085.

KENTUCKY R. (N. Fork), Ky. (S.) (Lexington & Eastern Ry. Co.—Crossing No. 7.) PLANS.—Approv. Jan. 25, 1911, 11, 1085.

KENTUCKY R. (N. Fork), Ky. (S.) (Lexington & Eastern Ry. Co.—Crossing No. 8.) PLANS.—Approv. Jan. 25, 1911, 11, 1085.

KENTUCKY R. (N. and S. Forks), Beattyville, Ky. (S.) (Brs. of George I. Hammond et al.) PLANS.—Approv. Aug. 29, 1906, 07, 821.

KEWAUNEE R., Kewaunee, Wis. (Sp., etc.) (Kewaunee, Green Bay & Western R. R. Co.) LEGISLATION.—Company au. to constr. br. under act July 13, 1892, and act of Wisconsin. PLANS.—Approv. Sept. 6, 1892, 92, 410.

KEWAUNEE R., Park Street, Kewaunee, Wis. (S.) (City br.) PLANS.—Submitted July 2, 1892, for replacing old with new br.; approv. Oct. 14, 1892, 93, 466. Approv. May 19, 1905, 05, 727.

KEY WEST. (See Florida Keys.)

KIAMICHI R., $\frac{1}{2}$ m. sw. of Roby or Sawyer Okla. (Choctaw County br.) PLANS.—Approv. Jan. 20, 1912, 12, 1304.

KIAMICHI R., 4 m. s. of Port Townsend, Choctaw County, Okla. (S.) (County br.) PLANS.—Approv. Jan. 25, 1912, 12, 1304, 1305.

KICKEMUIT R., Warren, R. I. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. plans approv. Apr. 7, 1911, 11, 1088.

KINGSLEYS CREEK, Fla. (O.) (County br.) PLANS.—Narrow opening of the county br., near the R. R. br., dangerous to S. S., 89, 2797.

KINGSLEYS CREEK, a part of the inland communication between Savannah, Ga., and Jacksonville, Fla. (O.) (Florida Ry. & Navigation Co.) PLANS.—Alterations required by Apr. 15, 1889; time extended to May 1, 1889. Br. provided with a 56.7" draw span, which is sufficient. 89, 377.

KINNICKINNICK R., Milwaukee, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Reconstr. plans and plans for a temporary br. approv. Jan. 13, 1897, 97, 533.

KINNICKINNICK R., Clinton Street, Milwaukee, Wis. (S., Sp., etc.) (City br.) LEGISLATION—City au. to constr. br. under act July 13, 1892, sec. 3, and act of Wisconsin. PLANS.—For new br. approv. Sept. 12, 1892, 92, 410. Modified plans approv. July 29 1893, 93, 470.

KINNICKINNICK R., Lincoln Avenue, Milwaukee, Wis. (S.) (City br.) PLANS.—For temporary br., for use pending reconstr. of existing br., approv. Nov. 1, 1898. Modified plans, change in location to permit constr. of br. at Lincoln Avenue, approv. Dec. 31, 1898. 99, 621. Reconstr. plans approv. Sept. 21, 1899, 00, 699.

KINNICKINNICK R., Kinnickinnick Avenue Milwaukee, Wis. (S.) (City br.) PLANS.—Rebuilding approv. Sept. 17, 1907 08, 870.

KINNICKINNICK R., near Kinnickinnick Avenue, Milwaukee, Wis. (S.) (Chicago & North Western Ry. Co.) (See above.) PLANS.—Rebuilding approv. Sept. 17, 1907, 08, 870.

KINNICKINNICK R., near Kinnickinnick Avenue, Milwaukee, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Br. to replace existing str. approv. Sept. 17, 1907, 08, 870.

Klickitat R., Wash. (S.) (Portland & Seattle Ry. Co.) PLANS.—Approv. Feb. 9, 1907, 07, 825.

KOOTENAI R., Bonners Ferry, Idaho. (Sp.) (International Ry. Co.) PLANS.—Approv. Oct. 19, 1905, 06, 799.

KOOTENAI R., Bonners Ferry, Idaho. (Sp.) (Bonners Ferry Bridge Commission.) Au. act Feb. 3, 1910. PLANS.—Approv. Feb. 18, 1910 10, 1021.

KOOTENAI R., Bonners Ferry, Idaho. (Sp.) (Kootenai Valley Ry. Co.) Au. act June 25, 1910. PLANS.—Approv. Sept. 13, 1910, 11, 1079.

KOOTENAI R., near Libby, Mont. (Sp.) (Lincoln County br.) Au. act Mar. 4, 1912. PLANS.—Approv. Mar. 15, 1912 12, 1297.

KOOTENAI R., near Rexford, Mont. (Sp.) (Lincoln County br.) Au. act Mar. 4, 1912. PLANS.—Approv. Mar. 15, 1912, 12, 1297.

KOOTENAI R., near Troy, Mont. (Sp.) (Lincoln County br.) Au. act Mar. 4, 1912. PLANS.—Approv. Mar. 15, 1912, 12, 1297.

L.

LACASSINE BAYOU, La. (S.) (Louisiana Western R. R. Co.) PLANS.—Approv. Sept. 25, 1903, **04**, 714.

LACOMBE BAYOU, St. Tammany Parish, La. (S.) (New Orleans Great Northern R. R. Co.) PLANS.—Approv. Sept. 10, 1907, **08**, 870.

LAFOURCHE BAYOU, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Reconstr. plans approv. July 29, 1899, **99**, 623.

LAFOURCHE BAYOU, Donaldsonville, La. (S.) (Lemann Co., Ltd.) PLANS.—Approv. May 10, 1905, **05**, 727.

LAFOURCHE BAYOU, Labadieville, La. (S.) (Labadieville Br. Co.) PLANS.—Approv. June 2, 1893, **93**, 470.

LAFOURCHE BAYOU, Labadieville, La. (S.) (Eugene Constantin, Jules Bragard, and Louis Coddon.) PLANS.—Approv. May 23, 1906, **06**, 807.

LAFOURCHE BAYOU, Laurel Grove Plantation, near Thibodeaux, La. (S.) (Proclair & Robichaux Co., Ltd.) PLANS.—Approv. Apr. 20, 1906, **06**, 806.

LAFOURCHE BAYOU, Lockport, La. (S.) (Lockport Br. Stock Co.) PLANS.—Approv. June 30, 1899, **99**, 623.

LAFOURCHE BAYOU, Napoleonville, La. (S.) (Napoleonville Br. Stock Co.) PLANS.—Approv. June 5, 1893, **93**, 470.

LAFOURCHE BAYOU, Napoleonville, La. (S.) (Leon Godchaux Co., Ltd.) PLANS.—Approv. July 6, 1905, **06**, 800.

LAFOURCHE BAYOU, Plattenville, La. (S.) (Baker-Wakefield Cypress Co.) PLANS.—Approv. Nov. 9, 1911, **12**, 1302.

LAFOURCHE BAYOU, Raceland, La. (S.) (Br. of M. J. Theriot, of Lafourche Crossing.) PLANS.—Approv. Oct. 18, 1911, **12**, 1302.

LAKE BIJEAU, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Approv. May 25, 1906, **06**, 807.

LAKE BIJEAU, St. Martin Parish, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Approv. Aug. 16, 1906, **07**, 821.

LAKE CHAMPLAIN, between Colchester and South Hero, Vt.; Grand Isle and North Hero, Vt.; and North Hero and Albany, Vt. (Sp.) (Rutland-Canadian R. R. Co.) LEGISLATION.—Company au. to constr. these brs. by act Feb. 4, 1899. PLANS.—Approv. Mar. 16, 1899, **99**, 619.

LAKE CHAMPLAIN, between North Hero and Alburg. (Sp.) **88**, 398, 2432. LEGISLATION.—Br. au. by act June 20, 1884, **88**, 2431. PLANS.—Maj. Adams reported br. not an obstr. to navigation, **88**, 2432-2433.

LAKE CHAMPLAIN, Rouse Pt., N. Y. (Sp.) LEGISLATION.—Br. au. act Feb. 24, 1883, **83**, 271. PLANS.—Chief of Engineers recom. plans and location of the br. be approv., **83**, 1611.

LAKE CHAMPLAIN, at Rouse Pt., between Alburg, Vt., and Champlain, N. Y. (Sp.) (Rutland-Canadian R. R. Co.) LEGISLATION.—Company au. to constr. br. act Feb. 4, 1899. PLANS.—Approv. Feb. 10, 1900, **00**, 697.

LAKE CHAMPLAIN CHAN., North Hero, Vt. (Sp.) LEGISLATION.—Au. act Oct. 12, 1883. PLANS.—Submitted and approv. July 2, 1889, **90**, 336.

LAKE CHAMPLAIN, chan. known as "The Gut," between Tromps, South Hero Isld., and Bow Arrow Pt., North Hero Isld., Vt. (O.) (Rutland R. R. Co.) PLANS.—Alternative alterations to be completed on or before Dec. 31, 1907, or within 4 months from Aug. 17, 1906, respectively, **07**, 823.

LAKE CHARLES, Ga. (See Calcasieu R.)

LAKES DITCH and BEACH THOROUGHFARE, Atlantic City, Atlantic County, N. J. (on line of new highway from Pleasantville to Atlantic City). (S.) (Atlantic County brs.) PLANS.—Approv. Feb. 3, 1903, **03**, 648, 649.

LAKES DORA and EUSTIS (waterway connecting), Fla. (O.) (Lake County br.) PLANS.—Alterations to be completed on or before Sept. 1, 1906, **06**, 809.

LAKES DORA and EUSTIS (waterway connecting), Fla. (O.) (Seaboard Air Line Ry. Co.) PLANS.—Alterations to be completed on or before Sept. 1, 1906, **06**, 809.

LAKES DORA and EUSTIS (waterway connecting), Fla. (O.) (Atlantic Coast Line Ry. Co.) PLANS.—Alterations to be completed on or before Sept. 1, 1906, **06**, 809.

LAKE ERIE. (See Detroit, Mich.)

LAKE HARNET, Fla. (See St. Johns R.)

LAKE HURON. (See Detroit, Mich.)

LAKE PEND OREILLE, Kootenai County Idaho. (S.) (Northern Pacific Ry. Co.) PLANS.—Approv. Oct. 10, 1902 **03**, 646.

LAKE PONTCHARTRAIN, La. (Dr.) **05**, 719.

- LAKE PONTCHARTRAIN**, La. (S.) (New Orleans & Northeastern R. R. Co.) PLANS.—For rebuilding approv. Mar. 15, 1906, **06**, 805.
- LAKE R.**, near Ridgefield, Wash. (S.) (Oregon & Washington R. R. Co.) PLANS.—Approv. May 3, 1907, **07**, 827. Grantee decided not to constr. br. and approv. was revoked by instrument dated Nov. 22, 1910, **11**, 1084.
- LAKE ST. CROIX**, Hudson City, Wis. (Sp. and A.) (Railway.) LEGISLATION.—Br. au. act May 15, 1872, **78**, 1091. PLANS.—Maj. Allen reported that sheer booms should be placed to assist vessels in passing the spans, **88**, 2637.
- LAKE UNION** (e. arm), Hester Avenue, Seattle, Wash. (S.) (City br.) PLANS.—Rebuilding approv. May 29, 1902, **02**, 589.
- LAKE UNION**, Seattle, Wash. (S.) (Seattle Electric Co.) PLANS.—Approv. Sept. 6, 1901, **02**, 585. Temporary str. approv. Nov. 17, 1908; change of location approv. Jan. 15, 1909, **09**, 916.
- LAKE UNION**, at waterway No. 14 and East Lake Avenue, Seattle, Wash. (S.) (City br.) PLANS.—Temporary trestle approv. Mar. 15, 1910, **10**, 1028.
- LAKE UNION**, at West Lake Avenue and Stone Way, Seattle, Wash. (City br.) PLANS.—Temporary trestle br. approv. Oct. 6, 1910, **11**, 1084.
- LAKE UNION**, Wash. (See Puget Sound and Lakes Union and Washington.)
- LAKE UNION and LAKE WASHINGTON** (portage between), Seattle, Wash. (S.) (City br.) PLANS.—Approv. Feb. 12, 1908, **08**, 871.
- LAKE UNION and LAKE WASHINGTON** (portage between), Seattle, Wash. (S.) (Seattle Electric Co.) PLANS.—Approv. Aug. 17, 1908, **09**, 914.
- LAKE UNION and LAKE WASHINGTON**, Wash. (br. over right of way for a canal between). (S.) (Br. of city of Seattle.) PLANS.—Temporary br. approv. Jan. 20, 1910, **10**, 1026.
- LAKE WASHINGTON**, Wash. (See Puget Sound and Lakes Union and Washington.)
- LAKE WASHINGTON SHIP CANAL**, Seattle, Wash. (S.) (City br.) PLANS.—Approv. Apr. 29, 1902, **02**, 588.
- LAKE WASHINGTON CANAL**, Seattle, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Approv. Aug. 5, 1902, **03**, 645.
- LAKE WASHINGTON and PUGET SOUND CANAL**, at 13th Avenue West, Seattle, Wash. (S.) (Seattle Electric Co.) PLANS.—Approv. Apr. 5, 1910, **10**, 1029.
- LAKE WORTH CHAN.**, Fla. (Dr.) **03**, 642.
- LAKE WORTH**, Palm Beach, Fla. (S.) (Florida East Coast Ry. Co.) PLANS.—Approv. June 14, 1901, **01**, 667.
- LAKE WORTH**, between Palm Beach and W. Palm Beach, Fla. (S.) (Palm Beach Imp. Co.) PLANS.—Approv. July 20, 1910, **11**, 1082.
- LARRABEE SLOUGH**. (See Nooksak R.)
- LAVACA R.**, near Texana and mouth of Navadad R., Tex. (S.) (St. Louis, Brownsville & Mexico Ry. Co.) PLANS.—Approv. Apr. 15, 1905, **05**, 727.
- LAZARETTO CREEK**, Ga. (A.) (Savannah & Tybee R. R. Co.) PLANS.—Very little C.; difficult to pass through the draw without striking the ps., **89**, 2796.
- LAZARETTO CREEK**, Ga. (Dr.) **06**, 797.
- LEAF R.**, near Atkinsons Creek or Cochrans Ferry, Miss. (S.) (Green County br.) PLANS.—Approv. Apr. 25, 1902, **02**, 588.
- LEAF R.**, near Beaumont, Miss. (S.) (Mobile Jackson & Kansas City R. R. Co.) PLANS.—Approv. Aug. 17, 1903, **04**, 714.
- LEAF R.**, near Beaumont, Miss. (S.) (Perry County br.) PLANS.—Approv. Jan. 16, 1907, **07**, 824.
- LEECH LAKE R.**, Minn. (S.) (Minneapolis, St. Paul & Sault Ste Marie Ry. Co.) PLANS.—Approv. Apr. 21, 1910, **10**, 1029.
- LEES R.**, between Swansea and Somerset, Mass. (S.) (Old Colony R. R. Co., New York, New Haven & Hartford R. R. Co., lessee.) PLANS.—Reconstr. approv. June 12, 1911, **11**, 1090.
- LEIPSIC R.**, Leipsic, Del. (O.) (Kent County br.) PLANS.—Alterations to be completed on or before Sept. 1, 1909, **09**, 919.
- LEIPSIC R.**, Kent County, Del. (O.) (Kent County br.—Martins br.) PLANS.—Alterations to be completed on or before Oct. 1, 1909, **09**, 920.
- LEONARDS, INGRAMS, and CRAVEN THOROUGHFARES, ELDER CREEK and AMOS CREEK**, N. J. (Brs. of Avalon Boulevard Co.) PLANS.—6 brs. approv. Nov. 30, 1910, **11**, 1085.
- LEONARDS THOROUGHFARE**, N. J. (S.) (Cape May County br.) PLANS.—Approv. Mar. 4, 1912, **12**, 1305.
- LEVISA FORK**. (See Big Sandy R.)
- LEWES CREEK**, Lewes, Del. (S.) (Queen Anne R. R. Co.) PLANS.—Approv. Mar. 30, 1898, **98**, 535. Modified plans approv. Oct. 12, 1910, **11**, 1084.
- LEWIS and CLARK R.**, Clatsop County, Ore. (S.) (Clatsop County br.) PLANS.—Approv. Mar. 25, 1903, **03**, 649.
- LEWIS and CLARK R.**, Ore. (S.) (Clatsop County br.) PLANS.—Approv. Mar. 30, 1896, **96**, 426.
- LEWIS and CLARK R.**, Ore. (Dr.) **02**, 581; **04**, 710.
- LEWIS GUT**, Bridgeport, H., Conn. (S.) (Bridgeport Steeplechase Co.) PLANS.—Approv. Apr. 16, 1908, **08**, 872.
- LEWIS R.**, Wash. (S.) (Washington & Oregon Ry. Co.) PLANS.—Approv. Sept. 28, 1901, **02**, 585.
- LEWIS R.**, La Center, Wash. (S.) (Clark County br.) PLANS.—Reconstr. approv. July 3, 1900, **01**, 661.
- LEWIS R.**, near Woodland, Wash. (S.) (Oregon & Washington R. R. Co.) PLANS.—Approv. May 4, 1907, **07**, 827. Approv. revoked by in-

- strument dated Nov. 25, 1910, it appearing that grantee did not intend to constr. br., **11, 1084.**
- LEWIS R.,** E. Fork, La Center, Wash. (S.) (Clark County br.) PLANS.—Approv. Apr. 11, 1894, **94, 428.**
- LEWIS R.,** N. Fork, at Woodland, Wash. (S.) (State br.) PLANS.—Approv. Jan. 8, 1912, **12, 1304.**
- LEWIS R.,** Wash. (Dr.) **10, 1019.**
- LEXAHATCHE (Jupiter) R.,** near West Jupiter, Fla. (S.) (Palm Beach County br.) PLANS.—Approv. July 20, 1910, **11, 1082.**
- LICKING R.,** Farmers, Ky. (S.) (Bath-Rowan Br. Co.) PLANS.—Approv. Sept. 1, 1909, **09, 915.**
- LICKING R.,** between Newport and Covington, Ky. (Sp., etc.) (Kenton and Campbell Counties br.) LEGISLATION.—Counties au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Kentucky. PLANS.—Approv. Apr. 20, 1892. Plans for false work, to be erected during constr., approv. Aug. 10, 1892; false work and all obstr. to be removed by Oct. 1, 1892. **92, 404.**
- LITTLE B. (Main Thorofare) N. J. (S.)** (Cape May County br.) PLANS.—Approv. Mar. 5, 1912, **12, 1305.**
- LITTLE CALUMET R.,** near Chicago, Ill. (S.) (Michigan Central R. R. Co.) **98, 536.** PLANS.—Reconstr. plans approv. June 16, 1898.
- LITTLE CALUMET R.,** near Chicago, Ill. (S.) (Calumet Western Ry. Co.) PLANS.—Approv. May 2, 1899, **99, 622.**
- LITTLE CHUTE, U. S. canal at lock, Wis. (S.)** (Kaukauna br.) PLANS.—Approv. June 22, 1894, **94, 429.**
- LITTLE FORK R.,** near Little Fork, Minn. (S.) (Big Fork & International Falls Ry. Co.) PLANS.—Approv. Apr. 16, 1907, **07, 826.**
- LITTLE HELL GATE.** (See East R.)
- LITTLE HOQUIAM R.,** at Hoquiam, Wash. (S.) (City br.) PLANS.—Reconstr. an existing br. approv. Feb. 23, 1910, **10, 1027.**
- LITTLE ISLAND, chan.** separating it from mainland at Osterville, in town of Barnstable, Mass. (Sp.) (Messrs. F. W. Dickinson, R. M. Winfield, F. P. Foster, and J. H. Murphy.) LEGISLATION.—Owners au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Massachusetts. PLANS.—Approv. May 19, 1891, **91, 431.**
- LITTLE KANAWHA R. (See Ohio R., etc.)**
- LITTLE KANAWHA R.,** Braxton County, W. Va. (S.) (Coal & Coke Ry. Co.) PLANS.—Plans in lieu of those approv. May 1, 1903, for a br. to be built by the Little Kanawha R. R. Co., were approv. July 29, 1904, **05, 723.**
- LITTLE KANAWHA R.,** Burnsville, W. Va. (S.) (Baltimore & Ohio R. R. Co.) PLANS.—Reconstr. approv. June 27 1906, **06, 808.**
- LITTLE KANAWHA R.,** Burnsville, W. Va. (S.) (Town br.) PLANS.—Approv. June 23, 1906, **06, 808.**
- LITTLE KANAWHA R.,** at Gilmer Station, W. Va. (S.) (County br.) PLANS.—Approv. June 7, 1910, **10, 1030.**
- LITTLE KANAWHA R.,** Grantsville (Graniteville), W. Va. (S.) (Calhoun County br.) PLANS.—Approv. Oct. 27, 1909, **10, 1025.** Approv. Oct. 22, 1909, and Mar. 10, 1910. Modified plans approv. Apr. 3, 1912, **12, 1306, 1307.** New plans approv. June 21, 1912, and instrument dated Apr. 3, 1912, canceled, **12, 1308.**
- LITTLE KANAWHA R. Hyers Run, Braxton County, W. Va. (S.)** (Braxton County br.) PLANS.—Approv. Feb. 21, 1903, **03, 649.**
- LITTLE KANAWHA R.,** Parkersburg, W. Va. (A.) (County, etc.) PLANS.—Description, **88, 2577.** Capt. Post recom. it be converted into a drawbr. by building a middle p., **88, 2577.** Br. destroys a former landing of Ohio R. steamers, and prevents the use of the mouth of the R. as an ice h., **88, 2649.**
- LITTLE KANAWHA R.,** Parkersburg, W. Va. (S.) (Parkersburg & South Side Br. Co.) PLANS.—Approv. Mar. 15, 1907, **07, 826.**
- LITTLE KANAWHA R.,** Wirt, Calhoun, Gilmer, and Braxton Counties, W. Va. (S.) (Little Kanawha R. R. Co.) PLANS.—Of 7 hrs. over this stream approv. May 1, 1903, **03, 650.**
- LITTLE POTTSBURG CREEK, Duvall County, Fla. (S.)** (Duvall County br.) PLANS.—To replace existing br. approv. Jan. 29, 1910, **10, 1027.**
- LITTLE RED R., Ark. (Dr.) 07, 815.**
- LITTLE RED R.,** Pangburn, Ark. (S.) (Harry Churchill.) PLANS.—Approv. May 22, 1909, **09, 918.**
- LITTLE R., Ark. (Dr.) 07, 815.**
- LITTLE R., Ark. (S.)** (Jonesboro, Lake City & Eastern Ry. Co.) PLANS.—Rebuilding approv. July 12, 1905, **06, 801.**
- LITTLE R.,** in Catahoula Parish, La. (S.) (Louisiana & Arkansas Ry. Co.) PLANS.—Approv. Sept. 19, 1911, **12, 1301.**
- LITTLE R., La. (Sp.)** (Houston, Central Arkansas & Northern R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 6, 1888; amending act Aug. 18, 1890, **91, 429.** PLANS.—Approv. Nov. 5, 1890. Navigation interests require a drawbr.; new plans for same approv. June 15, 1891, **91, 429.**
- LITTLE R.,** near Morris Ferry, Ark. (Sp.) (Texarkana & Fort Smith Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 21, 1894; amending act Jan. 19, 1895. PLANS.—Approv. Mar. 27, 1895, on certain conditions respecting height above water, **95, 475.**
- LITTLE R. (near Whitecliffs), Ark. (S.)** (Kansas City Southern Ry. Co.) PLANS.—Approv. Oct. 10, 1902, **03, 646.** Plans in lieu thereof approv. June 15, 1906, **06, 808.**
- LITTLE R.,** between Grant and Catahoula Parishes, near Simmons Ferry, La. (S.) (Louis-

- ana & Arkansas R. R. Co.) PLANS.—Approv. May 9, 1903, 03, 650.
- LITTLE R.**, Jonesville, La. (S.) (Catahoula Parish br.) PLANS.—Rebuilding approv. May 29, 1909, 09, 918.
- LITTLE R.**, between Jonesville and Trinity, La. (S.) (Catahoula Parish br.) PLANS.—Approv. June 1, 1904, 04, 719.
- LITTLE R.**, Lodie Ferry, Ark. (S.) (St. Louis, San Francisco & New Orleans R. R. Co.) PLANS.—Br. to replace existing str. approv. May 31, 1904, 04, 719.
- LITTLE R.**, Lynn, Mass. (S.) (City br.) PLANS.—Approv. Aug. 1, 1907, 08, 868.
- LITTLE R.**, near Middletown, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. plans approv. July 9, 1910, 11, 1082.
- LITTLE R.**, Perry, Washington County, Me. (O.) (City br.) PLANS.—Alterations required: A draw with 16' width of opening in the chan. span of the br. to be completed within 3 months from Oct. 15, 1895; time extended frequently, last extension being to Sept. 1, 1896, 96, 427.
- LITTLE R.**, near Whitecliffs (Folmina), Ark. (S.) (Memphis, Paris & Gulf R. R. Co.) PLANS.—Approv. May 9, 1907, 07, 827.
- LITTLE SHOALS R.**, Minn. (See Big Fork R.)
- LITTLE ST. MARKS R.**, Fla. (See St. Marks R., Fla.)
- LITTLE SUNFLOWER R.**, in Sharkey County, and Big Sunflower R., in Sharkey and Yazoo Counties, Miss. (S.) (Yazoo & Mississippi Valley R. R. Co.) PLANS.—Approv. Apr. 24, 1906, 06, 806.
- LITTLE TENNESSEE R.**, Niles Ferry, Tenn. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Br. to replace existing str. approv. Oct. 21, 1904, 05, 724.
- LITTLE WABASH R.**, New Haven, Ill. (S.) (Gallatin and White Counties br.) PLANS.—Approv. Nov. 9, 1894; modified plans approv. Feb. 23, 1895. Br. completed. 95, 477.
- LIVINGSTONE CREEK**, near Cronly, N. C. (S.) (Seaboard Air Line Ry.) PLANS.—Reconstr. approv. Sept. 19, 1907, 08, 870.
- LOCUST FORK**, Ala. (See Black Warrior R.)
- LOGGY BAYOU**, La. (Sp.) (Shreveport & Red River Valley Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 11, 1898, 99, 619. PLANS.—Approv. Apr. 12, 1899. Temporary br. for use during constr. of permanent br. au. to be built at this place. 99, 619.
- LONG BEACH CHAN.**, from Barnum Isld. to Inner Beach, N. Y. (S.) (Hempstead city br.) PLANS.—Approv. Dec. 24, 1896, 97, 533.
- LONG BEACH CHAN.**, Wreck Lead, Long Isld., N. Y. (Long Island Ry. Co.) PLANS.—Reconstr. of existing br. approv. Apr. 26, 1912, 12, 1307.
- LONG CREEK**, near Lynnhaven Inlet, Va. (S.) (Princess Anne County br.) PLANS.—Approv. Feb. 26, 1912, 12, 1305.
- LONG TOM R.**, Bundys, Oreg. (S.) (Benton County br.) PLANS.—Approv. Feb. 2, 1900. Br. proving unsatisfactory, new plans approv. June 26, 1900. 00, 701.
- LOS ANGELES H.**, Cal. (across chan. in, leading from turning basin into w. basin). (O.) (2 brs. of Southern Pacific Co. and Los Angeles Interurban Ry. Co.) PLANS.—Alterations of brs. across West Basin and Los Angeles H. to be completed within 12 months, and removal of trestle in Los Angeles H. within 60 days from Dec. 27, 1910, 11, 1091.
- LOS ANGELES R.**, Cal. (Dr.) 08, 865.
- LOUIS BAYOU**, Catahoula Parish, La. (S.) (Catahoula Parish br.) PLANS.—Approv. Sept. 27, 1902, 03, 646.
- LOUISIANA STREAMS**, certain. (Dr.) 07, 815.
- LOUISVILLE AND PORTLAND CANAL**. (See Ohio R.)
- LUDINGTON H.**, Washington Street, Ludington, Mich. (O.) (City br.) PLANS.—Alterations to be completed on or before June 1, 1907, 07, 828.
- LUDLAM'S THOROUGHFARE**, Sea Isle City, N. J. (S.) (Cape May County br.) PLANS.—Approv. June 22, 1905, 05, 728.
- LUMBER R.**, N. C. (O.) Notices served as to alterations required, 90, 343.
- LUMBER R.**, N. C. (S.) (Wilmington, Columbia & Augusta R. R. Co.) PLANS.—Approv. Jan. 26, 1893, 93, 467.
- LUMBER R.**, near Fair Bluff, N. C. (S.) (Butters Lumber Co.) PLANS.—Approv. June 8, 1898, 98, 536.
- LUMBER R.**, Fair Bluff; Princess Ann; Ivey Bluff; Phillips, and Matthews Bluff, N. C. (O.) (Owned jointly by Robeson and Columbus Counties.) 89, 377; 90, 343. PLANS.—Alterations required by May 7, 1890, 89, 378; 90, 343. Time extended to June 30, 1890, 90, 343.
- LUMBER R.**, N. C. (A.) (Carolina Central R. R. brs. below Lumberton; W. & C. R. R. brs., S. C., above river's mouth, and a br. at Nicholas.) PLANS.—Should be provided with draw openings, 89, 2795.
- LUMBER R.**, at Lumberton and Alma, N. C. (Sp.) (Beaufort County br.) Au. act Aug. 5, 1905. PLANS.—Approv. Jan. 18, 1910, 10, 1020.
- LYNCH'S R.**, near Johnsonville, S. C. (S.) (Georgetown & Western R. R. Co.) PLANS.—Approv. Nov. 13, 1911, 12, 1302.
- LYNN-HAVEN INLET**, Va. (S.) (Chesapeake Transit Co.) PLANS.—Approv. Mar. 13, 1901, 01, 665.
- LYNN-HAVEN INLET**, Va. (O.) (Norfolk & Southern Ry. Co.) PLANS.—Alterations to be completed on or before 3 months from July 25, 1908, 09, 919.

M.

MABSCO CREEK. (See Pamunkey R.)

MACHIAS R., Machiasport and E. Machias, Me. (S.) (Trustees of Machiasport br.) PLANS.—For reconstr. approv. Sept. 7, 1907, **08**, 869.

MACKEYS CREEK. (See Albemarle Sound.)

MACKEYS CREEK, Mackeys Ferry, N. C. (S.) (Virginia & Carolina Coast R. R. Co.) PLANS.—Approv. July 11, 1906, **07**, 820.

MACKEYS CREEK, N. C. (Dr.) **03**, 642; **09**, 912.

MAD R. SLOUGH, Eureka, Cal. (S.) (Humboldt Northern Ry. Co.) PLANS.—Approv. May 13, 1905, **05**, 727.

MAHONING CREEK, Armstrong County, Pa., at 6 and 11 m. from confluence with Allegheny R. (S.) (Pittsburgh & Shawmut R. R. Co.) PLANS.—Approv. Nov. 26, 1910, **11**, 1084, 1085.

MALDEN R., between Everett and Medford, Mass. (S.) (State br.) PLANS.—Approv. May 1, 1903, **03**, 650, and Feb. 13, 1904, **04**, 716.

MANAHAWKEN B., between Hilliards and Barnegat City Junction, N. J. (S.) (Long Beach Turnpike Co.) PLANS.—Approv. June 17, 1912, **12**, 1308.

MANASQUAN R., between Manasquan and Pt. Pleasant, N. J. (S.) (Monmouth and Ocean Counties br.) PLANS.—Reconstr. plans approv. Nov. 9, 1896, **97**, 532.

MANASQUAN R., between Breele and Pt. Pleasant, N. J. (S.) (New York & Long Branch R. R. Co.) PLANS.—Reconstr. plans approv. May 24, 1914, **11**, 1089.

MANATEE R., Craigs Pt., Fla. (Sp.) (U. S. & West Indies R. R. & S. S. Co.) Au. act May 7, 1902. PLANS.—Approv. Nov. 19, 1902, **03**, 643.

MANATEE R., Manatee, Fla. (S.) (Manatee Br. Co.) PLANS.—Approv. Apr. 12, 1909, **09**, 917.

MANCHAC (Pass), St. John the Baptist Parish, La. (S.) (Illinois Central R. R. Co.) PLANS.—Rebuilding approv. Aug. 5, 1902, **03**, 645.

MANCHESTER H., Mass. (Dr.) **10**, 1019.

MANCHESTER H., Mass. (O.) (Boston & Maine R. R. Co.) PLANS.—Alterations to be completed on or before 12 months from May 18, 1910, **10**, 1032.

MANISTEE R., Smith Street, Manistee, Mich. (S.) (City br.) PLANS.—Approv. Sept. 27, 1893; modification approv. Jan. 18, 1894, **94**, 427.

MANISTEE R., Maple Street, Manistee, Mich. (S.) (City br.) PLANS.—Rebuilding approv. Feb. 11, 1905, **05**, 725.

MANISTEE R., Manistee, Mich. (Sp.) (Manistee Township br.) Au. act May 20, 1908. PLANS.—Approv. Aug. 15, 1908, **09**, 914.

MANITOWOC R., Manitowoc, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Approv. Feb. 28, 1899, **99**, 622. Reconstr. approv. Mar. 16, 1910, **10**, 1028.

MANITOWOC R., foot of 8th Street, Manitowoc, Wis. (Sp., etc.) (City br.) LEGISLATION.—City au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Wisconsin. PLANS.—For new br. approv. Mar. 8, 1892, **92**, 404.

MANITOWOC R., near High Street, Manitowoc, Wis. (S.) (Manitowoc Terminal Co.) PLANS.—Approv. Jan. 18, 1896, **96**, 426.

MANITOWOC R., Manitowoc, Wis. (S.) (Manitowoc Terminal Co., 2 brs.) PLANS.—For brs. at Main Street and at 8th Street, approv. Aug. 2, 1892, **95**, 480. Modified plans for first crossing, providing for a fixed span with a lift draw, approv. Jan. 18, 1896, **96**, 425, 426.

MANITOWOC R., Main Street, Manitowoc, Wis. (S.) (City br.) PLANS.—Reconstr. plans approv. June 16 1897, **97**, 534.

MANITOWOC R., Manitowoc, Wis. (S.) (Manitowoc, Green Bay & Northwestern Ry. Co.) PLANS.—Approv. Mar. 15, 1905, **05**, 726.

MANITOWOC R., Park and Center Streets, Manitowoc, Wis. (S.) (City br.) PLANS.—Approv. Mar. 4, 1907, **07**, 825.

MANITOWOC R., State and Center Streets, Manitowoc, Wis. (S.) (City br.) PLANS.—Temporary br. approv. Sept. 6, 1900, **01**, 662. Modified plans approv. Sept. 2, 1905, **06**, 801.

MANTUA CREEK. (See Schuylkill R.)

MANTUA CREEK, at Mount Royal, N. J. (S.) (Gloucester County br.) PLANS.—New br. in place of existing str. approv. Dec. 8, 1911, **12**, 1303.

MARSH R., Newcastle, Me. (S.) (Maine Central R. R. Co.—Knox & Lincoln branch.) PLANS.—Rebuilding approv. Apr. 8, 1903, **03**, 649.

MASHPEE R., Mass., over Mashpee R., Opponessett B., and a chan. connecting these waterways between Gooseberry Isld. and the mainland. (S.) (Brs. of the town of Mashpee.) PLANS.—Approv. Feb. 11, 1910, **10**, 1027.

MASON and BRUSH (Boush) **CREEKS,** Va. (S.) (Willoughby Bay Traction Co.) PLANS.—Approv. June 8, 1906, **06**, 807.

MASSALONA BAYOU, Fla. (S.) (Panama City br.) PLANS.—Approv. Mar. 25, 1910, **10**, 1028.

- MATANZAS R.**, Fla. (Dr.) 02, 581.
- MATANZAS R.**, St. Augustine, Fla. (S.) (St. Augustine Br. Co.) PLANS.—Approv. June 10, 1895, 95, 479.
- MATTAPONI R.**, Walkerton, Va. (S.) (Walkerton & Mattaponi Br. Co.) PLANS.—Approv. Oct. 28, 1898, 99, 621. Reconstr. of existing br. approv. Mar. 14, 1912, 12, 1306.
- MATTITUCK CREEK**, Suffolk County, N. Y. (S.) (Southold town, br.) PLANS.—Approv. Sept. 11, 1909, 10, 1024.
- MAUMEE R.**, Toledo, Ohio. (S.) (City br.) PLANS.—Submitted Feb. 4, 1895; modified Mar. 25, 1895; approv. Apr. 12, 1895, 95, 478. Modified plans approv. Nov. 16, 1895, 96, 425. Approv. July 1, 1911, 12, 1299.
- MAUMEE R.**, Toledo, Ohio. (S.) (Lake Shore & Michigan Southern Ry. Co.) PLANS.—New br. approv. Sept. 27, 1899, 00, 699.
- MAUMEE R.**, near Toledo, Ohio. (S.) (Maumee Railway Br. Co.) PLANS.—Modified plans for upper br. approv. June 24, 1901, 01, 667, and Apr. 25, 1902, 02, 588.
- MAUMEE R.**, Cherry and Main Streets, Toledo, Ohio. (S.) (City br.) PLANS.—Reconstr. approv. Jan. 22, 1907, 07, 824.
- MAURICE R.**, at Mauricetown, N. J. (S.) (Cumberland County br.) PLANS.—Reconstr. approv. Feb. 21, 1910, 10, 1027.
- M'GIRTS CREEK**, Duval County, Fla. (S.) (Jacksonville, Tampa & Key West Ry. Co.) Reconstr. plans approv. Aug. 15, 1893, 93, 470.
- M'GIRTS CREEK**, Fla. (S.) (Duval County br.) PLANS.—Approv. May 28, 1907, 07, 828.
- M'GIRTS CREEK**, Ortega, Fla. (S.) (Duval County br.) PLANS.—Approv. Jan. 29, 1912, 12, 1305.
- MENOMINEE CANAL**, 1st Avenue, Milwaukee, Wis. (S.) (City br.) PLANS.—Approv. July 7, 1905, 06, 800.
- MENOMINEE (North) CANAL**, Muskego Avenue, Milwaukee, Wis. (S.) (City br.) PLANS.—Rebuilding approv. May 12, 1902, 02, 588.
- MENOMINEE (North) CANAL**, 6th Street, Milwaukee, Wis. (S.) (City br.) PLANS.—Rebuilding approv. July 26, 1905, 06, 801.
- MENOMINEE (South) CANAL**, 1st Avenue, Milwaukee, Wis. (S.) (City br.) PLANS.—Rebuilding approv. July 26, 1905; plans in lieu thereof approv. Jan. 31, 1907, 07, 824, 825.
- MENOMINEE (South) CANAL**, e. of 1st Avenue br., Milwaukee, Wis. (S.) (City br.) PLANS.—Temporary br. approv. Aug. 15, 1907, 08, 869.
- MENOMINEE R.**, Wis. (Sp.) (Menominee, Mich., and Mariette, Wis., cities' br.) LEGISLATION.—Municipalities au. to constr. br. by act July 29, 1886, 89, 369. PLANS.—Approv. Sept. 10, 1888; reported completed, 89, 369.
- MENOMINEE R.**, West Water Street, Milwaukee, Wis. (S.) (City br.) PLANS.—Rebuilding approv. Mar. 13, 1903, 03, 649.
- MENOMINEE R.**, West Water Street, Milwaukee, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Rebuilding approv. Mar. 13, 1903, 03, 649.
- MENUNKETESUCK R.** (See Stony Creek, Conn.)
- MENUNKETESUCK R.**, Conn. (S.) (Br. of the town of Westbrook.) PLANS.—Br. to replace existing str. approv. Mar. 24, 1910, 10, 1028.
- MERMENTAU R.**, La. (Dr.) 08, 865.
- MERRIMAC R.**, between Haverhill and Bradford, Mass. (O.) (Cities' br.) PLANS.—Specified alterations required on or before Oct. 1, 1894, 94, 430.
- MERRIMAC R.**, Haverhill, Mass. (S.) (Essex County br.) PLANS.—Approv. June 23, 1905, 05, 728.
- MERRIMAC R.**, between Newburyport and Deer Isld., Mass. (S.) (Essex County br.) PLANS.—Rebuilding approv. Apr. 8, 1909, 09, 917.
- MERRIMAC R.**, Mass. (Dr.) 10, 1019.
- MERRIMAC R.**, Newburyport and Salisbury, Mass. (S.) (Essex County br.) PLANS.—Rebuilding approv. Dec. 20, 1901, 02, 586.
- MIAMI R.**, Fla. (Dr.) 03, 642; 12, 1294.
- MIAMI R.**, Miami, Fla. (S.) (Florida East Coast Ry. Co.) PLANS.—Approv. Feb. 11, 1903, 03, 648.
- MIAMI R.**, Miami, Fla. (S.) (J. H. Tatum.) PLANS.—Approv. Oct. 24, 1904, 05, 724.
- MIAMI R.**, Avenue D, Miami, Fla. (S.) (Dade County br.) PLANS.—Approv. Oct. 15, 1902, 03, 646.
- MIAMI R.**, N. Fork, Dade County, Fla. (S.) (Dade County br.) PLANS.—Approv. Dec. 17, 1908, 09, 916.
- MICHIGAN CITY**, Ind., inner H. (A.) (Michigan Central Ry. br.) PLANS.—Draw opening too narrow, and swinging by hand very laborious, 89, 2803.
- MIDDLE R.**, Cal. (S.) (San Francisco & San Joaquin Valley R. R. Co.) PLANS.—Approv. Oct. 28, 1898, 99, 621.
- MIDDLE NORTH R.**, from Generals Isld. to Butler Isld., near Darien, Ga. (S.) (William H. Strain.) PLANS.—Approv. May 12, 1904, 04, 718.
- MIDDLE ISLD. CREEK** (St. Marys R.), near St. Marys, W. Va. (S.) (Baltimore & Ohio R. R. Co.) PLANS.—Approv. Oct. 27, 1909, 10, 1025.
- MILL CREEK**, Fort Monroe, Va. (Sp.) (Iron pile br.) APPROPRIATIONS.—1889, \$20,000, 89, 466. CONTRACTS.—1889. Groton Br. & Mfg. Co., br., \$17,500, 90, 387. ENGINEERS.—Chief of Engineers: Rs., 89, 12; 90, 9. Engineer in charge: Lt. Col. P. C. Hains, 1889-90. Rs., 89, 465; 90, 387. OPERATIONS.—1889-90. Constr. of br. under contract com-

- pleted, **90**, 387. PLANS.—Description of proposed str., **89**, 466.
- MILL CREEK**, at Fort Monroe, Old Point Comfort, Va. (S.) (Hampton Roads Ry. & Electrical Co.) PLANS.—Approv. July 15, 1904, **05**, 722.
- MILL CREEK**, Humphrey and Lombard Streets, New Haven, Conn. (S.) (City br.) PLANS.—Approv. June 22, 1906, **06**, 808.
- MILL CREEK**, Thomaston, Me. (S.) (Maine Central R. R. Co.) PLANS.—Approv. Feb. 6, 1899, **99**, 622.
- MILL NECK CREEK INLET**, from Allens Pt. to Pine Isld. at Bayville, N. Y. (S.) (Oyster B. br.) PLANS.—Approv. Jan. 5, 1897, **97**, 533.
- MILL R.**, Chapel Street, New Haven, Conn. (S.) (City br.) PLANS.—Approv. Apr. 29, 1897, **97**, 534.
- MILL R.**, Conn. (Dr.) **02**, 581.
- MILL TAIL CREEK**, tributary of Alligator R., Albemarle Sound, Darien County, N. C. (S.) (Dare Lumber Co.) PLANS.—Approv. May 23, 1911, **11**, 1089.
- MILL R.**, New Haven, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. approv. May 21, 1906, **06**, 807.
- MILLS CREEK**, at Woodmere, N. Y. (S.) (Woodmere Realty Co.) PLANS.—Br. to replace an existing str. approv. May 21, 1910, **10**, 1030.
- MILWAUKEE H.**, Wis. (Dr.) **11**, 1078.
- MILWAUKEE R.**, Milwaukee, Wis. (S.) (City br.) **96**, 426; **99**, 621. PLANS.—Approv. Apr. 14, 1893, **93**, 469. Reconstr. plans for br. at Huron Street, approv. Feb. 25, 1896, **96**, 426. Modified plans providing for a row of fender piling along each abutment, approv. Nov. 1, 1898, **99**, 426.
- MILWAUKEE R.**, Broadway, Milwaukee, Wis. (S.) (City br.) PLANS.—Reconstr. plans approv. Sept. 21, 1899, **00**, 699.
- MILWAUKEE R.**, connecting Grand Avenue and Wisconsin Street, Milwaukee, Wis. (S.) (City br.) PLANS.—Reconstr. plans approv. June 5, 1900, **00**, 701.
- MILWAUKEE R.**, Chestnut Street, Milwaukee, Wis. (S.) (City br.) PLANS.—Reconstr. approv. July 5, 1900, **01**, 661.
- MILWAUKEE R.**, Grand Avenue, Milwaukee, Wis. (S.) (City br.) PLANS.—Temporary br., during constr. of permanent br., approv. Oct. 9, 1901, **02**, 585.
- MILWAUKEE R.**, East Water and Ferry Streets, Milwaukee, Wis. (S.) (City br.) PLANS.—Rebuilding approv. Mar. 24, 1908, **08**, 872.
- MILWAUKEE R.**, Michigan Street, Milwaukee, Wis. (S.) (City br.) PLANS.—Br. to replace existing str. approv. Jan. 9, 1909, **09**, 916.
- MILWAUKEE R.**, Oneida to Wells Streets, Milwaukee, Wis. (S.) (City br.) PLANS.—Br. to replace existing swing br. approv. Feb. 15, 1911, **11**, 1087.
- MINGO** (or Black Mingo) **CREEK**, at Mingo (or Black Mingo) Br., S. C. (S.) (Br. of Georgetown and Williamsburg Counties.) PLANS.—Approv. Mar. 12, 1907, **07**, 826.
- MINNESOTA R.**, Minn. (Dr.) **10**, 1019.
- MINNESOTA R.**, Savage, Minn. (S.) (Minneapolis, Rochester & Dubuque Traction Co.) PLANS.—Permanent br., and for a temporary br. for use during constr. of the permanent str., approv. Sept. 9, 1907, **08**, 869.
- MISSISQUOI B.**, Alburg Pt., Vt. (S.) (Vermont & Providence Line R. R. Co.) PLANS.—Modified plans approv. Aug. 20, 1897, **97**, 535.
- MISSISQUOI B.**, Vt. (A. and O.) (Lamoille Valley Extension R. R. Co.) **88**, 2652; **90**, 343. LEGISLATION.—Notice served as to alteration required, **90**, 344. PLANS.—Maj. Adams recom. the removal of the br., it being no longer in use and being a great obstr. on account of the narrowness of the draw, **88**, 2652.
- MISSISQUOI B.**, Lake Champlain, between Swanton and Alburg, Vt. (Sp.) (Central Vermont R. R. Co.) Au. act Mar. 4, 1911. PLANS.—Reconstr. plans approv. Apr. 13, 1911, **11**, 1080.
- MISSISSIPPI R.**, between St. Paul and Missouri Rs. (Dr.) **02**, 581.
- MISSISSIPPI R.**, brs. over. (See Ohio R.) ENGINEERS.—Engineer in charge: Maj. G. K. Warren, 1870-79. **R.**, **70**, 58; (Lt. Col.) **79**, 1462. Maximum grade and curvature of the following brs.: **79**, 1462: St. Paul highway, St. Paul railway, Hastings railway, Winona railway (2), La Crosse railway, Prairie du Chien railway (pontoon), Dubuque railway, Clinton railway, Rock Isld. rail and highway, Keokuk rail and highway, Quincy railway, Hannibal rail and highway, Louisiana railway.
- MISSISSIPPI R.** (O.) **90**, 338. LEGISLATION.—Act Aug. 11, 1888, providing for alteration of strs. impeding navigation, **90**, 338. Notice served upon various br. owners, requiring alterations, **90**, 339.
- MISSISSIPPI R.**, Aitkin, Minn. (Sp.) (Aitkin County br.) LEGISLATION.—Company au. to constr. br. by act Mar. 23, 1896, **96**, 423. PLANS.—Submitted Dec. 2, 1895, and Jan. 30, 1896; approv. May 9, 1896, **96**, 423.
- MISSISSIPPI R.**, Alton, Ill. (Sp.) (St. Clair, Madison & St. Louis Belt R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 29, 1890. PLANS.—Approv. Aug. 1, 1891, on certain conditions, **91**, 432.
- MISSISSIPPI R.**, Anoka, Minn. (Sp.) (Minneapolis, Superior, St. Paul & Winnipeg Ry. Co.) Au. act June 27, 1902. PLANS.—Approv. Aug. 5, 1902, **03**, 643.
- MISSISSIPPI R.**, at Fort Snelling, Minn. APPROPRIATIONS.—1906, \$125,000, **07**, 2475. 1909, \$20,000, **09**, 2515. 1910, \$1,200, **10**, 2742. Total, \$146,200. Contributions: City of St. Paul, \$100,000, **07**, 2475. Twin City Rapid Transit Co., \$25,000, **07**, 2475. Total, \$125,000. ENGINEERS.—Chief of Engineers. **R.**, **06**, 832; **07**,

- 861; **08**, 901; **09**, 948; **10**, 1059; **11**, 1118. In charge: Lt. Col. G. McC. Derby. **R.**, **06**, 2279. Capt. E. H. Schulz. **R.**, **07**, 2475. Maj. F. R. Shunk. **R.**, **08**, 2557; **09**, 2515; **10**, 2741; **11**, 3037. OPERATIONS.—1906-07. Site surveyed; borings made; land acquired; proposals issued, **07**, 861, 2475. 1907-08. Work commenced; substr. about 64 per cent completed; abutment St. Paul side completed; Fort Snelling side one-half completed, **08**, 2557. 1908-09. Substr. work completed; erection of superstr. completed; grading approaches commenced; about 20 per cent of entire work completed, **09**, 2515. 1909-10. Work suspended Nov., 1909; br. placed in charge of custodian, **10**, 2741. 1910-11. Street opened; approaches completed; minor repairs, **11**, 3037. PROJECT.—Act Mar. 17, 1906, provides for constr. of br. at limiting cost of \$250,000, toward which city of St. Paul to contribute \$100,000, not less than \$25,000 by street railway company receiving right of transit across br. Site selected for proposed br. about 330' below old Fort Snelling br. **06**, 832, 2279.
- MISSISSIPPI R.**, Bemidji, Minn. (Sp.) (City br.) Au. act May 20, 1908. PLANS.—Approv. June 13, 1908, **08**, 868.
- MISSISSIPPI R.**, Bemidji, Minn. (Sp.) (Minneapolis, St. Paul & Sault Ste. Marie R. Co.) Au. act Mar. 24, 1910. PLANS.—Approv. Aug. 10, 1910 **11**, 1079.
- MISSISSIPPI R.**, near Bemidji, Minn. (Sp.) (Minnesota & International Ry. Co.) Au. act Mar. 12, 1912. PLANS.—Approv. May 27, 1912, **12**, 1298.
- MISSISSIPPI R.**, Blackberry, Minn. (Sp.) (Town br.) Au. act Feb. 15, 1911. PLANS.—Approv. Jan. 29, 1912, **12**, 1297.
- MISSISSIPPI R.**, Burlington, Iowa. (Sp.) (Railway.) COMMERCE.—Influence of br. upon navigation, **78**, 1004. ENGINEERS.—Chief of Engineers, **R.**, **77**, 96. Approv. recom. of board, **77**, 817. BE. convened at St. Louis, Mo., July 17, 1876, to inquire into the expediency of placing sheer booms on the upper end of all or any br. p. on the Mississippi R. Adjourned to await the completion of maps. **77**, 821. Reconvened Jan. 26, 1877. Recom. a sheer boom 500' in length at br. **R.**, **77**, 819, 824. (Cols. Macomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) LEGISLATION.—Br. au. by act July 25, 1866, **77**, 824; **78**, 1003. Various acts relating to the br., **78**, 1089. PLANS.—Dimensions of br., **77**, 824; **78**, 1003. Description of plans by Maj. Warren, **78**, 1003. High br. would be very expensive, **78**, 1006. Changes in br. proposed by Maj. Warren, **78**, 1006. SURVEYS.—Maps. Diagram of ps., **78**, 1004. Maps of locality of br., Nos. 21 and 22, **78**, 1126.
- MISSISSIPPI R.**, Cass and Itasca Counties, Minn. (S.) (Great Northern Ry. Co.) PLANS.—Br. to replace existing str. approv. Sept. 10, 1907, **08**, 870.
- MISSISSIPPI R.**, Clinton, Iowa. (Sp.) (Pontoon.) ENGINEERS.—Chief of Engineers. **R.**, **75**, 121. Approv. conclusions of BE., **75**, ii, 682. Approv. by Sec. of War, **75**, ii, 683. BE. convened at Clinton, Iowa, Oct. 8, 1874. Recom., **75**, ii, 683. **R.**, **75**, ii, 683. (Col. Macomb, Maj. Weitzel and Farquhar.) LEGISLATION.—Br. au. by acts Apr. 1, 1872, and June 6, 1874, **75**, ii, 682. Various acts relating to the br., **78**, 1093. PLANS.—By br. company, **75**, ii, 683. Modified by BE., **75**, ii, 683.
- MISSISSIPPI R.**, Clinton, Iowa. (Sp.) (Railway.) COMMERCE.—Influence of br. upon navigation, **78**, 989. ENGINEERS.—Chief of Engineers. Approv. recom. of board, **77**, 96, 817. BE. 1876. Recom. constr. of 1,000' of sheer booms. **R.**, **77**, 819, 825. (Cols. Macomb and Simpson, Maj. Warren, Suter, and Farquhar, and Capt. Allen.) LEGISLATION.—Br. au. by act Feb. 27, 1867, **78**, 987. Abstracts of debates in Congress relating to Clinton br., **78**, 1051. Various acts relating to br., **78**, 1089, 1093. PHYSICAL CHARACTERISTICS.—Description of R. and valley at locality of br., **78**, 987. PLANS.—Description of br., **77**, 823; **78**, 988. Alterations recom. by Maj. Warren, **78**, 989. Proposed location for a high br., **78**, 990. Maj. Warren's R. on br., **78**, 987. SURVEYS.—Maps. Diagram of ps., **78**, 985. Maps of locality of br., **78**, 1126.
- MISSISSIPPI R.**, near Clinton, Iowa. (Sp.) (Clinton & Illinois Br. Co.) ENGINEERS.—Chief of Engineers. **R.**, **91**, 428. BE. constituted by S. O. No. 10, Mar. 11, 1890. (Lt. Col. C. R. Suter, Maj. A. Mackenzie, and Capt. W. L. Marshall.) Engineer in charge: Maj. A. Mackenzie. LEGISLATION.—Company au. to constr. br. by act July 16, 1888; amending act Mar. 1, 1890, **91**, 428. PLANS.—Br. at Stoney Pt. submitted Feb. 1, 1889, withdrawn; new plans with location below br. of the Chicago & North Western Ry. Co. disapprov. July 16, 1889. Plans for a high br. at Stoney Pt. submitted Nov. 12, 1889; referred to BE., who reported Mar. 31, 1890, adversely on this location and suggested a place about 1 m. below city near R. R. br.; revised plans in accordance with above suggestion approv. Sept. 22, 1890. Modification of superstr. of certain spans submitted Jan. 21, 1891; approv. Feb. 10, 1891. Modification of arrangement of e. chan. span submitted June 26, 1891; approv. July 10, 1891. **91**, 428.
- MISSISSIPPI R.**, Clinton, Iowa. (Sp.) (Br. of Albany R. R. Br. Co., by Chicago & North Western Ry. Co.) Au. act Feb. 6 1907. PLANS.—Reconstr. approv. May 4, 1907, **07**, 819.
- MISSISSIPPI R.**, at Cohasset, Minn. (Sp.) (Bass Brook town br.) Au. act Jan. 23, 1910. PLANS.—Approv. May 13, 1910, **10**, 1022.
- MISSISSIPPI R.**, between Davenport, Iowa, and Rock Isld., Ill. (Sp.) (Davenport & Rock Island Ry. Br. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 3, 1885 **95**,

474. PLANS.—Submitted Nov. 19, 1894; modified Jan. 5, 1895; approv. Jan. 23, 1895, 95, 474.

MISSISSIPPI R. (Des Moines Rapids Canal), at foot of Des Moines Rapids, above present lower lock in Hancock County, Ill. (S.) (Keokuk & Hamilton Water Power Co.) PLANS.—Temporary br. for use in connection with power development au. by acts Feb. 8, 1901, and Dec. 9, 1905; approv. Mar. 6, 1911, 11, 1087.

MISSISSIPPI R., Dubuque, Iowa. (Sp.) (Railway.) COMMERCE.—Influence of br. upon navigation, 78, 985. ENGINEERS.—Chief of Engineers. R., 77, 96, 817; 83, 271, 1598; 84, 271. BE. recom., 1876, a sheer boom 1,200' in length. R., 77, 819, 823. (Cols. Maccomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) LEGISLATION.—Br. au. by act July 25, 1866, 78, 983. Various acts relating to br., 78, 1089, 1093. Act Mar. 3, 1875, fixed width of the draw span at 500'. Act May 29, 1884, reduced it to 400', 84, 271. PHYSICAL CHARACTERISTICS.—Description of R. valley at locality of br., 78, 983. PLANS.—Description of br., 77, 823; 78, 984. Proposed location of high br., 78, 986. By Maj. Warren for extension of left rest p. 800', 78, 986. Modifications in spans discussed by br. company, 83, 1595, 1598. Recom. by Chief of Engineers, 83, 1598. Action of Congress necessary before modification can be made, 83, 1599. Modified by act May 29, 1884, 84, 271. SURVEYS.—Maps. Diagram of ps., 78, 985. Maps of locality of br., 78, 1126 (Nos. 15 and 16).

MISSISSIPPI R., Dubuque, Iowa. (Sp.) 88, 309. COMMERCE.—Dimensions of the largest Mississippi packet boats, 88, 2496. LEGISLATION.—Br. au. by act Feb. 21, 1887, 88, 2493. PLANS.—Maj. Mackenzie reported the dimensions of the br. spans such as to furnish no obstr. to the passage of the largest Mississippi boats, 88, 2496-97.

MISSISSIPPI R., Dubuque, Iowa. (Sp.) (Pontoon.) 76, 92, ii, 308. COMMERCE.—Would be seriously obstr. by proposed br., 76, ii, 311, 313. BE. convened at Dubuque, Iowa, May 31, 1875. Br. on proposed site would be very injurious to navigation. 76, ii, 311. R., 76, ii, 309. Reconvened Oct. 15, 1875. Site inadmissible so long as the bar in front of the city exists, 76, ii, 313. R., 76, ii, 312. Reconvened Mar. 15, 1876. The board approved of the revised plans and change of site presented by the br. company, 76, ii, 309. R., 76, ii, 309. Approv. by Chief of Engineers and Sec. of War, 76, ii, 308. (Col. Maccomb and Maj. Farquhar and Suter.) LEGISLATION.—Br. au. by act Mar. 3, 1875, 76, ii, 308, 309. PLANS.—Submitted by J. P. Quigley, 76, ii, 309. Description of, 76, ii, 309. Discussed by board, 76, ii, 309. R. of Maj. Warren, 78, 986.

MISSISSIPPI R., between Dubuque, Iowa, and Dunleith (East Dubuque), Ill. (Sp.) (Dubuque & Dunleith Br. Co.) 99, 619. LEGISLATION.—Company au. to constr. br. by act July 25, 1866, 99, 619. PLANS.—Reconstr. plans approv. Mar. 4, 1899, 99, 619.

MISSISSIPPI R., Dubuque, Iowa, and East Dubuque, Ill. (S.) (Dubuque High Br. Co.) PLANS.—Reconstr. approv. May 16, 1906, 06, 807.

MISSISSIPPI R., Eagle Pt., Dubuque, Iowa. (Sp.) (Dubuque & Wisconsin Br. Co.) Au. act Mar. 6, 1900, and Dec. 21 1900. PLANS.—Approv. Jan. 4, 1901, 01, 660.

MISSISSIPPI R., near Elk R., Minn. (Sp.) (Elk R. village, county of Wright and town of Otsego br.) Au. act Apr. 28, 1904. PLANS.—Approv. Nov. 4, 1904, 05, 720.

MISSISSIPPI R., Fort Madison, Iowa. (Sp.) LEGISLATION.—Br. au. by acts Apr. 1, 1872, and May 17, 1872, 78, 1091, 1092.

MISSISSIPPI R., Fort Snelling, Minn. (Sp.) 78, 111; 80, 200. BE. approv. plan, 80, 200. (Gen. Terry and Col. Warren.) LEGISLATION.—Br. au. by act June 30, 1878, 80, 199, 1869. PLANS.—Constr. of a free wagon br., with st. abutments and iron superstr., 78, 111. Approv. by Sec. of War, 78, 111. Test of br. assigned to Capt. C. J. Allen, 80, 200. R., 80, 1869.

MISSISSIPPI R., Grand Rapids, Minn. (Sp.) (Town br.) Au. act Mar. 23, 1912. PLANS.—Approv. Apr. 20, 1912, 12, 1298.

MISSISSIPPI R., Hannibal, Mo. (Sp.) (Railway.) COMMERCE.—Number of rafts passing the br., 77, 826. Effect of br. upon navigation, 78, 1017. Ath. w. a very serious obstr. to navigation, 78, 1017. ENGINEERS.—Chief of Engineers. Approv. recom. of board, 77, 817. BE. recom., 1876, placing of a sheer boom 1,200' in length at this br. R., 77, 819, 826. (Cols. Maccomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) LEGISLATION.—Br. au. by act July 25, 1866, 77, 826; 78, 1015, 1089. PHYSICAL CHARACTERISTICS.—Description of the R. and valley in the vicinity of the br., 78, 1015. PLANS.—Dimensions, 77, 826; 78, 1016. R. of Maj. Warren on plans of br., 78, 1015. Height required for h. br., 78, 1019. SURVEYS.—Maps. Of locality of br., 78, 1126 (No. 27).

MISSISSIPPI R., Hannibal, Mo. (O.) (Wabash R. Co., Hannibal Br. Co. & Missouri Pacific Ry. Co.) PLANS.—Alterations to be completed on or before Mar. 15, 1907, 06, 809.

MISSISSIPPI R., above Hannibal, Mo. (O.) (Hannibal Br. Co., controlled by the Wabash Ry. Co.) PLANS.—Alterations required by Mar. 1, 1889; time extended to Nov. 8, 1888. No action taken by the companies interested, 89, 373, 374.

MISSISSIPPI R., Hastings, Minn. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. by act June 29, 1894. PLANS.—Approv. Nov. 9, 1894. Reported completed. 95, 474.

MISSISSIPPI R., Hastings, Minn. (S.) (Railway, draw.) COMMERCE.—Influence of br. upon navigation, 78, 969. LEGISLATION.—Br. au. by Minnesota, Feb. 7, 1867, 78, 967. PLANS.—Description of br., 78, 969. Proposed

location for h. br., 78, 970. Of Maj. Warren for extension of sheer booms and the placing of br. signals above bend in R., 78, 970.

MISSISSIPPI R., Itasca County, Minn. (Sp.) (Itasca County br.) Au. act Apr. 21, 1904. PLANS.—Approv. Aug. 19, 1904, 05, 720.

MISSISSIPPI R., point between Kansas City and 5 m. below, Mo. (Sp.) (Randolph & Kansas City Br. Co.) Company au. to constr. br. by act July 23, 1888. PLANS.—For pontoon draw-span br. approv. July 26, 1889, 89, 372.

MISSISSIPPI R., Keithsburg, Ill. (Sp.) LEGISLATION.—Br. au. by act Apr. 26, 1882, 86, 369. PLANS.—After certain modifications the plan and location were approv. by Sec. of War, 86, 369, 2111.

MISSISSIPPI R., Keithsburg, Ill. (Sp.) (Iowa Central Ry. Co.) Au. act Feb. 25, 1909, 90, 313. PLANS.—Reconstr. approv. Apr. 12, 1909, 09, 913.

MISSISSIPPI R., Keokuk, Iowa. (Sp.) (Rail and high way.) COMMERCE.—Influence of br. upon navigation, 78, 1008. ENGINEERS.—Chief of Engineers. Approv. recom. of board, 77, 96, 817. BE. recom., 1876, placing of 1,200' of sheer booms. R., 77, 819, 825. (Cols. Maccomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) LEGISLATION.—Br. au. by act July 25, 1866, 77, 825; 78, 1006, 1089. PHYSICAL CHARACTERISTICS.—Description of R. and valley at locality of br., 78, 1006. PLANS.—Dimensions, 77, 825; 78, 1007. Maj. Warren's R. on plans of br., 78, 1006. Alterations proposed by Maj. Warren, 78, 1009. Proposed location of h. br., 78, 1010.

MISSISSIPPI R., Keokuk, Iowa. (O.) (Keokuk & Hamilton br.) 89, 376. LEGISLATION.—Company failed to comply with the requirements of the notice served on them; matter referred, Apr. 13, 1889, to Atty. Gen. for such action as is required by law, 89, 376. PLANS.—Alterations required by Mar. 31, 1889, 89, 376.

MISSISSIPPI R., La Crosse, Wis. (Sp.) (City.) 90, 336. LEGISLATION.—Au. by act Feb. 23, 1889, 90, 336. PLANS.—Plan and location submitted, and approv. by Sec. of War Sept. 30, 1889, 90, 336.

MISSISSIPPI R., La Crosse, Wis. (Railway.) COMMERCE.—R. R. and city interests described and discussed, 73, 564, 574. Growth of Milwaukee & St. Paul R. R. and of Wisconsin, 73, 576. Influence of br. on navigation, 78, 972. ENGINEERS.—Chief of Engineers. R., 73, 63; transmits papers and copies of acts to Maj. Warren for R., 73, 553. R. on sheer booms for br. ps. of Mississippi R., 77, 96, 817. BE. convened at La Crosse, July, 1872, condemned all the sites thereto proposed, and selected a site at foot of Mount Vernon Street, La Crosse, as most suitable for highway as well as R. R. purposes. R., 73, 563, et seq. Reconvened Sept. 25, 1872, upon decision of Atty. Gen. (regarding the highway reference in act June 4, 1872, 73, 565); board adhered to their orig. decision, which was approv.

by Chief of Engineers and Sec. of War, 73, 572. R., 73, 572. Convened at La Crosse, Wis., Jan. 15, 1875. Recom., 78, 721, 722, 723. R., 78, 721. (Col. Maccomb and Maj. Weitzel and Merrill.) Recom., 1876, placing of 1,000' sheer boom above abutment. R., 77, 819, 822. (Cols. Maccomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) LEGISLATION.—Acts of Congress relating to br. Act July 25, 1866, compared in full with act Apr. 1, 1872, 73, 561. Act Feb. 21, 1868, described, 73, 555. No br. built under this act, 78, 973. Acts Apr. 1, 1872, and June 4, 1872, described, 73, 555. Act June 4, 1872, in full, 73, 563. Opinion of Atty. Gen. regarding reference therein to highways, 73, 570. Various acts relating to br. referred to, 78, 1089, 1091, 1093. PHYSICAL CHARACTERISTICS.—Of La Crosse and region surrounding, 73, 556, 564. Crossings of R. described, 73, 556; 78, 974. PLANS.—Of St. Paul R. R. Co., by J. T. Dodge, filed by A. Mitchell, president, Milwaukee & St. Paul R. R. Co., for br. at Minnesota Isld., 2 m. above La Crosse, crossing the Mississippi and Black Rs., 73, 555. Petition of mayor of La Crosse and president of board of trade, and of governor of Wisconsin, protesting against this location, 73, 555. Letter of J. M. Rusk thereon, requesting a BE., 73, 555. Remarks by Maj. Warren on this plan and site, 73, 557, 560. Location disapprov. by BE., 73, 566. Plan of city of La Crosse for a br. in city, discussed by Maj. Warren, 73, 558; by BE., 73, 566. Plan of Southern Minnesota R. R. Co. for a br. at "Travers de Sioux," 2 m. below the city of La Crosse. Remarks on, by Maj. Warren, 73, 559; by BE., 73, 567. Plan of BE. for a br. at foot of Mount Vernon Street, La Crosse, described, 73, 567. Description of br., 77, 822. Proposed location of h. br., 78, 979. R. of Maj. Warren, 73, 554; 77, 817, 822; 78, 973. SURVEYS.—Maps. Of locality of br., 78, 1126 (Nos. 11 and 12). Diagram of ps., 78, 977.

MISSISSIPPI R., Little Falls, Minn. (Sp.) (City br.) Au. act June 30, 1902. PLANS.—Approv. July 10, 1902, 03, 642.

MISSISSIPPI R., Louisiana, Mo. (Sp.) COMMERCE.—C. and R. R. interests described and discussed by BE., 73, 579. Number of rafts passing the br., 77, 820. Influence of br. upon navigation, 78, 1021. ENGINEERS.—Chief of Engineers. R., 77, 817. BE. convened at St. Louis, Mo., June 21, 1873; reported in favor of site selected, but with modifications of plan, and additions costing \$81,800. R., 73, 578. Approv. by Chief of Engineers, 73, 577. (Col. Simpson and Maj. Weitzel, Merrill, and Allen.) Recom., 1876, that the cribwork or bulkhead above the rest p. be extended upstream 500', and a fixed boom from its upper end 820'. R., 77, 821. (Cols. Maccomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) Approv. by Chief of Engineers, 77, 817. LEGISLATION.—Acts of Congress au. br., Mar. 3, 1871, 77, 826. Acts modifying same, of Apr. 1, 1872, and June 4, 1872, 77, 826; 78, 1018. Acts referred to, 78, 1090. PHYSICAL CHARAC-

TERISTICS.—Description of R. and valley at the locality of br., 78, 1019. **PLANS.**—By E. L. Corthell, chief engineer of Louisiana & Missouri River R. Co., submitted to Sec. of War, 73, 578. Objections to same by BE., 73, 579. Revised by E. L. Corthell, and approv. by Chief of Engineers and Sec. of War, 73, 584. Description of the br., 77, 826; 78, 1019. Accessory works, 78, 1021. Proposed alterations, 78, 1022. Proposed location of h. br., 78, 1024. R. of Maj. Warren, 77, 817; 78, 1018. **SURVEYS.**—Maps. Of locality of br., 78, 1126 (Nos. 28 and 29.) Diagram of ps., 78, 1020.

MISSISSIPPI R. (Sp.) (Lyons & Fulton Br. Co., at Lyons, Iowa.) 90, 337. **LEGISLATION.**—Au. by acts Mar. 2, 1889, and Mar. 15, 1890, 90, 337. **PLANS.**—Plan and location submitted, and approv. by Sec. of War, Apr. 22, 1890, 90, 338.

MISSISSIPPI R., Memphis. (Sp.) (Kansas City & Memphis R. R. & Br. Co.) **ENGINEERS.**—Chief of Engineers. R., 88, 309; 89, 369. BE. convened at Memphis, May 26, 1888, by S. O. No. 26, to ex. and R. upon the plans of the proposed br. across the Mississippi R. at Memphis. Majority R. in favor of a main span of 1,000', 2 other spans of 600' each, and the whole str. to be 75' above h. w., 88, 2517, 2522. (Maj. Ernst, Capt. Kingman, and Capt. Gillette.) Minority R. in favor of a main span of 700', 88, 2521. (Lt. Col. Merrill.) Sec. of War decided in favor of a main span of 770', 88, 2516. **LEGISLATION.**—Au. by act Apr. 24, 1888, 88, 2514, 2525. **PLANS.**—Approv. Aug. 23, 1888, 89, 369.

MISSISSIPPI R., Minneapolis, Minn. (Stone arch.) **ENGINEERS.**—Chief of Engineers. R., 86, 369. BE. convened to consider the effect of such a br. upon the works of the U. S. for the preservation of the Falls of St. Anthony, 86, 2111. The board did not think these works would be jeopardized by the constr. of the proposed br., 86, 2113. (Lt. Col. Poe, Maj. Mackenzie and Allen.) **PLANS.**—An arch br. of st. of 4 spans of 125' each, 86, 2112.

MISSISSIPPI R., near Minneapolis, Minn. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) **PLANS.**—Reconstr. approv. Aug. 4, 1900, 01, 662.

MISSISSIPPI R., Minneapolis, Minn. (Sp.) (Minneapolis, St. Paul & Sault Ste. Marie Ry. Co.) Au. act Jan. 19, 1905. **PLANS.**—Approv. Mar. 10, 1905, 05, 721.

MISSISSIPPI R., e. chan., Boom Isld. and Minneapolis, Minn. (S.) (Wisconsin Central Ry. Co.) **PLANS.**—Approv. June 22, 1905, 05, 728.

MISSISSIPPI R., slough between Boom Isld. and e. bank, at 5th Avenue, Minneapolis, Minn. (S.) (Wisconsin Central Ry. Co.) **PLANS.**—Approv. Apr. 14, 1903, 03, 650.

MISSISSIPPI R., e. bank to Nicollet Isld. and from Nicollet Isld. to Boom Isld., Minneapolis, Minn. (S.) (Wisconsin Central Ry. Co.) **PLANS.**—Brs. approv. July 24, 1901, 01, 667.

MISSISSIPPI R., 32d Avenue, Minneapolis, Minn. (Sp.) (City br.) Au. act Jan. 19, 1905. **PLANS.**—Approv. Feb. 18, 1905, 05, 721.

MISSISSIPPI R., 42d Avenue, Minneapolis, Minn. (Sp.) (City br.) Au. act Jan. 27, 1912. **PLANS.**—Approv. Mar. 13, 1912, 12, 1297.

MISSISSIPPI R., Plymouth Avenue, Minneapolis, Minn. (Sp.) (City br.) Au. act Jan. 27, 1912. **PLANS.**—Approv. Mar. 15, 1912, 12, 1297, 1298.

MISSISSIPPI R., near Moose Rapids, Minn. (Sp.) (Minneapolis, St. Paul & Sault Ste. Marie R. R. Co.) Au. act Aug. 5, 1909. **PLANS.**—Approv. Oct. 27, 1909, 10, 1020.

MISSISSIPPI R., Minn. (S.) (Eastern Ry. Co.) **PLANS.**—Approv. Apr. 7, 1898, 98, 535.

MISSISSIPPI R., Muscatine, Iowa. (Sp.) **LEGISLATION.**—Br. au. by act Apr. 1, 1872, 78, 1091.

MISSISSIPPI R., Muscatine, Iowa. (Sp.) (Muscatine Br. Co.) **LEGISLATION.**—Au. by act July 16, 1888. **PLANS.**—Plan and location submitted by the company, and approv. by Sec. of War, June 11, 1889, 90, 336.

MISSISSIPPI R., at or near New Orleans, La. **COMMERCE.**—C. interests affected, 90, 3455. **ENGINEERS.**—Chief of Engineers. R., 90, 3453. BE. convened at New Orleans, La., June 14, 1890, by S. O. No. 29, to R. upon the erection of a h. level br. across the Mississippi near New Orleans. No br. should be built at or below the city; one could be built above the city without serious obstr. to navigation. 90, 3454. (Col. Comstock, Lt. Col. Suter, Maj. Ernst and Allen, and Capt. Kingman.)

MISSISSIPPI R. (above and below), New Orleans, La. **COMMERCE.**—C. interests involved, 90, 3451. **ENGINEERS.**—Chief of Engineers. R., 90, 3450. BE. convened at New Orleans, La., Nov. 30, 1889, by S. O. No. 47, to R. upon the question of the erection of brs. across the Mississippi above and below New Orleans. Board R. that any br. across this portion of the R. would be an obstr., and that but 1 br. was needed for R. R. purposes at New Orleans, and that should be located above the city. 90, 3457. (Col. Comstock, Maj. Allen, and Capt. Kingman.)

MISSISSIPPI R., above New Orleans, La. (Sp.) (Southern Br. & Ry. Co.) **LEGISLATION.**—Constr. au. by act Jan. 26, 1893. **PLANS.**—Approv. Apr. 19, 1893, 93, 465.

MISSISSIPPI R., between the mouths of Pine R. and Dean Brook, Minn. (A.) (Crow Wing County br.) **PLANS.**—Replacing existing br. with new str. approv. June 2, 1905, 05, 729.

MISSISSIPPI R., Prairie Du Chien, Wis. (Sp.) (Ponton railway.) **COMMERCE.**—Influence of br. on navigation, 78, 983. **ENGINEERS.**—Chief of Engineers. R., 74, 71. Approv. recom. of board, 77, 96, 817. BE. Sheer booms, 1876. not necessary, 77, 819, 823. (Cols. Macomb and Simpson, Maj. Warren, Farquhar, and Suter,

- and Capt. Allen.) LEGISLATION.—Br. au. by act July 25, 1866, 78, 980. Legalized by act June 6, 1874, 77, 823. Various acts relating to br., 78, 1089, 1093. PLANS.—Description of br., 74, 681; 77, 823; 78, 981. Rs. of Col. Macomb and E. F. Hoffman, 74, 681. Plan of br. designed by J. Lawler, 78, 983. Plan discussed by Maj. Warren, 78, 983. Proposed location of h. br., 78, 983. PHYSICAL CHARACTERISTICS.—Description of R. in vicinity of br., 78, 980. SURVEYS.—Maps. Of locality of br., 78, 1126 (Nos. 13 and 14).
- MISSISSIPPI R.,** between Prairie Du Chien Wis., and North McGregor, Iowa. (Sp.) (Chicago, Milwaukee & St. Paul Ry. Co.) LEGISLATION.—Company au. to reconstr. br. by act Mar. 30, 1898. PLANS.—Reconstr. plans. approv. June 29, 1898, 98, 532.
- MISSISSIPPI R.,** Quincy, Ill. (Sp.) (Railway.) COMMERCE.—Influence of br. upon navigation, 78, 1012. ENGINEERS.—Chief of Engineers. Approv. the recom. of board, 77, 96, 817. BE. recom. a fixed sheer boom 1,000' in length. R., 77, 819, 825. (Cols. Macomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) LEGISLATION.—Br. au. by act July 25, 1866, 78, 1010. Various acts relating to br. referred to, 78, 1089, 1091. PHYSICAL CHARACTERISTICS.—Description of the R. and valley at location of br., 78, 1010. PLANS.—Dimensions of br., 77, 825; 78, 1011. R. of Maj. Warren, 78, 1010. Alterations necessary, 78, 1014. Proposed location of h. br., 78, 1015. Incompatibilities of the law for building drawbrs., 78, 1014. SURVEYS.—Maps. Of location of br., 78, 1126 (Nos. 25 and 26). Diagram of ps., 78, 1011.
- MISSISSIPPI R.,** Quincy, Ill. (Sp.) (Chicago, Burlington & Quincy R. R. Co.) Au. act Apr. 24, 1902. PLANS.—Rebuilding draw span approv. May 3, 1902, 02, 583.
- MISSISSIPPI R.,** Red Wing, Minn. (Sp.) LEGISLATION.—Br. au. by acts July 25, 1866, and June 10, 1872, 78, 1092.
- MISSISSIPPI R.,** Red Wing, Minn. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. by act May 12, 1894. PLANS.—Approv. June 16, 1894, 94, 425.
- MISSISSIPPI R.,** near Royalton, Minn. (Sp.) (Minneapolis, St. Paul & Sault Ste. Marie Ry. Co.) Au. act Feb. 1, 1907. PLANS.—Approv. May 8, 1907, 07, 819.
- MISSISSIPPI R.,** Ill. (Rock Isl. br. over, constr. of). (Sp.) APPROPRIATIONS.—1867, \$200,000, 70, 252. 1869, \$500,000, 70, 253. 1870, \$300,000, 70, 58. 1877, \$15,000 (sheer booms), 77, 145; 78, 97. Total, \$1,015,000. COMMERCE.—Effect of br. on navigation, 77, 824; 78, 1002. CONTRACTS.—Harvey & Livesey, masonry, 71, 299. Annulled for lack of energy, 71, 300. Efforts to obtain damages, 71, 300. Baltimore Br. Co., 3 spans of superstr., \$459,784, 71, 301; contract extended, 71, 302. Satisfactory work done, 72, 279, 292. Fau Claire Lumber Co., constr. of sheer booms at br., 77, 818. Proposals to be invited for plans 1, 2, and 3 of Maj. Warren and for spans of 80, 150, and 190', 70, 262. Specifications on which proposals were based, 72, 286. For superstr.; abstracts of, 71, 301; 72, 287. ENGINEERS.—Chief of Engineers. Rs., 68, 50; 69, 44; 70, 58, 240; 71, 57; 72, 49; 73, 52; 77, 96, 817; 78, 97; 79, 132. Letter of to Maj. Warren, stating objections of Lt. Col. Rodman to location of draw, 70, 229. BE. reported, 1859, that the br. not located or const. with proper regard to the interests of navigation, ps. not of the best form, and improperly placed with reference to direction of currents, 67, 291; 68, 1036. (Capts. Humphreys, Meade, and Franklin.) Board of commissioners au. by Congress, Apr. 19, 1864, 70, 247. Report of, 70, 248. Limited in expend. on br., 70, 253. Control of br. assigned to Engineer Dept., 69, 44. (Brig. Gen. Schofield, J. Barnes, and S. M. Church.) To ex. and R. on the expediency of constr. sheer booms, to be placed at the upper end of all or any br. ps. on the Mississippi R., 77, 821. Recom. the removal of the remains of the old n. p. and the constr. of sheer booms, 77, 819, 824. (Cols. Macomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) Engineers in charge: Maj. G. K. Warren, 1869-71. R. on brg. navigable waters of the U. S., 68, 315; 78, 900, 991, 1033. Rs., 69, 194; 70, 236, 240, 256. Col. J. N. Macomb, 1871-78. Rs., 71, 256; 72, 279; 73, 415; 78, 710. Maj. F. U. Farquhar, 1878-79. Rs., 78, 710; 79, 1144. Maj. D. W. Flagler (Ordinance), 79, 1144, 1145. Assistants: Capt. W. H. H. Benyaurd, in charge of designs for superstr., 69, 199. Rs., 70, 263; 71, 301; 72, 286. Capt. A. Stickney, in charge of masonry, 69, 199. Rs., 71, 298; 72, 293. Capt. A. H. Burham, in local charge, 73, 416. G. B. Nicholson, inspector of ironwork, 72, 292. E. F. Hoffman. R., 79, 1145. ESTIMATES (see Plans and Projects).—By E. H. Johnson, C. E., of Chicago, Rock Island & Pacific R. R. (made for board of commissioners), for a single-track br., with passage for highway 17' wide, \$1,296,292, 69, 194; 70, 237, 249. By Maj. Warren, on basis and plans of E. H. Johnson, for double-track R. R. and highway br., with approaches, \$2,134,168, 69, 194; 70, 251. Est. saving of plan suggested by Maj. Warren over plan of E. H. Johnson, \$125,966, 69, 195. By Lt. Col. T. J. Rodman, U. S. A., plan No. 1, \$1,234,525; plan No. 2, \$978,085, 70, 257. Plan No. 3, \$934,291, 70, 258. By Maj. Warren, plan No. 2, \$2,187,547, 70, 246, 264. Plan No. 3, \$1,232,356, 70, 246, 266. Cost to U. S. of plan No. 3, \$587,675; cost to R. R. company of plan No. 3, \$694,681, 70, 246. Review of previous ests., 78, 992. EXPENDITURES (see also Financial statements).—On part of U. S. not to exceed \$1,000,000, 70, 253. Relative expense to be borne by U. S. and R. R.

¹ Reversion to Treasury of \$500,000, 70, 58; reappropriated, 71, 256. Congress provides that expenditures on part of the U. S. shall not exceed \$1,000,000, 70, 253. Statements of appropriations, 69, 44; 70, 58, 252, 253; 71, 57, 256.

company, 70, 237, 246. FINANCIAL STATEMENTS.—71, 256, 262; 72, 279, 285; 73, 416; 78, 97, 711; 79, 132, 1145. Payment to U. S. by R. R. company, \$177,320.25, 73, 415. LEGISLATION.—Act June 27, 1866, * * * for estab. of an armory * * * on Rock Isld.; au. Sec. of War to fix location of br., and to grant to the R. R. companies and other parties in interest pecuniary aid toward changing present location of br. and road; action to be under control of board of commissioners, as fixed by act Apr. 19, 1864, 70, 247, 254. Act July 25, 1866, to au. constr. of certain brs.; * * * fixing minimum h. of lower chord above h. w., length of span, and position of ps., 70, 249. Act Mar. 2, 1867, making app. for support of Army and other purposes, \$200,000 provided for the constr. of br. at Rock Isld., 70, 252. Act Mar. 3, 1869, making app. for support of Army and other purposes, \$500,000 provided for constr. of br. at Rock Isld., 70, 253. Act July 20, 1868, in relation to br., au. commencement of, with general provisions and conditions, and providing that the expend. on part of U. S. shall not exceed \$1,000,000, 70, 253, 255. Action of Congress allowed a change to single-track R. R. br. with highway beneath, 70, 239. Various acts relating to constr. of brs., 77, 145, 824; 78, 1089, 1091. OPERATIONS.—1868-69. Work commenced by contract on the Davenport abutment, 69, 198. 1869-70. Progress on substr.; completion of Davenport abutment; constr. of cofferdam at draw pr.; embankment for Davenport wagon road in progress, 70, 224; 71, 298. 1870-71. Completion of ps. Nos. 1, 2, 3, and 4; masonry for pivot p. and Davenport wagon road embankment, 71, 298. Work taken from contractor and prosecuted with hired labor, 71, 300. Operations on superstr. commenced, 71, 301. 1871-72. Removal of r. from draw-span chan. and completion of superstr. May 8, 1872, 72, 291, 295. 1872-73. Final completion and opening of br. and transferment to Ordnance Dept., Feb. 4, 1873, 73, 52, 415. 1877-78. 1,150 l. f. of sheer boom built, 78, 97, 710, 997. 1878-79. Repairs of sheer boom, 79, 132, 1144, 1145. PHYSICAL CHARACTERISTICS.—Of valley of R., 68, 315. Sectional area of natural waterway at location of br., 69, 197; 78, 1001. Velocity of current at br., 69, 197. PLANS (see Estimates and Projects).—For wagon way, width 26', with 2 sidewalks, of 6' each, considered by board of commissioners and rejected as giving pivot p. too great width, 69, 194; 70, 242. By E. H. Johnson, for single-track R. R., truss to be 16' wide, with wagon road (without sidewalks) 17' wide, 69, 194; 70, 237, 241, 249. By Lt. Col. Rodman, U. S. A., as follows: (1) Truss wide enough for double-track R. R. and h. enough for wagon road above R. R., 70, 257; (2) same arrangement of track and road, but only wide enough for single track, 70, 257; (3) same as plan No. 2, but with wagon road below single-track R. R., 70, 258. By Maj. Warren, placing R. R. above wagon road: (1) Truss 33' h., 28' apart, wagon way 28' wide and 12' h., R. R. with double

tracks and 2 sidewalks, to be reached by steps from ends, 69, 195; 70, 244, 262; (2) trusses of same general dimensions as preceding, wagon road 18' wide, with 2 5' sidewalks, double-track R. R. above, 69, 195; 70, 244, 262; (3) single-track R. R., trusses 18' wide, with wagon road beneath 18' wide, and 2 sidewalks (outside of trusses) 5' wide, 69, 195; 70, 244, 262. Maj. Warren recom. plan No. 3, 70, 246. General details of proposed plans, 70, 263. PRIVATE AND CORPORATE WORK. (See Legislation.) PROJECTS (see Estimates and Plans).—Congress, June 27, 1863, au. Sec. of War to fix location of br. and grant pecuniary aid to parties interested, to aid them in changing present location and rebuilding, the details to be under immediate control of board of commissioners, 70, 247, 254. Congress, July 25, 1866, fixing height of lower chord above h. w. on navigable streams; also length of spans and position of ps., 70, 249. Proposition of Chicago, Rock Island & Pacific R. R. Co. as to joint action with U. S., 70, 248. Agreement and guaranty of, 70, 254. Proj. adopted by board of commissioners (Brig. Gen. J. M. Schofield, J. Barnes, and S. M. Church.) The U. S. to build over main chan. a br. with iron draw, the truss to be of proper width for double track, the wagon way to be planked h. enough to leave lower chord for R. R. track, 69, 194; 70, 248. The Chicago, Rock Island & Pacific R. R. Co. to have right of way over same, provided they pay to the U. S. one-half the cost of constr. and mainten. of the part over the main chan., 70, 248, 253; it being provided that in no case shall the expend. on the part of the U. S. exceed \$1,000,000, 70, 253, 256; proj. approv. by Chief of Ordnance. By order of Sec. of War constr. of br. placed under control of Engineer Dept., 69, 44. Modifications of law or plan necessary, 69, 194. Doubt as to details of plan adopted by board of commissioners, 69, 194; 70, 237, 241. Maj. Warren submitted that board est. for single-track R. R. and narrow wagon road, 69, 194; 70, 237, 241. Ps. designed and built so that either double or single track br. could be put on them, 69, 195; 70, 240. Recom. of Chief of Ordnance practically annulled, 70, 243. Proj. of Maj. Warren, an iron br. for single-track R. R. with wagon way beneath; trusses to be 18' apart, wagon way 18' wide and 12' h., with 2 sidewalks 5' wide and outside of truss, 69, 195; 70, 244, 246, 262. Dimensions of br., 71, 301; 72, 287; 77, 824; 78, 1002. Location of axis of br., 69, 196; of draw, 69, 196, 198; 70, 229. Objections by Lt. Col. Rodman, 69, 196; 70, 229. Specifications for superstr., 72, 286, 293. Draw span, details of, 72, 288, 293. Effect of combined R. R. and highway br.; R. R. above highway most desirable, 70, 261. Test and acceptance of br., 72, 291. Completion and transferment to Ordnance Dept., 73, 53, 415. History of, 70, 237, 241; 73, 416; 78, 992, 1002, 1003.

MISSISSIPPI R., Sabula, Iowa. 81, 268, 2016. LEGISLATION.—Br. au. by act Apr. 1, 1872, 81, 268. PLANS.—Requirements of Congress,

81, 2015. Maj. A. Mackenzie reported that the plans and location of br. as proposed by the R. R. company interfered as little as possible with the requirements of navigation, **81**, 2016, 2018.

MISSISSIPPI R. (upper), below Falls of St. Anthony. (See Navigable waters of the U. S.)—P. 2203 this Index.

MISSISSIPPI R., St. Louis, Mo. (Sp.) **COMMERCE**.—Br. a very serious obstr. to navigation, **74**, 641. Names and dimensions of boats which pass the br., **74**, 648. Height of steamboat chimneys, **74**, 654. Importance of completion of the br., **74**, 671. **ENGINEERS**.—Chief of Engineers. **R.**, **74**, 71, 636. **Approv. R. of BE.**, **74**, 637. **BE.** convened at St. Louis, Mo., Sept. 2, 1873. Considered the br. being constr. a very serious obstr. to navigation, **74**, 641. Modification proposed, **74**, 641. **R.**, **74**, 638. Reconvened at St. Louis, Jan. 14, 1874. **Recom. constr.** of a canal behind the e. p., with a draw; est., \$1,172,436, **74**, 650. **Review of first R. of board** by J. B. Eads, **74**, 665. **Reply of board**, **74**, 653. "The substance of Mr. Eads's reply is that the majority of R. steamboats must be rebuilt to conform to his br.," **74**, 662. **Statements of various persons relating to R. of BE.**, **74**, 664, 670, 671, 673, 674. **Personal statement of Col. J. H. Simpson** in reply to Mr. Eads, **74**, 675. **Of Maj. G. K. Warren**, **74**, 678. **Rs. of board** referred to, **78**, 1077. **Sec. of War approv. R. of board**, **74**, 638. (Col. Simpson and Maj. Warren, Weitzel, Merrill, and Suter.) **LEGISLATION**.—Br. au. by act July 20, 1868, **74**, 637, 643. Various acts relating to the br. referred to, **78**, 1089, 1090, 1091, 1093. **PHYSICAL CHARACTERISTICS**.—Description of the R. and valley at locality of br., **78**, 1024. **H.-w. records**, **74**, 644, 645, 646. **Duration of each stage**, **74**, 648. **PLANS**.—Plan and est. of J. B. Eads, **78**, 1060. **Description of brs.**, **78**, 1025. **Review of Mr. Eads's est.**, **78**, 1028. **R. of Maj. Warren** upon br., **78**, 1024. **Description of proposed modifications of plans**, by **BE.**, **74**, 650. **History of br.**, **78**, 1055. **Designs of brs. proposed** by J. A. Roebling, C. E., **78**, 1078. **Sources of information concerning br.**, **78**, 1078.

MISSISSIPPI R., St. Louis, Mo. **R. of board** of 1886. Board decidedly of opinion that a low br. with a draw should not be au. below the mouth of the Missouri R., **87**, 338, 2638.

MISSISSIPPI R., St. Louis, Mo. (St. Louis Merchants' Br. Co.) **LEGISLATION**.—Company au. to constr. br. by act Feb. 3, 1887. Amended act Sept. 10, 1888. **PLANS**.—**Approv.** Nov. 14, 1888, **89**, 369.

MISSISSIPPI R., St. Louis, Mo. (Sp.) (St. Clair & Carondelet Br. Co.) **COMMERCE**.—Navigation of the Ohio compared with the Mississippi R., **75**, ii, 680. **ENGINEERS**.—Chief of Engineers. **R.**, **75**, 121. **Approv. report** of board, **75**, ii, 677. **BE.** convened at St. Louis, Mo., Aug. 3, 1874. **Recom.**—1. Acceptance of site No. 2, on certain conditions. 2. Prohibition of an arched br. 3. Reduction of chan. openings to 450'. 4. Constr. of a draw, **75**, ii, 681. **Comparison with other brs.**, **75**, ii, 680.

R., **75**, ii, 678. **Approv. by Sec. of War**, **75**, ii, 677. (Col. Simpson and Maj. Merrill and Suter.) **LEGISLATION**.—Br. au. act Mar. 3, 1873, **75**, ii, 678. Various acts relating to the br., referred to, **78**, 1070, 1093. **PLANS**.—Description of plans, **75**, ii, 678.

MISSISSIPPI R., Salisbury Street, St. Louis, Mo. (Sp.) (St. Louis Electric Br. Co.—McKinley Br.) Au. act Feb. 15, 1907. **PLANS**.—**Approv.** July 5, 1907, **08**, 866.

MISSISSIPPI R., St. Louis, Mo. (Sp.) (City br.) Au. act June 25, 1909. **PLANS**.—**Approv.** Dec. 17, 1908. **Modified plans approv.** May 20, 1909, **09**, 913.

MISSISSIPPI R., St. Paul. **COMMERCE**.—Influence of br. upon navigation, **78**, 967. Formerly a toll br., **78**, 967. **PLANS**.—Description of br., **78**, 965. Maj. Warren's **R.** on plan of br., **78**, 965. **SURVEYS**.—Maps. Of locality of br., **78**, 1126 (No. 6). **Diagram of ps.**, **78**, 966.

MISSISSIPPI R., St. Paul, Minn. (S.) (Railway.) **COMMERCE**.—Influence of br. upon navigation, **78**, 965. Br. opened for travel in 1869, **78**, 963. **Damages by collision** with ps., decisions of the U. S. Supreme Court, **78**, 1019. **LEGISLATION**.—Br. au. by act Legislature of Minnesota, Feb. 20, 1855, **78**, 963. **PHYSICAL CHARACTERISTICS**.—Description of R. near location of br., **78**, 963. **PLANS**.—Description of br., **78**, 963. **Proposed location of h. br.**, **78**, 963. Maj. Warren **recom. br. company** be compelled to imp. R. above the br., **78**, 965. **R.**, **78**, 964. **SURVEYS**.—Maps. Of location of br., **78**, 1126 (No. 5).

MISSISSIPPI R., St. Paul, Minn. (Sp.) (City br.) **LEGISLATION**.—City au. to constr. br. by act July 5, 1884; amending act Aug. 29, 1890. **PLANS**.—**Approv.** Dec. 17, 1890, **91**, 430.

MISSISSIPPI R., South St. Paul, Minn. (Sp.) (South St. Paul Belt R. R. Co.) **94**, 425; **95**, 474. **LEGISLATION**.—Company au. to constr. br. by act Apr. 26, 1890; amended by acts Feb. 24, 1891; Feb. 15, 1892; and Feb. 15, 1893, **94**, 425. **PLANS**.—Submitted Dec. 7, 1893; modified Jan. 16, 1894; approv. Feb. 7, 1894, **94**, 425. **Revised plans submitted** Oct. 12, 1894; approv. Nov. 1, 1894, **95**, 474.

MISSISSIPPI R., St. Paul, Minn. (Sp.) (St. Paul Br. & Terminal Ry. Co.) Au. act Dec. 18, 1908. **PLANS**.—**Approv.** Feb. 16, 1909, **09**, 913.

MISSISSIPPI R., St. Paul, Minn. (Sp.) (Chicago Great Western R. R. Co.) Au. Feb. 15, 1911. **PLANS**.—For replacing existing str. approv. May 24, 1911, **11**, 1081. **Modified plans approv.** May 17, 1912, and instrument dated May 24, 1911, canceled, **12**, 1298.

MISSISSIPPI R., Thebes, Ill., and Grays Pt., Mo. (Sp.) (Southern Illinois & Missouri Br. Co.) Au. act Jan. 26, 1901. **PLANS**.—**Approv.** Jan. 16, 1902. **Modified plans for increased length of clear span approv.** Mar. 17, 1902, **02**, 582.

MISSISSIPPI R., Warsaw, Ill. (Sp.) **LEGISLATION**.—Br. au. act May 17, 1872, **78**, 1091, 1092.

MISSISSIPPI R., Winona, Minn. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. by act Sept. 25, 1890. PLANS.—Approv. June 4, 1891, 91, 431.

MISSISSIPPI R., Winona, Minn. (Sp.) (Railway.) COMMERCE.—Influence of br. upon navigation, 78, 972. ENGINEERS.—Chief of Engineers. R., 77, 96. Approv. recom. of board, 77, 817, 818. BE. recom., 1876, straight sheer boom from p. to 150' above the elevator. R., 77, 819, 822. (Cols. Macomb and Simpson, Maj. Warren, Farquhar, and Suter, and Capt. Allen.) LEGISLATION.—Br. au. act by July 25, 1886, 77, 822; 78, 970, 1089. PLANS.—Description of br., 77, 822; 78, 971. Proposed location of h. br., 78, 973. R. of Maj. Warren, 78, 970. SURVEYS.—Maps. Of locality of br., 78, 1126 (Nos. 9 and 10). Diagram of ps., 78, 971.

MISSISSIPPI R., Winona, Minn. (Sp.) (Winona & Northwestern Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 13, 1888. PLANS.—Approv. July 9, 1890. Sept. 7, 1891, br. reported completed. 91, 427.

MISSOURI R. and tributaries. (Dr.) 10, 1019.

MISSOURI R., at American Isld. and the town of Chamberlain, S. Dak. (Sp.) (White River Valley Ry. Co.) Au. act Feb. 9, 1905. PLANS.—Approv. May 10, 1905, 05, 721, 722.

MISSOURI R., Atchison, Kans. (Railway, draw.) PLANS.—Description of br. by Maj. Warren, 78, 1087.

MISSOURI R., Atchison, Kans. (O.) (Atchison & Eastern Br. Co.) PLANS.—Alterations to be completed on or before 1 year from Feb. 24, 1908, for constr. of new draw span, or 4 months from Feb. 24, 1908, for providing chan. through existing draw span, 08, 874.

MISSOURI R., Bellefontaine Bluffs, Mo. (Sp.) (St. Louis, Keokuk & Northwestern R. R. Co.) LEGISLATION.—Au. act Feb. 17, 1888. PLANS.—Plan and location submitted, and approv. by Sec. of War, Dec. 21, 1889, 90, 337.

MISSOURI R., Boonville, Mo. (Sp.) (Boonville & Howard County Br. Co.) LEGISLATION.—Company au. to constr. br. by act May 25, 1896. PLANS.—Approv. Sept. 11, 1896, 97, 529.

MISSOURI R., Boonville, Mo. (Sp.) (Railway, draw.) LEGISLATION.—Br. au. act May 11, 1872. PLANS.—Description of br. by Maj. Warren, 78, 1087.

MISSOURI R., Brownville, Nebr. (Sp.) LEGISLATION.—Br. au. act June 4, 1872, 78, 1092.

MISSOURI R., between Cass County, Nebr., and Mills County, Iowa. (Sp.) (Plattsmouth Pontoon Br. Co.) Au. act June 28, 1902. PLANS.—Approv. Apr. 30, 1903, 03, 644.

MISSOURI R., between Council Bluffs, Iowa, and East Omaha, Nebr. (Sp.) (Omaha Br. & Terminal Ry. Co., formerly the Interstate Br. & Street Ry. Co.) LEGISLATION.—Constr. au. by act Feb. 13, 1891; amending act Jan. 28, 1893, and act May 23, 1902. PLANS.—Orig. plans approv. Mar. 5, 1891; modified plans approv. May 9, 1893, 91, 431; 93, 465. Replacing tem-

porary br. with permanent str. approv. July 10, 1902, 03, 642.

MISSOURI R., Glasgow, Mo. (Sp.) ENGINEERS.—Chief of Engineers. R., 78, 111. Approv. conclusions of board, 78, 897. BE. convened at St. Louis, Mo., Apr. 15, 1878. Board approv. plan and location proposed by R. R. company. R., 78, 897. (Col. Simpson, Maj. Suter, and Capt. Allen.) LEGISLATION.—Br. au. act Mar. 3, 1871, 78, 1091. PLANS.—Dimensions of proposed br., 78, 898. Letter from W. S. Smith to Sec. of War, transmitting plans and drawings, 78, 897.

MISSOURI R., Jefferson City, Mo. (Sp.) (Jefferson City Br. & Transit Co.) LEGISLATION.—Company au. to constr. br. by act May 28, 1894; amending act Jan. 8, 1895. PLANS.—Approv. July 22, 1895; d. of w. to and through draw spans to be maintained at not less than that found in adjacent imp. parts of the R., 95, 476.

MISSOURI R., Jefferson City, Mo. (O.) (Jefferson City Br. & Transit Co.) PLANS.—Alterations to be completed on or before 6 months from Feb. 24, 1908, 08, 874.

MISSOURI R., pt. between Kansas City and 5 m. below, Mo. (Sp.) (Randolph & Kansas City Br. Co.) LEGISLATION.—Company au. to constr. br. by act July 23, 1888. PLANS.—Pontoon draw-span br. approv. July 26, 1889, 89, 372.

MISSOURI R., Kansas City, Mo. (Sp.) 69, 51, 307. COMMERCE.—Complaints against the br. as an obstacle to navigation, 69, 307, 308. LEGISLATION.—Act au., referred to, 69, 306. Act July 25, 1866, partly given, 69, 309; 78, 1089. PHYSICAL CHARACTERISTICS.—Of Missouri R., at Kansas City, 69, 304. PLANS.—Description of proposed br., 69, 304; 78, 1087. Objections to location arising from the difficulty in seeing the br. by descending boats, 69, 306. R. of Capt. Suter 69, 303, 304.

MISSOURI R., Kansas City, Mo. (Sp.) (Kansas City, Parkville & St. Joseph Electric Ry. Co.) Au. acts Feb. 28, 1903, and Mar. 29, 1904. PLANS.—Approv. June 25, 1904, 04, 713.

MISSOURI R., Grand Avenue, Kansas City, Mo. (Sp.) (Kansas City, St. Joseph & Excelsior Springs Ry. Co.) Au. act May 16, 1906. PLANS.—Approv. Feb. 11, 1907, 07, 818.

MISSOURI R., Kansas City, Mo. (Sp.) (Union Depot Br. & Terminal Co.) Au. act Mar. 3, 1887, and Feb. 20, 1907. PLANS.—Approv. Mar. 19, 1908, 08, 867.

MISSOURI R., Kansas City, Mo. (Sp.) (Chicago, Burlington & Quincy R. R. Co.) Au. act July 25, 1866. PLANS.—Reconstr. approv. Oct. 5, 1911, 12, 1296.

MISSOURI R., Leavenworth, Kans. (Railway.) PLANS.—Description of br. by Maj. Warren, 78, 1087.

MISSOURI R., between Leavenworth, Kans., and Platte County, Mo. (Sp.) (Leavenworth & Platte County Br. Co.) ENGINEERS.—

- 89, 372; 91, 428; 92, 405. LEGISLATION.—Company au. to constr. br. by act Feb. 25, 1889, 89, 372; amending act July 25, 1890, 91, 428. PLANS.—For a pontoon br. approv. June 20, 1889, 89, 372. Act of July 25, 1890, 'provided for a pivot drawbr. instead of a pontoon; plans approv. Sept. 25, 1890, 91, 428. Plans approv. to change the location from Cherokee to Choctaw Street, Leavenworth, Apr. 27, 1892, 92, 405.
- MISSOURI R., Lexington, Mo. (Sp.)** LEGISLATION.—Br. au. by acts July 25, 1866, and Mar. 3, 1873, 78, 1093.
- MISSOURI R., Lexington, Mo. (Sp.)** (Lexington Br. & Terminal Co.) LEGISLATION.—Company au. to constr. br. by act July 26, 1894. PLANS.—Approv. July 9, 1895, 95, 475.
- MISSOURI R., Lexington, Mo. (Sp.)** (Lexington & Suburban Ry. Co.) Au. Apr. 28, 1904. PLANS.—Approv. Aug. 18, 1904, 05, 720.
- MISSOURI R., Nebraska City, Nebr. (Sp.)** COMMERCE.—Rafting interests insignificant on the Missouri R., 73, 589. R. R. interests, 73, 591. ENGINEERS.—Chief of Engineers. R., 88, 308. BE. convened at Nebraska City, Jan. 20, 1873; approv. site and plan with slight modifications. R., 73, 588. Concurred in by Chief of Engineers and approv. by Sec. of War, 73, 587. (Col. Simpson and Maj. Weitzel and Suter.) LEGISLATION.—Br. au. by act June 4, 1872, 73, 586; 88, 2464. Various acts relating to the br., 78, 1090, 1094. PLANS.—Submitted to Sec. of War by Nebraska City Br. Co., Dec. 5, 1872. Briefly described by Chief of Engineers, 73, 586. Lt. Col. Suter approv. the location and dimensions of the proposed br., with the exception that the proposed height be increased from 48 to 50' above extreme h. w., 88, 2465.
- MISSOURI R., Nebraska City, Nebr. (Sp.)** (City.) LEGISLATION.—Au. by act July 16, 1888. PLANS.—Plan and location submitted, and approv. by Sec. of War Apr. 3, 1890, 90, 337.
- MISSOURI R., Omaha, Nebr. (Sp.)** (Railway.) LEGISLATION.—Br. au. by act Feb. 24, 1871, under provisions of act July 25, 1866, 78, 1090. PLANS.—Description of br. by Maj. Warren, 78, 1087.
- MISSOURI R., between Omaha and Council Bluffs. (Sp.)** (Omaha & Council Bluffs R. R. & Br. Co., railway and wagon.) 88, 309. LEGISLATION.—Br. au. by act Mar. 3, 1887, 88, 2467. PLANS.—Maj. Raymond R. br. as proposed would not interfere with the existing requirements of navigation, 88, 2469.
- MISSOURI R., Omaha, Nebr. (Sp.)** (Nebraska Central R. R. Co.) LEGISLATION.—Au. by act June 22, 1888. PLANS.—Plan and location submitted, and approv. by Sec. of War Feb. 27, 1890, 90, 337.
- MISSOURI R., Pierre, S. Dak. (Sp.)** (Pierre & Fort Pierre Br. Ry. Co.) Au. act May 17, 1886. PLANS.—Approv. July 14, 1907, 07, 816.
- MISSOURI R., Plattsmouth, Nebr. (S.)** (Chicago, Burlington & Quincy R. R. Co.) PLANS.—Reconstr. approv. Nov. 5, 1901, 02, 586.
- MISSOURI R., near Quindaro, Kans., about 8.6 m. above Hannibal & St. Joseph R. R. br. at Kansas City. (Sp.)** (Kansas City Terminal Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 1, 1889; amending act June 28, 1890. PLANS.—Approv. Dec. 1, 1890, 91, 430.
- MISSOURI R., St. Charles, Mo. (Railway.)** PLANS.—Description of br. by Maj. Warren. Cost of, \$1,797,186.19. 78, 1087.
- MISSOURI R., St. Charles, Mo. (Sp.)** (Occidental Br. & Construction Co.) LEGISLATION.—Constr. au. by act May 23, 1892. PLANS.—Submitted Feb. 21, 1893; modified Apr. 11, 1893; approv. Apr. 29, 1893, 93, 465.
- MISSOURI R., St. Charles, Mo. (Sp.)** (St. Charles & St. Louis County Br. Co.) LEGISLATION.—Counties au. to constr. br. by act June 3, 1896, amending acts May 28, 1898, and Jan. 27, 1900. PLANS.—Approv. June 27, 1900, 00, 698.
- MISSOURI R., St. Joseph, Mo. (Sp.)** (Rail and high way.) LEGISLATION.—Br. au. acts July 20, 1868; July 14, 1870; and Mar. 5, 1872, 78, 1089, 1090, 1091. PLANS.—Description of br. by Maj. Warren, 78, 1087.
- MISSOURI R., most accessible point between Sibley and Kansas City, Mo. (Sp.)** (Kansas City & Atlantic R. R. Co., successors to the Chicago, Kansas City & Texas Ry. Co.) ENGINEERS.—Chief of Engineers. R., 89, 370; 96, 422; 99, 619. LEGISLATION.—Orig. company au. to constr. br. by act Mar. 3, 1887, 89, 370. Owners received au. from same act, as extended by act Mar. 29, 1894, 96, 422. PLANS.—Orig. company's plans approv. Feb. 14, 1889; br. partly constr., 89, 370. Owner's new plans approv. Dec. 17, 1895, 96, 422. Modified plans, for a draw span instead of a lifting span, approv. Apr. 28, 1899, 99, 619.
- MISSOURI R., Sibley, Mo. (Sp.)** (Kansas City, Topeka & Western R. R. Co.) 88, 308, 2435. LEGISLATION.—Br. au. by act July 3, 1884, 88, 2434. PLANS.—In 1887 Lt. Col. Suter R. that the br. would not form any obstr. to navigation, 88, 2436.
- MISSOURI R., at or near Sibley, Mo. (Sp.)** (Atchison, Topeka & Santa Fe Ry. Co.) Au. acts Mar. 23, 1910, and Jan. 22, 1912. PLANS.—Approv. Dec. 19, 1910, 11, 1080. Reconstr. approv. Mar. 8, 1912, 12, 1297.
- MISSOURI R., Sioux City, Iowa. (Sp.)** (Sioux City & Pacific R. R. Co.) LEGISLATION.—Br. au. by act Aug. 15, 1876, 78, 1094. Br. au. by act June 27, 1882, 83, 271. PLANS.—Maj. Suter R. if the br. be located and built as proj. it would form no unnecessary obstr. to navigation, 83, 1603.
- MISSOURI R., Sioux City, Iowa. (Sp.)** (Sioux City Br. Co.) 88, 309. LEGISLATION.—Br. au. by act Aug. 15, 1886, 88, 2477. PLANS.—Dimensions of proposed br., 88, 2476. Lt. Col. Suter R. the proposed span of 400', with a treadway of 50', amply sufficient for the requirements of navigation, 88, 2477.

MISSOURI R., Sioux City, Iowa. (Sp.) (Pacific Short Line Br. Co.) LEGISLATION.—Au. by act Mar. 2, 1889. PLANS.—Plan and location submitted, and approv. by Sec. of War, June 26, 1890, 90, 338.

MISSOURI R., South Omaha, Nebr. (Sp.) (South Omaha R. R. & Br. Co.) Au. act Mar. 26, 1902. PLANS.—Approv. Apr. 8, 1904, 04, 711, 712.

MISSOURI R., between Walworth and Dewey Counties, S. Dak. (Sp.) (Chicago, Milwaukee & St. Paul Ry. Co.) Au. act Apr. 12, 1906. PLANS.—Approv. Aug. 3, 1906, 07, 817.

MISSOURI R., near mouth of Kansas R., between Wyandotte County, Kans., and Clay County, Mo. (Sp.) (Missouri River & Land Imp. & Construction Co.) LEGISLATION.—Company au. to constr. br. by acts Oct. 12, 1888, and Feb. 6, 1890, 91, 432. PLANS.—Submitted Oct. 12, 1889; not conforming to the act Oct. 12, 1888, were not approv. Plans submitted Feb. 7, 1890, and Jan. 24, 1891; R. upon adversely by the Missouri R. Commission; not approv. Amended plans submitted Mar. 2, 1891; approv. June 4, 1891, 91, 432.

MISSOURI R., Yankton, S. Dak. (Sp.) (Yankton Br. Co.) LEGISLATION.—Company au. to constr. br. by act June 22, 1892; amending act May 28, 1894, 94, 425. PLANS.—Approv. Aug. 3, 1894, 94, 425. Subsequently plans for lengthening of 2 n. end main spans approv. Sept. 11, 1896. Plans in lieu of the last approv. Nov. 23, 1896, 97, 529.

MISSOURI R., Yankton, S. Dak. (Sp.) (Yankton, Norfolk & Southern Ry. Co.) Au. act Mar. 9, 1904. PLANS.—Approv. Aug. 23, 1904, 05, 720.

MOBILE B., Cedar Pt. to Dauphin Isld., Ala. (Sp.) (Mobile Ry. & Dock Co.) Au. act Feb. 5, 1906. PLANS.—Approv. Feb. 23, 1907, 07, 818.

MOBILE B. and MISSISSIPPI SOUND, across shoal water between, Cedar Pt. to Dauphin Isld., Ala. (Sp.) (Mobile & Dauphin R. R. & Harbor Co.) LEGISLATION.—Constr. au. by act Sept. 26, 1890; amending act Feb. 28, 1893. PLANS.—Submitted Sept. 10, 1892; approv. Aug. 21, 1893, 93, 465.

MOBILE COUNTY., between Cedar Pt. and Big Dauphin Isld., Ala. (Sp.) (Dauphin Island Ry. & Harbor Co.) Au. act June 25, 1910. PLANS.—Constr. of brs. and trestles approv. Apr. 17, 1911, 11, 1080.

MOBILE R., Ala. (Dr.) 08, 865.

MOCCASIN R. (Contentnia Creek), Hookertown, N. C. (S.) (Green County br.) PLANS.—Br. to replace existing str. approv. June 1, 1908, 08, 872.

MOCCASIN R. (Contentnia Creek), Grifton, N. C. (S.) (Pitt County br.) PLANS.—Approv. Nov. 26, 1907, 08, 871.

MOHAWK R., Schenectady County, N. Y. (S.) (Schenectady Ry. Co.) PLANS.—Approv. July 29, 1903, 04, 713.

MOKELUMNE R., Cal. (S.) (Western Pacific Ry. Co.) PLANS.—Approv. Jan. 13, 1906, 06, 803.

MOKELUMNE R., Benson Ferry, Cal. (S.) (San Joaquin County br.) PLANS.—Approv. June 23, 1909, 09, 918.

MOKELUMNE R., near mouth of Snodgrass Slough, Cal. (S.) (Sacramento and San Joaquin Counties' br.) PLANS.—Approv. Aug. 25, 1902, 03, 646.

MOKELUMNE R., S. Fork, New Hope Landing, Cal. (S.) (San Joaquin County, Cal.) PLANS.—Approv. Mar. 24, 1893. Completion of br. R. on June 30, 1893, 93, 469.

MONONGAHELA R. (See Ohio R., etc.)

MONONGAHELA R., Pa. (Sp.) (Br. of Allegheny and Washington Counties.) Au. act Apr. 3, 1908. PLANS.—Approv. May 21, 1908, and July 5, 1908, 08, 868; 09, 912.

MONONGAHELA, Allegheny, and at the lower end of the Muskingum Rs. (A.) 88, 2566. PLANS.—Tabular statement of all brs., with dimensions thereof, over the navigable portions of the Monongahela and Allegheny Rs., 88, 2566, 2568. Brs. on the Monongahela and Allegheny requiring modification, 88, 2567, 2569.

MONONGAHELA R., between Braddock and Mifflin Townships, Pa. (Sp.) (Braddock & Duquesne Br. Co.) LEGISLATION.—Company au. to constr. br. by act Jan. 26, 1897. PLANS.—Approv. Apr. 10, 1897, 97, 530.

MONONGAHELA R., Bridge Street, Bridgeport, Pa. (O.) (Monongahela Br. Co.—Brownsville br.) PLANS.—Alterations to be completed on or before Aug. 1, 1905, 05, 729.

MONONGAHELA R., Clairton Station, Pa. (Sp.) (St. Clair Terminal R. R. Co.) Au. act Mar. 10, 1902. PLANS.—Approv. Mar. 26, 1902, 02, 582.

MONONGAHELA R., near Denora and Webster, Pa. (Sp.) (Br. of Westmoreland and Washington Counties, Pa.) PLANS.—Constr. au. by act Feb. 21, 1903, as amended by act Jan. 11, 1905. Plans approv. Nov. 2, 1905, 06, 799.

MONONGAHELA R., Elizabeth, Pa. (Sp.) (West Elizabeth Br. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 15, 1893. PLANS.—Submitted June 17, 1892; modified Aug. 25, 1892, and Feb. 28, 1893; approv. Mar. 18, 1893, 93, 464.

MONONGAHELA R., near Fairmont, W. Va. 85, 293, 1923. PLANS.—Referred to Lt. Col. Merrill for ex. and E., 85, 293, 1920. Recom. that site and plans be approv., provided that 1 chan. span be arranged with opening of 220' and a clear height of 41½, 85, 1922. Clear span reduced to 140', 85, 1924; and the recom. mead and approv. by Sec. of War that the br. company be permitted to build at a less height than that above indicated, provided they should subsequently raise the br. if required, 85, 1924.

MONONGAHELA R., Fairmont, Marion County, W. Va. (A.) (Marion County br.) PLANS.—Reconstr. approv. May 26, 1903, 03, 651.

MONONGAHELA R., 1½ m. below Fairmont, W. Va. (O.) (Fairmont, Morgantown & Pittsburgh R. R. Co., and the Baltimore & Ohio R. R.

- Co.) PLANS.—Alterations to be completed on or before Aug. 1, 1905, **05**, 729.
- MONONGAHELA R.**, $1\frac{1}{2}$ m. below Fairmont, W. Va. (A.) (Baltimore & Ohio R. R. Co., and the Fairmont, Morgantown & Pittsburg R. R. Co.) PLANS.—New br. at a different location to replace existing str., approv. Mar. 15, 1905, **05**, 729.
- MONONGAHELA R.**, between Fayette and Green Counties, near Geneva, Pa. (Sp.) (Monongahela R. R. Co.) Au. act May 3, 1911. PLANS.—Approv. May 31 and modified plans approv. Oct. 7, 1911, and former plans canceled, **12**, 1296.
- MONONGAHELA R.**, 1 m. above New Geneva, Pa. (Sp.) (Monongahela R. R. Co.) Au. act Jan. 27, 1910. PLANS.—Approv. May 3, 1911, and modified plans approv. May 31, 1911, **11**, 1081.
- MONONGAHELA R.**, between Homestead and Pittsburgh, Pa. (Sp.) (Braddock & Homestead Br. Co.) LEGISLATION.—Company au. to constr. br. by act June 7, 1894. PLANS.—Submitted July 26, 1894, proved unsatisfactory to navigation interests; modified plans approv. Sept. 20, 1894, **95**, 473.
- MONONGAHELA R.**, at McCanns Ferry, Pa. (Sp.) (Leckrone & Little Whiteley R. R. Co.) Au. act Feb. 16, 1905. PLANS.—Approv. June 12, 1905, **05**, 722. Plans in lieu thereof approv. Jan. 22, 1906, **06**, 799.
- MONONGAHELA R.**, McKeesport, Pa. (Sp.) (Mifflin Br. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 25, 1897. PLANS.—Modified plans approv. Feb. 24, 1898, **98**, 531.
- MONONGAHELA R.**, between Mifflin and Rankin, Pa. (at Carrie Furnaces). (Sp.) (Union R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 2, 1900. PLANS.—Approv. Mar. 10, 1900, **00**, 697.
- MONONGAHELA R.**, Monongahela City, Pa. (Sp.) (Pittsburgh, Monongahela & Wheeling R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 2, 1895. PLANS.—Approv. Sept. 12, 1895, **96**, 422.
- MONONGAHELA R.**, Monongahela, Pa. (O.) (Williamsport Br. Co., and Washington and Allegheny Counties, Pa.) PLANS.—Alterations to be completed on or before 2 years from Oct. 15, 1906, **07**, 828.
- MONONGAHELA R.**, Morgantown, W. Va. (A.) (Monongahela County br.) PLANS.—Reconstr. approv. Dec. 26, 1905, **06**, 808.
- MONONGAHELA R.**, Pleasant Street, Morgantown, W. Va. (A.) (Monongahela County br.) PLANS.—Rebuilding approv. Dec. 26, 1905. Modified plans in lieu thereof approv. July 11, 1907, **08**, 873.
- MONONGAHELA R.**, North Charleroi, Pa. (Sp.) (Charleroi & Monessen Br. Co.) Au. act Mar. 3, 1901. PLANS.—Approv. Dec. 18, 1901, **02**, 582.
- MONONGAHELA R.**, North Charleroi, above Dam No. 4, Pittsburgh H., Pa. (Sp.) (Mercan-
- tile Br. Co.) PLANS.—Constr. approv. Aug. 8, 1904. Plans in lieu thereof approv. Aug. 2, 1905, **06**, 798, 799.
- MONONGAHELA R.**, near Ferry Street, Pittsburgh, Pa. (Sp.) (Pittsburgh & Mansfield R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 2, 1895. PLANS.—Approv. May 20, 1896, **96**, 423. Modified plans involving slight change in line of br., location, and size of ps., approv. July 17, 1901, **02**, 581.
- MONONGAHELA R.**, Pittsburgh, Pa. (Sp.) (Glenwood Highway Br. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 2, 1894. PLANS.—Approv. Nov. 3, 1894; reported completed, **95**, 474.
- MONONGAHELA R.**, S. 10th Street, Pittsburgh, Pa. (S.) (Birmingham & Pittsburgh Br. Co.) PLANS.—Reconstr. of br. submitted July 20, 1894; unsatisfactory to navigation interests; modified plans approv. Oct. 22, 1894, **95**, 477.
- MONONGAHELA R.**, S. 22d Street, Pittsburgh, Pa. (Sp.) (Pittsburgh city br.) LEGISLATION.—City au. to constr. br. by act May 7, 1894. PLANS.—Submitted May 29, 1894; modified Aug. 3, 1894; approv. Aug. 21, 1894, **94**, 426.
- MONONGAHELA R.**, Pittsburgh, Pa. (Sp., etc.) (S. 22d Street Br. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Pennsylvania. PLANS.—Modified plan approv. Dec. 26, 1891, **92**, 403.
- MONONGAHELA R.**, near Pittsburgh, Pa. (Sp.) (The Upper Br. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, sec. 7, and act of Pennsylvania. PLANS.—Modified plans approv. Aug. 21, 1891, **91**, 432.
- MONONGAHELA R.**, near 30th Street, s. side, Pittsburgh, Pa. (S.) (Monongahela Connecting R. R. Co.) PLANS.—An addl. span for a Y to the existing br. approv. Apr. 9, 1898, **98**, 535.
- MONONGAHELA R.**, Pittsburgh, Pa. (S.) (Pennsylvania Co.) PLANS.—Reconstr. of existing br. approv. Aug. 19, 1901, **02**, 584.
- MONONGAHELA R.**, Pittsburgh, Pa. (Sp.) (Monongahela Connecting R. R. Co.) Au. act June 28, 1906. PLANS.—Approv. June 11, 1907, **07**, 819.
- MONONGAHELA R.**, above Dam No. 4, Pittsburgh H., Pa. (Sp.) (Mercantile Br. Co.) Au. act Mar. 14, 1904. PLANS.—Approv. Aug. 8, 1904, **05**, 720.
- MONONGAHELA R.**, S. 10th Street, Pittsburgh, Pa. (S.) (City br.) PLANS.—Reconstr. approv. Aug. 29, 1900, **01**, 662. Repairs to s. p. approv. June 10, 1912, **12**, 1308.
- MONONGAHELA R.**, between Pittsburgh and Homestead, Pa. (Sp.) (Homestead & Pittsburgh Br. Co.) LEGISLATION.—Constr. au. by act Feb. 14, 1893. PLANS.—Modified plans approv. May 24, 1893, **93**, 465.
- MONONGAHELA R.**, Port Perry, Pa. (S.) (Pennsylvania R. R. Co.) PLANS.—Rebuilding approv. June 25, 1902, **02**, 589.

MONONGAHELA R., between Port Perry and Mifflin Townships, Pa. (Sp.) (Union R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Jan. 26, 1897. PLANS.—For br. in lieu of those approv. Oct. 2, 1896, for br. between Mifflin and Wilkins Townships, submitted Jan. 30, 1897; modified Feb. 23, 1897; approv. Mar. 8, 1897, 97, 529.

MONONGAHELA R., Port Vue to Jefferson, Pa. (Sp.) (Glassport Br. Co.) Au. act Feb. 18, 1901. PLANS.—Approv. June 18, 1901, 01, 661.

MONONGAHELA R., Rankin, Pa. (Sp.) (West Braddock Br. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 21, 1894, 96, 424. PLANS.—Approv. July 20, 1896, 96, 424. Specified modified plans submitted Dec. 3, 1896; approv. Dec. 21, 1896, 97, 533.

MONONGAHELA R., Rivesville, W. Va. (Sp.) (Buckhannon & Northern R. R. Co.) Au. act Apr. 5, 1904. PLANS.—Approv. Apr. 14, 1904, 04, 712.

MONONGAHELA R., Rostraver Township, Pa. (Sp.) (Charleroi & Monessen Br. Co.) Au. acts Mar. 3, 1901, and Mar. 14, 1904. PLANS.—Approv. Dec. 18, 1901, 02, 582. Time limit prescribed by the act having expired before constr. was commenced, and the orig. act having been revived and reenacted, the plans were approv. Apr. 12, 1905, 04, 712.

MONTEZUMA SLOUGH, tributary of Suisun B., Cal. (S.) (Oakland, Antioch & Eastern Ry. Co.) PLANS.—Approv. June 17, 1912, 12, 1308.

MONUMENT R., Mass. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. approv. Aug. 5, 1909, and modified plans approv. Nov. 30, 1909, 10, 1023.

MONUMENT and BLACK RS., Bourne, Mass. (S.) (Town br.) PLANS.—Approv. July 3, 1897; 97, 534.

MORMON CHAN., Stockton, Cal. (S.) (San Francisco & San Joaquin Valley R. R. Co.) PLANS.—Approv. Sept. 10, 1895, 96, 424.

MORMON CHAN., Otter Street, Stockton, Cal. (S.) (City br.) PLANS.—Approv. Sept. 17, 1894. Plans changing the location approv. Jan. 7, 1895. Br. completed. 95, 476.

MORMON CHAN., Stockton, Cal. (S.) (Southern Pacific Co.) PLANS.—Approv. Feb. 3, 1903, 03, 648.

MORRIS and CUMMINGS CHAN., near Steadman Isld., Tex. (Sp.) (Aransas Harbor Terminal Ry.) Au. act Jan. 22, 1912. PLANS.—Approv. Feb. 9, 1912, 12, 1297.

MORRISON CHAN., between Benton H. and St. Joseph, Mich. (S.) (Michigan Central R. R. Co.) PLANS.—Rebuilding approv. Apr. 20, 1906, 06, 806.

MORRISON CHAN., at St. Joseph, Mich. (Sp.) (City br.) Act Mar. 23, 1910. PLANS.—Temporary br. approv. Feb. 28, 1910. Modified plans of temporary br. approv. Mar. 24, 1910. Plans of permanent br. approv. Apr. 20, 1910. 10, 1021, 1022.

MORSE and SPRAGUE RS., Phippsburg, Me. (S.) (Town brs.) PLANS.—Approv. Jan. 18, 1899, 99, 621.

MOUNT DESERT NARROWS, between Trenton and Eden, Me. (S.) (Mount Desert Transit Co.) PLANS.—Approv. Jan. 25, 1909, 09, 917.

MOUNT PLEASANT and SULLIVANS ISLD., cove between, S. C. (S.) (Charleston Sea Shore R. R. Co.) PLANS.—Approv. June 7, 1898, 98, 536.

MUD R., at or near Rochester, Ky. (S.) (Butter & Muhlenburg Counties' br.) PLANS.—Approv. Oct. 2, 1897, 98, 533.

MURDERERS (Moodna) CREEK, near mouth, Cornwall, Orange County, N. Y. (O.) (R. R. br.) LEGISLATION.—As the R. R. company failed to comply with requirements of notice, the Atty. Gen. of U. S. was requested, July 23, 1889, to take action as prescribed by law. PLANS.—Alterations required by July 1, 1889; no action taken, 89, 377.

MURDERERS CREEK, N. Y. (O.) LEGISLATION.—Notice served as to alterations required, 90, 342.

MUSKEGON LAKE, Mich. (S.) (North Muskegon br.) PLANS.—Submitted Feb. 15, 1892; approv. Mar. 1, 1893, 93, 468.

MUSKEGON R., Muskegon, Mich. (S.) (City br.) PLANS.—Submitted Feb. 19, 1892; approv. Mar. 11, 1893, 93, 468.

MUSKEGON R., Muskegon County, Mich. (S.) (Muskegon County br.) PLANS.—Approv. Sept. 18, 1908, 09, 915.

MUSKINGUM R. (See Monongahela R.; Ohio R., etc.)

MUSKINGUM R., Ohio. (O.) LEGISLATION.—Notice served as to alterations required, 90, 341.

MUSKINGUM R., between Beverly and Waterford, Ohio. (O.) (County br.) PLANS.—Alterations required by Sept. 30, 1889, 89, 876.

MUSKINGUM R., below Dresden, Ohio. (O.) (Cincinnati & Muskingum Valley R. R. Co.) PLANS.—Alterations to be completed on or before 14 months from June 27, 1908, 08, 874.

MUSKINGUM R., Gaysport, Ohio. (O.) (Muskingum County br.) PLANS.—Alterations to be completed on or before Jan. 1, 1905, 04, 720.

MUSKINGUM R., Marietta, Ohio. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. under act Apr. 2, 1888. PLANS.—Public hearing held; plans approv. Aug. 11, 1899, 99, 620.

MUSKINGUM R., Marietta, Ohio. (A.) (Baltimore & Ohio Southwestern R. R. Co.) PLANS.—Proceedings instituted against the company, under act Aug. 11, 1888 (amending act Sept. 19, 1890), requiring a suitable drawspan opening. Company failed to alter br.; alteration required to be completed by Oct. 31, 1891; time extended to July 1, 1892; order revoked Feb. 6, 1893. Act Aug. 17, 1894, required changes, to be paid by the U. S. In accordance

- therewith Col. Stickney submitted plans for pivot p.; approv. June 4, 1895; superstr. of the draw to be completed by the railway company. **95**, 481. (See Muskingum R., Ice H. at mouth of, **96**, 277.)
- MUSKINGUM R.**, between Marietta and Harmar, Ohio. (O.) (Baltimore & Ohio Southwestern R. R. Co.) PLANS.—Specified alterations required on or before Oct. 31, 1891; time extended to Jan. 1, 1892, **91**, 434.
- MUSKINGUM R.**, Muskingum, Mich. (S.) (City br.) PLANS.—Submitted Feb. 19, 1892; approv. Mar. 11, 1893, **93**, 468.
- MUSKINGUM R.**, McConnellsville to Malta, Ohio.) (S.) (Morgan County br.) PLANS.—Reconstr. approv. May 29, 1901, **01**, 666.
- MUSKINGUM R.**, over Lowell Canal, Ohio. (O.) (County br.) PLANS.—Alterations required by Nov. 1, 1899, **89**, 377.
- MUSKINGUM R. CANAL**, Lowell Ohio. (Sp.) (Washington County br.) Au. act Apr. 2, 1888. PLANS.—Approv. May 28, 1901, **01**, 660.
- MUSKINGUM R.**, Stockport, Ohio. (Sp.) (Morgan County br.) LEGISLATION.—County au. to constr. br. by act Apr. 2, 1888. PLANS.—Approv. Aug. 14, 1888. On June 3, 1899, it was discovered that the pivot p. of the draw span had been located 10' w. of position in the approv. drawings; the adopted location approv. June 15, 1899, **89**, 372.
- MUSKINGUM R.**, Taylorsville, Ohio. (A.) (Muskingum County br.) PLANS.—In Jan., 1890, br. a probable obstr. upon completion of Lock No. 9, at Taylorsville; under act Aug. 11, 1890, notices were served for a suitable draw span to be completed by Sept. 30, 1891. Legal proceedings were instituted against the commissioners, which resulted in a verdict for defendant. **91**, 434; **92**, 2004, 2006. Act Aug. 17, 1894; required changes to be made to conform to the accommodation of C. and imp. of the R., using public funds; superstr. of the draw to be built by the county commissioners. **95**, 482. Lt. Col. Stickney submitted plans for pivot p. and guide cribs; approv. June 12, 1895, **95**, 482. (See Muskingum R., lock at Taylorsville, Ohio, **96**, 277.)
- MUSKINGUM R.**, Zanesville, Ohio. (Sp.) (County.) LEGISLATION.—Au. by act Apr. 2, 1888. PLANS.—Plans and location submitted, and approv. by Sec. of War, Aug. 5, 1889, **90**, 336.
- MUSKINGUM R.**, canal at foot of Main Street, Zanesville, Ohio. (O.) (Muskingum County br.) PLANS.—Specified alterations required on or before Dec. 1, 1891; time extended to Dec. 1, 1892, to be then further extended or abandoned if U. S. work of constr. l. and d. No. 11 be not commenced, **91**, 434.
- MUSKINGUM R.**, over canal at Zanesville, Ohio. (Muskingum County br.) PLANS.—Alterations required by Nov. 1, 1889, **89**, 377.
- MUSKINGUM R.**, 5th Street, Zanesville, Ohio. (O. and Sp.) (Muskingum County br.) PLANS.—Alterations required by Nov. 1, 1889, **89**, 377. Reconstr. approv. Sept. 23, 1910, **11**, 1079, 1080.
- MUSKINGUM R.** (Y br.), Zanesville, Ohio. (Sp.) (Muskingum County br.) Au. act Apr. 2, 1888. PLANS.—Approv. Aug. 18, 1900, **01**, 659.
- MUSKINGUM R.**, 5th Street, Zanesville, Ohio. (Sp.) (Muskingum County br.) Au. Apr. 2, 1888. PLANS.—Reconstr. approv. Sept. 23, 1910, **11**, 1079, 1080.
- MUSKINGUM R.** (lateral canal along), Zanesville, Ohio. (S.) (Muskingum County br.) PLANS.—Approv. June 18, 1901, **01**, 667.
- MUSKINGUM R. CANAL**, Zanesville, Ohio. (Sp.) (Baltimore & Ohio R. R. Co.) Au. act Apr. 2, 1888. PLANS.—Reconstr. plans approv. Apr. 8, 1911, **11**, 1080.
- MYAKKA R.**, Fla. (S.) (Alafia, Manatee & Gulf Coast Ry. Co.) PLANS.—Approv. June 9, 1906, **06**, 807.
- MYSTIC R.**, Boston, Mass. (Dr.) **06**, 797.
- MYSTIC R.** (Malden br.), Boston, Mass. (S.) (City br.) PLANS.—Reconstr. plans approv. Aug. 12, 1899, **99**, 623. Plans for temporary br., during constr. of permanent br., approv. Nov. 4, 1899; alternate plans submitted Jan. 13, 1900; approv. Jan. 30, 1900, **00**, 700.
- MYSTIC R.**, between Boston and Chelsea (Chelsea Br.), Mass. (S.) (Boston city br.) PLANS.—For reconstr. of draw span approv. May 4, 1895, **95**, 478. Reconstr. plans for the draw, and plans for a temporary br. for use during reconstr. of permanent br., approv. Sept. 7, 1899. Plans for n. extension of draw p. approv. June 29, 1900, **00**, 698. Temporary br. during reconstr. of existing br. approv. Sept. 3, 1910, **11**, 1083.
- MYSTIC R.**, Boston, Mass. (S.) (Lynn & Boston R. R. Co., temporary br.) PLANS.—Temporary br. approv. May 21, 1895, **95**, 478. Approv. Apr. 13, 1893, **93**, 469.
- MYSTIC R.**, Conn. (Dr.) **08**, 865.
- MYSTIC R.**, Mass. (Dr.) **02**, 581; **03**, 642.
- MYSTIC R.**, Boston H., Mass. (O.) (Br. of the cities of Boston and Chelsea.) PLANS.—Alterations to be completed on or before June 30, 1911, **10**, 1032. Plans for temporary br. approv. Sept. 3, 1910, and time of completion of alterations extended to Dec. 31, 1911, **11**, 1090, 1091.
- MYSTIC R.** (main or n. chan.), Boston, Mass. (S.) (City br.) PLANS.—Reconstr. of existing br. approv. Dec. 5, 1911, in lieu of alterations required by War Dept., June 3, 1910, and instrument of approv. for temporary br., dated Sept. 3, 1910, revoked. **12**, 1303.
- MYSTIC R.**, Medford, Mass. (S.) (State br.) PLANS.—Approv. June 22, 1906, **06**, 808.
- MYSTIC R.**, between Somerville and Medford, Mass. (S.) (State br.) PLANS.—Approv. May 29, 1902, **02**, 589.
- MYSTIC R.**, Stonington, Conn. (S.) (Br. of Groton and Stonington Townships.) PLANS.—Rebuilding existing br. and constr. of temporary br. approv. Feb. 5, 1904, **04**, 716.

N.

NANSEMOND R., Va. (See Elizabeth R.)

NANTICOKE R., W. Fork, Federalsburg, Md. (S.) (Philadelphia, Baltimore & Washington R. R. Co.) PLANS.—Reconstr. approv. Feb. 23, 1906, 06, 804.

NANTICOKE R., Sharpstown, Md. (S.) (State br.) PLANS.—Approv. May 11, 1911, 11, 1089.

NAPA R., Napa, Cal. (Sp., etc.) (City br.) LEGISLATION.—City au. to constr. br. under act July 13, 1892, sec. 3, and act of California. PLANS.—New br. approv. Sept. 6, 1892, 92, 410.

NAPA R., Napa Junction, Cal. (S.) (Southern Pacific R. R. Co.) PLANS.—Reconstr. approv. Dec. 3, 1901, 02, 586.

NAPA R., near Napa Junction, Cal. (O.) (Southern Pacific Co.) PLANS.—Alterations to be made and completed within 60 days from Oct. 23, 1911, 12, 1309.

NARRAGANSETT B. (See Bullocks Cove.)

NASEL R., Wash. (S.) (Pacific County br.) PLANS.—Approv. Aug. 16, 1907, 08, 869.

NARRAGUAGUS R., Milbridge, Me. (Sp., etc.) (Town br.) LEGISLATION.—Town au. to alter br. under act Sept. 19, 1890. PLANS.—Alteration plans for the "Great Bridge" approv. July 7, 1892, 92, 407.

NARROW B., from Mucachogue, Great South Beach, to Smiths Pt., N. Y. (S.) (Tangier's Manors' Corp.) PLANS.—Approv. Nov. 10, 1910, 11, 1084.

NASSAU R., Fla., on the Duval and Fernandina Road, Fla. (S.) (Br. of Nassau and Duval Counties.) PLANS.—Approv. Aug. 17, 1911, 12, 1300.

NAVIGABLE WATERS OF THE UNITED STATES, BRIDGING. (See also Topical Index.) COMMERCE.—List of brs., and of brs. au. over the Mississippi R., 73, 575. List of apps. for Rs. and Hs. in Mississippi Valley, and for all Rs. and Hs., 73, 576. All brs. are obstrs., 74, 585. Right of way belongs to navigation, and draws should stand open when not in use, 74, 586. Agriculture the only industry not protected by the U. S., but rather injured by the overproduction stimulated by the homestead land policy; the only help is cheap transportation, 74, 608. General requirements of western R. navigation, 78, 926. Statement of losses by collision with the ps. of brs. on the Ohio R., 71, 429. Signals at draws, plan for, 73, 583; 78, 723; objections to, 73, 585. Power of Congress to protect, 82, 1980. List of brs. on Upper Mississippi which impede C., 82, 1981. Importance of coal interests on the Ohio R. and the requirements of its C., 82, 2005. Obstr. to

navigation on Chippewa R., Wis., from existing brs., 82, 1811. Dimensions of coal and grain tows on the Mississippi R., 88, 2380, 2381. Testimony before the board in regard to dimensions of tows and desirable dimensions of chan. spans, 88, 2397, 2398, 2400, 2404, 2406, 2408, 2409, 2410. ENGINEERS.—Chief of Engineers Rs., 88, 307, 2371; 00, 40. BE. R. of 1888, relative to constr. of certain brs. across the Missouri, Mississippi, and Illinois Rs. Rs., 88, 2374 (Lt. Col. Suter, and Maj. Mackenzie, Miller, and Handbury); 88, 2383 (Lt. Col. Suter and Maj. Miller). Constituted by S. O. No. 7, Feb. 3, 1900, to consider and R. upon the House bill 1065, 56th Cong., 1st sess., "to authorize the constr. of brs. across the Ohio, Monongahela, Mississippi, Great Kanawha, Tennessee, Cumberland, and Illinois Rs., and prescribe the dimensions of the same." R., 00, 5103. (Lt. Col. M. B. Adams, Maj. C. F. Powell, J. H. Willard, W. H. Bixby, and D. C. Kingman; and Capt. H. F. Hodges and E. Burr.) GENERAL CONSIDERATIONS.—Object, to secure interests of navigation, 73, 559. Number of brs. can not be limited, nor their details controlled, except as regards needs of navigation, 73, 559. Drawbrs. v. h. brs. discussed by Maj. Warren, 73, 560. General subjects of concession to R. Rs. discussed by BE., 73, 574. Bad results to navigation from legislation, such as that au. br. at Kansas City, discussed by Capt. Suter, 69, 306. Discussion of the greatest length of span practicable, by Maj. Warren, 78, 1063, 1065. Names and dimensions of the largest boats on the Mississippi R., 78, 929. Discussion on headway required under brs. on the Mississippi R., 78, 934. Grades and curvatures upon brs. and approaches, 79, 149, 1461. Maj. Warren's R. on br. the Mississippi R., 78, 900-1125. List of brs. au. on the Missouri R. but not built, 78, 1088. List of brs. on the Ohio, 78, 1086. List of brs. on the Mississippi R. from St. Paul, Minn., to St. Louis, Mo., 78, 1028. Of navigation through brs. over Upper Mississippi R., 82, 1979. Power of Congress to protect navigation, 82, 1980. Necessity for changes in laws relating to brs. across the Ohio R., 82, 1813, 2002. General considerations at special localities, 80, 199, 1849; 81, 267, 2009; 82, 262, 1989; 83, 271, 1591; 84, 269, 1769; 85, 292, 1917; 86, 369, 2111; 87, 337, 2613. LEGISLATION (see BE.).—By Wisconsin and Minnesota au. brs. over navigable part of Wisconsin, Mississippi, and Minnesota Rs., 73, 558. No au. from Congress for 3 brs. over the Mississippi at Hastings and St. Paul, 73, 568. Au. of Congress required before War Dept. can au. or forbid the constr. of a br., 76, ii, 298. Passage for highways to be a part of all brs. built after act

- June 4, 1872, **73**, 565, 569; not so considered by Atty. Gen., **73**, 570. Abstracts of debates in Congress attending the legalization of brs. across the Mississippi R., **78**, 1041. Decisions of U. S. Supreme Court relating to damages, **78**, 1079. Riprap considered as an obstr. to navigation on the Ohio, H. Doc. 41, 43d Cong., 2d sess. Amendment of existing laws proposed by BE. for constr. of brs. over the Ohio, **71**, 454, 455. Act of Congress, July 11, 1870, constituting BE. for ex. of brs. on the Ohio, **71**, 426. Abstract of laws for br. the Ohio, Mississippi, and Missouri Rs., **78**, 1088. Acts of Congress: Act July 25, 1866, partially described, **69**, 309; described, **73**, 555; compared in full with act Apr. 1, 1872, **73**, 561. Act Feb. 21, 1868, described, **73**, 555. Act Apr. 1, 1872, described, **73**, 555; compared in full with act July 25, 1866, **73**, 561. Act June 4, 1872, **73**, 563. Necessity of legislation relating to brs. over the Upper Mississippi R., **82**, 1979. Consideration of a proposed act to prescribe the dimensions of brs. across the Ohio R., **82**, 2001. Defects in present laws relating to brs. across the Ohio R., **82**, 2008. Amendatory act proposed for Ohio R., **82**, 2010. Necessity for general law applying to brs. over navigable waters, **82**, 1813. Bill au. the constr. of brs. across the Missouri, Mississippi, and Illinois Rs., and prescribing the character, location, and dimensions of the same, **88**, 2384. Draft of the bill au. constr. of brs. across the above-named Rs., **00**, 5117. PLANS.—Dimensions of spans and draw openings, as fixed by the board of 1888, for brs. over the Mississippi, Missouri, and Illinois Rs., **88**, 2372-2373. PROJECTS.—Decisions of BE., 1900, **00**, 5104. SURVEYS.—Maps. Made by Maj. Warren of surveys for brs. over the Mississippi R., **72**, 817; **78**, 1126.
- NEABSCO CREEK**, Va. (Dr.) **07**, 815.
- NEABSCO, POWELLS, QUANTICO, and AQUA CREEKS**, Va. (S.) (Washington Southern Ry. Co.) PLANS.—Rebuilding approv. Dec. 24, 1903, **04**, 716.
- NECHES R.**, Beaumont, Tex. (S.) (Texarkana & Fort Smith Ry. Co.) PLANS.—Approv. Sept. 12, 1896, **97**, 531.
- NEHALEM R.**, S. Fork, Oreg. (S.) (Tillamook County br.) PLANS.—Approv. Aug. 10, 1909, **10**, 1024.
- NEMADJI R.**, Superior, Wis. (S.) (Northern Pacific Ry. Co.) PLANS.—Rebuilding approv. July 16, 1903, **04**, 713.
- NEPONSET R.**, Boston and Quincy, Mass. (A.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. approv. July 24, 1905, **06**, 808.
- NEPONSET R.**, between Boston and Milton, Mass. (S.) (City br.) PLANS.—Rebuilding approv. Oct. 5, 1909, **10**, 1024.
- NEPONSET R.**, Quincy and Neponset, Boston, Mass. (O.) (New York, New Haven & Hartford R. R. Co., lessee of Old Colony R. R. Co.) PLANS.—Alterations to be completed on or before Dec. 31, 1904, **05**, 729.
- NEPONSET R.**, between Boston and Quincy, at Neponset Avenue and Hancock Street, Boston, Mass. (City br.) PLANS.—Rebuilding tender ps. approv. June 2, 1911, **11**, 1089.
- NESHAMINY CREEK**, near Croydon, Pa. (S.) (Philadelphia, Bristol & Trenton Street Ry. Co.) PLANS.—Approv. Oct. 17, 1902, **03**, 646.
- NEUSE R.**, N. C. (S.) (Wilmington & Weldon R. R. Co.) PLANS.—Approv. Dec. 17, 1894, **95**, 477.
- NEUSE R.**, near Canadys Landing, N. C. (S.) (Lenoir County br.) PLANS.—Approv. June 22, 1904, **04**, 719.
- NEUSE R.**, Goldsboro, N. C. (Wilmington & Weldon R. R. Co.) PLANS.—Capt. Bixby recom. br. be permitted to remain in its condition, provided the owners should clear away the obstr. portion of the old p. beneath, **88**, 2545.
- NEUSE R.**, Kinston, N. C. (Atlantic & North Carolina R. R. Co.) Capt. Bixby R. br. no obstr. to navigation, **88**, 2545. PLANS.—Approv. Dec. 23, 1905, **06**, 803.
- NEUSE R.**, near Kinston, N. C., and **NEWPORT R.**, near Newport, N. C. (S.) (Howland Imp. Co.) PLANS.—Reconstr. approv. Jan. 23, 1905, **05**, 725.
- NEUSE R.**, at or near Maple Cypress, N. C. (S.) (Craven County br.) PLANS.—Approv. Oct. 2, 1906, **07**, 822.
- NEUSE R.**, Newbern, N. C. (S.) (Craven County br.) PLANS.—Modified plans approv. Mar. 22, 1898, **98**, 535.
- NEUSE R.**, Newbern, N. C. (S.) (Pamlico, Oriental & Western R. R. Co.) PLANS.—Approv. July 29, 1903, **04**, 713.
- NEWARK B.**, between Elizabethport and Bayonne, N. J. (S.) (Central R. R. Co. of New Jersey.) PLANS.—Reconstr. approv. June 12, 1902, **02**, 589.
- NEWARK B.**, N. J., and tributaries. (Dr.) **02**, 581; **07**, 815; **10**, 1019.
- NEWARK SLOUGH**, near Potrero Pt., San Francisco B., Cal. (S.) (Southern Pacific Co.) PLANS.—Approv. Sept. 6, 1906, **07**, 821, 822.
- NEW HAVEN**, Conn. (See Coscob, etc.)
- NEW HAVEN H.**, Conn. (Dr.) **02**, 581.
- NEW MEADOWS R.**, between Brunswick and West Bath, Me. (S.) (Lewiston, Brunswick & Bath Street Ry. br.) PLANS.—Approv. May 23, 1898, **98**, 535.
- NEW MEADOWS R.**, Bath, Me. (O. and A.) (City br.—Bull Rock Br.) PLANS.—Specified alterations to be completed on or before 30 days from date of service of notice, May 31, 1901, **01**, 669.
- NEW MILL CREEK**, Norfolk County, Va. (S.) (Elizabeth River R. R. Co.) PLANS.—Approv. July 20, 1906, **07**, 820.
- NEWPORT B.** (inner chan.), Orange County, Cal. (S.) (W. S. Collins.) PLANS.—Approv. June 12, 1911, **11**, 1090.

NEWPORT R., N. C. (Dr.) **08**, 865.

NEWPORT H., tidewaters between Sheeps Pt. and Gull Rocks, R. I. (S.) (Robert N. Carson.) **PLANS.**—**Approv.** June 7, 1904, **04**, 719.

NEWPORT R., Morehead City to Beaufort, N. C. (S.) (Atlantic & North Carolina Co.) **PLANS.**—**Approv.** Aug. 22, 1905, **06**, 801.

NEW R., near Fort Lauderdale, Fla. (S.) (Florida East Coast Ry. Co.) **PLANS.**—**Reconstr.** **approv.** Feb. 8, 1909. Modified plans **approv.** Mar. 19, 1909, **09**, 917.

NEWTON CREEK, Greenpoint Avenue, New York, N. Y. (S.) (City br.) **PLANS.**—**Reconstr.** plans **approv.** June 17, 1898, **98**, 536.

NEWTON CREEK, between Long Island City and Brooklyn, N. Y. (A.) (Brs. of Kings and Queens Counties.) **PLANS.**—**Proceedings** instituted against the br. at Manhattan Avenue (Vernon Avenue); alteration plans, together with plans for a temporary br., **approv.** May 7, 1895, **95**, 481. Revised plans **approv.** Nov. 21, 1896, **97**, 535. Alteration plans **approv.** June 3, 1898, **98**, 537.

NEWTON CREEK, Meeker Avenue, Brooklyn, N. Y. (O.) (Kings and Queens Counties br.) **PLANS.**—**Specified** alterations to drawbr. required on or before Oct. 1, 1892, **92**, 411.

NEWTON CREEK, between Vernon and Manhattan Avenues, New York, N. Y. (O.) (City br.) **PLANS.**—**Specified** alterations to be completed June 30, 1899, **98**, 538.

NEWTOWN CREEK, N. Y. (Dr.) **02**, 581; **04**, 710.

NEWTOWN CREEK, Vernon Avenue to Manhattan Avenue, New York City. (S.) (City br.) **PLANS.**—**Constr.** of temporary br., pending completion of permanent str., **approv.** June 15, 1901, **01**, 667.

NEZPIQUE BAYOU, near Jennings, Acadia, and Calcasieu Parishes, La. (S.) (Parish br.) **PLANS.**—**Reconstr.** **approv.** Jan. 13, 1906, **06**, 803.

NIAGARA R. (See Black Rock H.)

NIAGARA R., Buffalo, N. Y. (S. and Sp.) (Grand Trunk Ry. Co., international br.) **ENGINEERS.**—Chief of Engineers. **R.**, **70**, 218; **71**, 49; **99**, 619. **BE.** convened at Buffalo, Oct. 3, 1870, submitted preliminary **R.**, and adjourned awaiting information from br. company and New York canal officers, **71**, 219. Reconvened at Washington, Jan. 28, 1871. **R.**, **approv.** location and plan, with certain modifications. **R.**, **71**, 219. **Approv.** by Sec. of War, **71**, 218. (Majs. Warren, Merrill, and Harwood.) **LEGISLATION.**—Company au. to constr. br. by acts June 30, 1870, and June 23, 1874, **71**, 49, 219; **99**, 619. Legislation suggested by **BE.**, **71**, 221. **PLANS.**—Described, **71**, 219. **Reconstr.** plans of the superstr. **approv.** Mar. 29, 1899, **99**, 619.

NIAGARA R., Grand Isld., near Buffalo, N. Y. (Sp.) (Niagara River Br. Co.) **LEGISLA-**

TION.—Company au. to constr. br. by act June 29, 1898. **PLANS.**—**Approv.** June 2, 1899, **99**, 619.

NIAGARA R., Lewiston, N. Y. (Sp.) (Lewiston Connecting Br. Co.) **LEGISLATION.**—Company au. to constr. br. by act May 22, 1896. **PLANS.**—**Approv.** Aug. 11, 1898, **98**, 532.

NIANTIC R., East Lyme, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) **PLANS.**—**Approv.** Oct. 30, 1906, **07**, 823.

NIORARA R., between the Santee and Ponca Reservations, Nebr. **APPROPRIATIONS.**—1908, \$12,000, **08**, 2517. **ENGINEERS.**—Chief of Engineers. **08**, 904; **09**, 948; **10**, 1060. In charge: Majs. E. H. Schulz, **09**, 2517; **10**, 2743. **OPERATIONS.**—1908-09. Work commenced Jan. 11, 1909, and finished and accepted Apr. 28, 1909, **09**, 949, 2517. 1909-10. Incidental expenses connected with minor work, **10**, 2743. **PROJECTS.**—Act Apr. 30, 1908, app. \$12,000 for repairing br. over Niobrara R., between Santee and Ponca Reservations, Nebr., **08**, 904.

NISQUALLY R., Wash. (S.) (Br. of Pierce and Thurston Counties.) **PLANS.**—**Approv.** June 15, 1910, **10**, 1030.

NISQUALLY R., Pierce County (sec. 8, T. 18 N., R. 1 E., Willamette meridian), Wash. (S.) **PLANS.**—**Approv.** Oct. 27, 1910, **11**, 1084.

NOOKSAK R., Ferndale, Wash. (Sp., etc.) (Whatcom County br.) **LEGISLATION.**—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington, **92**, 408. **PLANS.**—**Approv.** Aug. 4, 1892, **92**, 408; modified plans **approv.** Feb. 25, 1893, **93**, 468.

NOOKSAK R., Lyden (Lynden), Wash. (Sp., etc.) (Whatcom County br.) **LEGISLATION.**—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington. **PLANS.**—**Approv.** Aug. 4, 1892, **92**, 408. Rebuilding **approv.** Apr. 4, 1906, **06**, 805.

NOOKSAK R. (Larrabee Slough), Marietta, Wash. (S.) (Whatcom County br.) **PLANS.**—**Reconstr.** **approv.** Mar. 11, 1909, **09**, 917.

NOOKSAK R., Orvis Ferry, Wash. (S.) (Whatcom County br.) **PLANS.**—**Approv.** Feb. 17, 1898, **98**, 534.

NOOKSAK R., Whatcom County, Wash. (S.) (Whatcom County br.) **PLANS.**—**Approv.** Sept. 6, 1904, **05**, 724.

NORTH EAST CREEK (Back R.), Md. (S.) (Chesaco Br. Co.) **PLANS.**—**Approv.** Feb. 23, 1911, **11**, 1087.

NORTHEAST R., Castle Hayne, N. C. (O.) (Atlantic Coast Line R. R. Co.) **PLANS.**—Notice dated Feb. 18, 1911, was addressed to the president of the company, **11**, 1091.

NORTHEAST R., near Castle Hayne, N. C. (S.) (Br. of New Hanover and Pender Counties, N. C.) **PLANS.**—**Approv.** May 17, 1912, **12**, 1307.

NORTHEAST (Cape Fear) **R.**, at Hilton (Wilmington), N. C. (O.) (Wilmington Ry. Br.

- Co.) PLANS.—Alterations to be completed within 6 months from Sept. 9, 1910, **11**, 1091.
- NORTH MENOMINEE CANAL**, 16th Street, Milwaukee, Wis. (S.) (City br.) PLANS.—Approv. July 29, 1893, **93**, 470.
- NORTH POINT CREEK and JONES** (or Welshmans) **CREEK**, Baltimore County, Md. (S.) (Baltimore, Sparrows Point & Chesapeake Ry. Co.) PLANS.—For these brs. approv. Dec. 20, 1904. Plans in lieu thereof approv. Sept. 27, 1905, **06**, 802.
- NORTH POINT THOROFARE**, N. J. (S.) (Long Beach Turnpike Co.) PLANS.—Approv. Mar. 14, 1912, **12**, 1306.
- NORTH R.**, Carteret County, N. C. (S.) (Carteret County br.) PLANS.—Approv. Apr. 21, 1909, **09**, 917.
- NORTONS CREEK**, Hempstead, Queens County, N. Y. (S.) (Hempstead City br.) PLANS.—Approv. Feb. 6, 1894. **R.** completed, **94**, 427.
- NORWALK R.** (or R.), South Norwalk, Conn. (S.) (New York New Haven & Hartford R. R. Co.) PLANS.—Approv. Apr. 4, 1895, **95**, 478.
- NORWALK R.**, Conn. (Dr.) **02**, 581.
- NORWALK R.**, Washington Street, Norwalk, Conn. (S.) (Town br.) PLANS.—Approv. Mar. 1, 1912, **12**, 1305.
- NOTTOWAY R.**, Monroe, Va. (S.) (Southampton County br.) PLANS.—Rebuilding approv. Aug. 22, 1905, **06**, 801.
- NOVATO CREEK**, Marin County, Cal. (S.) (Bay Counties Ry. Co.) PLANS.—Approv. July 16, 1906, **07**, 820.
- NOXUBEE R.**, Ala. (Sp.) (Alabama, Tennessee & Northern R. R. Co.) Au. act Aug. 5, 1909. PLANS.—Approv. Aug. 11, 1909, **10**, 1020.
- NUECES R.**, Tex. (S.) (Brownsville & Mexico Ry. Co.) PLANS.—Approv. Feb. 27, 1904, **05**, 726.

O.

OAK CREEK, Md. (Dr.) 02, 581.

OAKLAND H., Alice and Harrison Streets, Alameda, Cal. (O. and A.) (Southern Pacific Co. and Central Pacific R. R. Co.) PLANS.—Alteration: A draw in br. at Alice Street of not less than 150' clear opening, to be operated by other than hand power and to be completed within 15 months from May 28, 1896, **96, 428.** In lieu of above orders, plans for a new br. at Harrison Street, to replace str. at Alice Street, approv. Apr. 30, 1897, **97, 535.**

OAKLAND H., Webster Street, Alameda, Cal. (O. and A.) (Alameda County br.) PLANS.—Alteration: A draw of not less than 150' clear opening, to be operated by other than hand power, and to be completed within 15 months from May 29, 1896, **96, 428.** Alteration plans in accordance with above requirements submitted Apr. 15, 1898; approv. Aug. 11, 1898, **98, 538.**

OBION R., near Bandmill, Tenn. (S.) (Dyersburg-Northern R. R. Co.) PLANS.—Approv. May 7, 1906, **06, 806.**

OBION R., near Burnt Mills, Dyer County, Tenn. (S.) (Dyer County br.) PLANS.—Approv. Sept. 19, 1902, **03, 646.**

OBION R., near Lanes Ferry, Tenn. (S.) (Dyer County br.) PLANS.—Approv. June 17, 1901 **01, 667.**

OBION R., Mengelwood (Bandmill), Tenn. (S.) (Mengel Box Co.) PLANS.—Approv. Aug. 22, 1907, **08, 869.**

OBION R., Pettys Ferry, Tenn. (S.) (Dyer County br.) PLANS.—Approv. Aug. 7, 1903, **04, 713.**

OCEANPORT, N. J. (See Shrewsbury R.)

OCKLOCKONEE R., McIntyre, Fla. (O.) (Carrabelle, Tallahassee & Georgia R. R. Co.) PLANS.—Removal of the row of piles from center of one of the open spans, to afford a clear opening of 32', to be completed on or before June 1, 1894; work completed, **94, 431.**

OCKLOCKONEE R., Fla. (O.) (Brs. of Leon and Gadsden Counties—Fairbanks Ferry br. and Stewart br.) PLANS.—Alterations to be completed within 120 days from Jan. 23, 1908, **08, 874.**

OCKLOCKONEE R., Ga. (O.) (Grady County br.—Hadley Ferry br.) PLANS.—Alterations to be completed within 120 days from Jan. 30, 1908, **08, 874.**

OCKLOCKONEE R., Leon County, Fla. (S.) (Leon County br.) PLANS.—Approv. Apr. 8, 1903, **03, 649.** Approv. Aug. 3, 1904, **05, 723.**

OCKLOCKONEE R., Leon and Gadsden Counties, Fla. (O.) (Georgia, Florida & Alabama R. R. Co.) PLANS.—Alterations to be completed within 7 months from Jan. 27, 1908, **08, 874.**

OCKLOCKONEE and SOPCHOPPY RS., near Sopchoppy, Fla. (O.) (Carrabelle, Tallahassee & Georgia R. R. Co.) PLANS.—Alterations to be completed within 2 months from Dec. 23, 1902, **03, 652.**

OCMULGEE R., above Hawkinsville and below Macon, Ga. (O.) (East Tennessee, Virginia & Georgia R. R.) LEGISLATION.—Notices served as to alterations required, **90, 343.** PLANS.—Capt. Hoxie recom. insertion of 60' draws in each br., **88, 2552.**

OCMULGEE R., near Lumber City, Ga. (O.) (East Tennessee, Virginia & Georgia Ry. Co.) PLANS.—Alterations required by Aug. 1, 1889, **89, 377.**

OCMULGEE R., Macon, Ga. (Sp., etc.) (S.) (Macon, Dublin & Savannah R. R. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Georgia. PLANS.—Approv. July 5, 1892, **92, 406.** Approv. Mar. 9, 1911, **11, 1087.**

OCOE R., Tenn. (See Hiwassee R.)

OCONEE R., above Dublin, Ga. (A.) (Central R. R.) PLANS.—Capt. Hoxie recom. insertion of a draw with 60' clear span, **88, 2552.**

OCONEE R., at or near Dublin, Ga. (Sp.) (Lawrence County br.) LEGISLATION.—County au. to constr. br. by act June 18, 1888. PLANS.—Approv. Aug. 17, 1888, **89, 369.**

OCONEE R., Dublin, Ga. (Sp.) (Macon, Dublin & Savannah R. R. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Georgia. PLANS.—Approv. Jan. 27, 1891, **91, 430.**

OCONEE R., Dublin, Ga. (S.) (Macon, Dublin & Savannah R. R. Co.) PLANS.—In substitution for those heretofore approv. were approv. Aug. 6, 1901, **02, 584.**

OCONEE R., Ga. (O.) LEGISLATION.—Notice served as to alterations required, **90, 344.**

OCONEE R., near Dublin, Ga. (Sp.) (Wrightsville & Tennille (Tennville) R. R. Co.) LEGISLATION.—Company au. to constr. br. by act May 21, 1890. PLANS.—Approv. Nov. 17, 1890, **91, 429.**

OCONEE R., Ga. (Dr.) **06, 797.**

OCONTO R., Oconto, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Br. to replace existing str. approv. Nov. 21, 1903, **04, 715.**

OGEECHEE R., Ga. (S.) (Chatham County br.) PLANS.—Rebuilding approv. Sept. 5, 1907, **08**, 869.

OGEECHEE, ALTAMAHA, and SATILLA RS., Ga. (S.) (Florida Central & Peninsula R. Co., on the line of its Savannah extension.) PLANS.—Approv. Feb. 21, 1893, **93**, 468.

OHIO R. ENGINEERS.—Chief of Engineers. **R.**, **00**, 40. BE. On House bill No. 1065, 56th Congress, 1st session, "To au. constr. of brs. across the Ohio, Monongahela, Mississippi, Kanawha, Tennessee, Cumberland, and Illinois Rs., and to prescribe the dimensions of the same." **R.**, **00**, 5103. (Lt. Col. M. B. Adams Maj. C. F. Powell, Maj. J. H. Willard, Maj. W. H. Bixby, Maj. D. C. Kingman, Capt. H. F. Hodges, and Capt. E. Burr.) Engineer in charge: Lt. Col. G. K. Warren, 1879. **R.**, **79**, 1463. PROJECTS.—Principal features and cost of the following brs.: Steubenville R. R., Wheeling (highway), Bridgeport (highway), Bellaire R. R., Parkersburg R. R., Newport & Cincinnati R. R. (as commenced), Newport & Cincinnati R. R. (as altered), Covington and Cincinnati (highway), Louisville R. R., Paducah R. R. **R.**, **79**, 1463.

OHIO R. (Dr.) **02**, 581.

OHIO R., brs. over, impeding safe and convenient navigation. The R. and H. act approv. June 13, 1902, contains the following item: "The Sec. of War is au. and directed to prepare a list of the brs. upon the Ohio R. which are an impediment to safe and convenient navigation, and the nature and extent of the modifications required in each of them, and **R.** the same to Congress, together with information as to whether necessary changes in said brs., or any of them, can be secured under existing law, and if not, what legislation is necessary in order to secure proper changes or modifications in said brs., respectively, and an est. of the cost thereof on each br.: Provided, That the Atty. Gen. is au. and directed to furnish, upon the request of the Sec. of War, an opinion upon the question whether the owners of these brs., or any of them, can be required, under existing laws, to make the necessary changes at their own expense, and, if further legislation is required, whether by such legislation the owners of such brs., or any or either of them, can be required to make such changes and modifications at their own expense, or whether such changes or modifications, or any or either of them, must be borne by the U. S., which opinion shall accompany the **R.** of the Sec. of War to Congress." The duty of preparing the required information was duly assigned to the local officer having charge of the general imp. of the R., and it is expected that **R.** on the subject will be received in time for consideration by the Atty. Gen. and transmission to Congress at its next session. **03**, 37. **R.** by Col. G. Lydecker, together with copy of an opinion dated July 15, 1904, furnished by Atty. Gen. in pursuance of the law. List of brs. which are considered impediments to safe and convenient navigation. **04**, 2433.

OHIO R., between Allegheny City and Borough of McKees Rocks, Pa. (Sp.) (Western Br. Co.) Au. act Apr. 30, 1902. PLANS.—Approv. Feb. 5, 1903, **03**, 644.

OHIO R., Beaver, Pa. (Sp.) (Pittsburgh & Lake Erie R. R. Co.) ENGINEERS.—Chief of Engineers. **R.**, **78**, 110, 891, 895; **80**, 199, 1849; **84**, 269, 1787; **87**, 338, 2659. BE. convened at Pittsburgh, Pa., Aug., 1877. Recom., **78**, 894. **R.**, **78**, 892. Approv. by Chief of Engineers and Sec. of War, **78**, 893, 896. (Col. Simpson, Majs. Weitzel and Merrill.) Convened in 1883 to ex. questions at issue with a view of avoiding legislation, **84**, 269. Br. an obstr. to navigation; failure to effect satisfactory arrangements with the company for the correction of the evil, **84**, 1786; **87**, 2655. (Lt. Cols. Craighill and Weitzel and Maj. Mackenzie.) LEGISLATION.—Executive requirements, **80**, 199, 1849; **87**, 2655. Company au. to constr. br., under acts Dec. 17, 1872, and Feb. 14, 1883, **89**, 371. PLANS.—Proposed by R. R. company; modification of, by BE., **78**, 894. R. R. company required to build in connection with the br. a dike for the protection of navigation, **80**, 199, 1849. Maj. Merrill **R.** that such dike not built, **80**, 1849. Dept. of Justice decided that the U. S. powerless to compel R. R. company to build dike, **80**, 1852. Subsequent changes of opinion, **84**, 1787, 1788; **87**, 2655. Submitted Nov. 26, 1888, to rebuild a part of the superstr. approv. Mar. 25, 1889, on specified conditions, which were accepted by the company Feb. 28, 1889, **89**, 371. Rebuilding considered by a BE. and approv. Oct. 29, 1907, **08**, 866. SURVEY.—Map. Location of br., **78**, 892.

OHIO R., Bellaire, Ohio. (Sp.) (R. R.) COMMERCE.—Serious accident by collision with ps., **71**, 403, 411. Losses by collision with ps., \$60,500, **71**, 411, 429. ENGINEERS.—BE. recom., 1870, no change, and commended the excellent manner of constr., **71**, 411. **R.**, **71**, 408, 425. (Majs. Warren, Weitzel, and Merrill.) LEGISLATION.—Br. au. by act July 14, 1862, **71**, 408. Act July 11, 1870, constituting BE., **70**, 67; **71**, 61, 426. PLANS.—Description of br., **71**, 408.

OHIO R., between Bellaire, Ohio, and Benwood, W. Va. (Sp.) (Bellaire, Benwood & Wheeling Br. Co.) LEGISLATION.—Au. by act Dec. 17, 1872; and plans referred to BE., as required by act Feb. 14, 1883, sec. 4, **98**, 531. PLANS.—Submitted Feb. 16, 1897. BE. recom., Apr. 23, 1897, chan. span 800' long and 90' above l. w.; modified plans in accordance submitted Apr. 22, 1898; approv. May 26, 1898, **98**, 531. Plans conforming to requirements of BE. approv. June 14, 1901, **01**, 660, 661. Br. not completed within the time limit. Plans reapprov. Apr. 21, 1904, **04**, 712. Plans reapprov. Nov. 29, 1905, and plans in lieu thereof approv. Apr. 20, 1906, **06**, 800. Plans reapprov. Apr. 24, 1907, **07**, 819.

OHIO R., Cairo, Ill. (Sp.) COMMERCE.—Dimensions of Ohio R. steamers, **86**, 2121. Protests of C. interests against the br., **86**, 2130. ENGINEERS.—Chief of Engineers. **R.**, **86**,

- 369, 2127. **BE.** **R.** adversely to a draw and recom. clear headway of 53' above h. w., **86**, 2127. (Lt. Cols. Abbot and Poe, and Maj. Mackenzie and Allen.) **LEGISLATION.**—Au. by acts Dec. 17, 1872, and Feb. 14, 1883, **86**, 370. **PLANS.**—Proposed by br. company considered inadmissible by **BE.**, **86**, 2127. Recom. of **BE.**, **86**, 2127. Concurred in by Chief of Engineers.
- OHIO R.**, between Chester, W. Va., and E. Liverpool, Ohio. (Sp.) (East Liverpool Br. Co.) **94**, 425; **96**, 422. **LEGISLATION.**—Au. by acts Dec. 17, 1872, and Feb. 14, 1883, **94**, 425. **PLANS.**—Submitted May 11, 1894, for 500' span, referred to a **BE.**, which recom. 650' in the clear. Modified plans approv. July 2, 1894. **94**, 425. Company reorganized; modified plans approv. Sept. 3, 1895, **96**, 422.
- OHIO R.**, Cincinnati, Ohio. (Sp.) **COMMERCE.**—Method of towing, **76**, ii, 303. Coal interests, **76**, ii, 303, 304. Chamber of C. committee, **R.** of, **76**, ii, 304. **ENGINEERS.**—Chief of Engineers. **Rs.**, **76**, 92, ii, 298, 306, 307. Approv. modified plan as proposed by board, **76**, ii, 307. Approv. by Sec. of War, **76**, ii, 308. **BE.** convened at Cincinnati, Ohio, Aug., 1874. Disapprov. of location unless width of chan. space be increased to 500', **76**, ii, 299, 305. Addl. cost of span, \$75,000, **76**, ii, 306. **R.**, **76**, ii, 300. (Col. Simpson, Maj. Merrill and Suter.) **LEGISLATION.**—Br. au. by act Dec. 17, 1872, **76**, ii, 299. **PLANS.**—Description of proposed br., **76**, ii, 302.
- OHIO R.**, Cincinnati, Ohio. (Sp.) (Newport & Cincinnati Br. Co.) **LEGISLATION.**—Orig. constr. au. by act Mar. 3, 1871. General laws of Dec. 17, 1872, and Feb. 14, 1883, required larger chan. clearance. **93**, 464. **PLANS.**—Feb. 15, 1893, plans submitted for reconstr. by widening but not altering the dimensions of the chan. span. Lt. Col. Stickney recom. the company be required to rebuild according to the existing law. The company's plans approv. Mar. 6, 1893. **93**, 464. Apr. 30, 1895, the Pennsylvania R. R. Co., controlling the br., submitted new plans for a greater height and length of chan. span and to be in lieu of the old plans; approv. May 21, 1895, **95**, 475.
- OHIO R.**, between Cincinnati, Ohio, and Covington, Ky. (See below.) (Sp.) **BE.** **Rs.** of board of 1886, **87**, 2616, 2621. **LEGISLATION.**—Br. au. by act May 20, 1886, **87**, 337. **PLANS.**—**BE.** of 1886 disapprov. location of br., **87**, 337. Approv. of changed location and plan, **87**, 337, 2631.
- OHIO R.**, between Cincinnati, Ohio, and Covington, Ky. (Sp., etc.) (Cincinnati & Covington Rapid Transit Br. Co.) **LEGISLATION.**—Company au. to constr. br. by acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS.**—Referred to **BE.**; modified plans based upon **R.** of board approv. July 27, 1892, **92**, 407.
- OHIO R.**, between Cincinnati, Ohio, and Newport, Ky. (Central R. R. & Br. Co.) **88**, 309, 2482. **BE.** convened at Cincinnati, Mar. 17, 1888, by S. O. No. 11, to ex. and **R.** upon plans and location of proposed br. across the Ohio R. between Cincinnati, Ohio, and Newport, Ky. **R.**, **88**, 2483. (Lt. Col. Poe and Maj. Stickney and Mackenzie.) **LEGISLATION.**—Au. by acts Dec. 17, 1872, and Feb. 14, 1883, **88**, 2480. **PLANS.**—Description of proposed br., **88**, 2482. The board of 1888 recom. approv. of plans and location of proposed br. as set forth by the Central R. R. & Br. Co., **88**, 2484.
- OHIO R.**, below Ceredo, W. Va. (Sp.) (West Virginia & Ironton R. R. Co.) **LEGISLATION.**—Au. by acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS.**—Plan and location submitted; approv. by Sec. of War, Dec. 24, 1889, **90**, 337.
- OHIO R.**, near the mouth of Corks Run. (Sp.) (Ohio Connecting R. R. Co.) **88**, 309, 2498, 2504, 2506. **BE.** convened at Washington, June 25, 1887, by S. O. No. 60, to consider and **R.** upon plans for the proposed br. across the Ohio R., about 1 m. below the junction of the Allegheny and Monongahela Rs., submitted by the Ohio Connecting R. R. Co. **R.**, **88**, 2499. (Lt. Cols. Merrill and Barlow, Maj. Stickney, and Lt. Spencer.) Second **R.** of board, **88**, 2505. (Lt. Cols. Merrill and Barlow, and Maj. Stickney.) **LEGISLATION.**—Br. au. by acts Dec. 17, 1872, and Feb. 14, 1883, **88**, 2498. **PLANS.**—Board of 1887 recom. site selected by the br. company be accepted on condition that the axis of the br. be changed to lie at right angles to the line of the current, and that the chan. space be increased to 800', but that otherwise the site be rejected, **88**, 2502. Revised plans approv. by the board on Oct. 4, 1887, **88**, 2506.
- OHIO R.**, Covington, Ky. (See above.) (S. and Sp.) (Suspension.) **BE.** recom., 1870, no changes, **71**, 416, 419. **R.**, **71**, 414, 454. (Majs. Warren, Weitzel, and Merrill.) **LEGISLATION.**—First charter granted by Ky., Feb., 1846; confirmed by Ohio, Mar., 1849; amended 1856, **71**, 415. Br. au. by Congress, Feb. 17, 1865, **71**, 415, 428; **78**, 1089. **PLANS.**—Description of plans, **71**, 414. Cost of br., \$1,480,000, **71**, 419, 425.
- OHIO R.**, East Cairo, Ky. (Sp.) (Chicago, St. Louis & New Orleans R. R. Co.) **88**, 308, 2437. **LEGISLATION.**—Au. by acts Dec. 17, 1872, and Feb. 14, 1883, **88**, 2437. **PLANS.**—Description of proposed br., **88**, 2436.
- OHIO R.**, Evansville, Ind. Chief of Engineers. **Rs.**, **72**, 440; **78**, 110; **79**, 149. Recom. modification of act au. constr. of brs. across the Ohio R., **72**, 440. **BE.** convened at Evansville, Ind., Nov., 1877; unable to reach any conclusions for want of h. w. surv., **78**, 110; **79**, 149. (Majs. Warren, Weitzel, and Merrill.)
- OHIO R.**, Henderson, Ky. (Sp.) **82**, 263, 1989; **86**, 370, 2138 2140. **COMMERCE.**—Requirements of the Ohio R., **82**, 1990. **BE.** **R.**, **82**, 1992. (Lt. Col. Comstock, Maj. Weitzel and Merrill.) **LEGISLATION.**—Br. au. by act Dec. 17, 1872, **82**, 1990. **PLANS.**—Description of spans proposed, **82**, 1891. Changes in plan

- approv. by BE. made without its approv., **86**, 2136, 2139. Modifications subsequently approv., **86**, 2140. BE. recom. plan submitted by R. R. company for approv., **82**, 1992.
- OHIO R.**, at Huntington, W. Va. (Sp.) (Huntington Northern R. R. Co.) Au. act Dec. 17, 1872; Feb. 14, 1883; and July 13, 1892. PLANS.—As amended, approv. June 15, 1910, **10**, 1023.
- OHIO R.**, Ironton, Ohio, to Ashland, Ky. (Sp.) (Ashland & Ironton Br. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. PLANS.—Conforming to requirements of BE. approv. Apr. 22, 1901, **01**, 660. Constr. under the plans approv. Apr. 22, 1901, not having been commenced within the limit of time prescribed, approv. became null and void. Plans reapprov. Feb. 16, 1903, **03**, 644. Not having been completed within the time limit, it became necessary to again approv. the plans and this was done Jan. 29, 1904, **04**, 711. Statutory time for completion having expired, plans were reapprov. Feb. 15, 1905, **05**, 721. Plans were reapprov. Feb. 14, 1908, **08**, 867, and again on Feb. 13, 1911, **11**, 1080.
- OHIO R.**, Kenova, W. Va. (Sp.) (Norfolk & Western Ry. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. PLANS.—Reconstr. of superstr. of existing br. approv. July 18, 1911, **12**, 1295.
- OHIO R.**, Liverpool (East), Ohio. (Sp.) (Newell Br. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. PLANS.—Considered by a BE. and approv. July 9, 1903, **04**, 711.
- OHIO R.**, Louisville, Ky. (Sp.) COMMERCE.—Losses by collision with ps. of brs., \$26,704, **71**, 421, 429. ENGINEERS.—Chief of Engineers. **R.**, **82**, 263, 1988. BE. on Ohio R. brs. considered this a first-class str. in all respects, **71**, 421. Recom. no changes of location or plan, **71**, 421. **R.**, **71**, 419, 454. (Majs. Warren, Weitzel, and Merrill.) **R.**, **82**, 1988. (Lt. Col. Comstock and Majs. Weitzel and Merrill.) LEGISLATION.—Br. au. by acts July 14, 1862, and Feb. 17, 1865, **71**, 419, 428; **78**, 1089. Act July 11, 1870, constituting BE., **70**, 67; **71**, 61, 426. Br. au. by act Dec. 17, 1872, **82**, 1986. Requirements of Ohio, **82**, 1987. PLANS.—Description of br., **71**, 419. Cost of br., \$1,615,120, **71**, 421, 425. Modification of previous plans, **82**, 1986. Approv. of plans by BE., **82**, 1988. BE. recom. plans adopted by R. R. company be approv., **82**, 1988.
- OHIO R.**, between Louisville, Ky., and Jeffersonville, Ind. (Sp.) (Louisville & Jefferson Br. Co.) ENGINEERS.—Chief of Engineers. **Rs.**, **89**, 370; **90**, 335. BE. constituted by S. O. No. 34, Apr. 19, 1889. **R.**, **90**, 3465. (Col. C. B. Comstock, Lt. Col. C. R. Suter, and Maj. C. J. Allen.) LEGISLATION.—Company au. to constr. br. under act Dec. 17, 1872; supple. act Feb. 14, 1883, **89**, 370. PLANS.—BE. recom. 650' span, Indiana side, and 400' span, Kentucky side; approv. Feb. 28, 1889, **89**, 370. Plans considered by second BE., Sept. 14, 1889, **90**, 3465. Modified plans approv. Oct. 19, 1889; new modification approv. Nov. 15, 1889. Substitution of l.-w. elevation of 1887 for that of 1889, approv. Jan. 29, 1890, **90**, 336.
- OHIO R.**, between Louisville, Ky., and New Albany, Ind. (Sp.) (Kentucky & Indiana Br. & R. R. Co.) Au. acts Dec. 7, 1872; Feb. 14, 1883; and June 7, 1910. PLANS.—Reconstr. approv. June 7, 1910, **10**, 1022. Modified plans approv. July 30, 1910, **11**, 1079.
- OHIO R.**, Louisville and Portland Canal. (Sp.) (Louisville & Portland Br. Co.) PLANS.—Reconstr. plans approv. Mar. 2, 1898, **98**, 531.
- OHIO R.**, between Marietta, Ohio, and Williams-town, W. Va. (Sp.) (Marietta & Williams-town Br. Co.) LEGISLATION.—Company au. to constr. br. by act Dec. 17, 1872; amending act Feb. 14, 1883. PLANS.—Submitted Nov. 2, 1897; modified plans conforming to the requirements of the BE. submitted June 26, 1898; approv. Feb. 4, 1898, **98**, 531.
- OHIO R.**, Mingo Junction, Ohio. (Sp.) (Cross Creek R. R. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. PLANS.—Considered by BE. and approv. Feb. 7, 1902, **02**, 582.
- OHIO, MONONGAHELA, ALLEGHENY, MUSKINGUM, BIG SANDY, GUYAN-DOT, LITTLE KANAWHA, and BUCK-HANNON RS.** **88**, 2672. PLANS.—List of brs., with location, dimensions, and chan. span in the clear, on the Ohio, **88**, 2673; the Monongahela, **88**, 2674; the Allegheny, **88**, 2675.
- OHIO R.**, Neville Isld., Pa., back chan. at the lower end of. (S.) (Pittsburgh & Lake Erie R. R. Co.) PLANS.—Approv. June 12, 1900, **00**, 701. New instrument executed July 24, 1900, in lieu of former dated June 12, 1900, **01**, 661.
- OHIO R.**, Neville Isld., Pa., back chan. from Fleming Park to head of. (S.) (Pittsburgh & Lake Erie R. R. Co.) PLANS.—Approv. May 16, 1900, **00**, 701.
- OHIO R.**, Newport, Ky. (Sp.) COMMERCE.—Losses by collision with ps. of br., **71**, 414, 429. Br. a serious obstr. to navigation, **71**, 431, 447. C. greatly increasing, **71**, 434, 448. ENGINEERS.—Chief of Engineers. **R.**, **71**, 61. BE. constituted by act July 11, 1870, **70**, 67; **71**, 61, 426. Discussion of the various acts relating to the Newport and Cincinnati br., **71**, 431, 432, 435. Proposed modifications, **71**, 452. Est. cost, \$288,605, **71**, 452, 453. Modified plan of br. approv. by Sec. of War, **71**, 61. (Majs. Warren, Weitzel, and Merrill.) LEGISLATION.—Br. au. by acts July 14, 1862; Mar. 3, 1869; and Mar. 3, 1871, **71**, 61, 414, 427, 431; 435, 455; **78**, 1086. Act July 11, 1870, constituting BE., **70**, 67; **71**, 61, 426. Acts relating to br. referred to, **78**, 1090. PLANS.—Of BE. for increasing height of br. 28½' and removal of draw span, **71**, 452. Description of present br., **71**, 440.
- OHIO R.**, Paducah, Ky. (Sp.) (Proposed.) ENGINEERS.—BE. on Ohio R. brs. recom. joint resolution of Apr. 7, 1869, be repealed, and that a general act be passed to regulate the constr. of all future brs. over the Ohio R., **71**, 424. Copy of proposed act, **71**, 455. If built under act proposed br. would not be injurious to navigation, **71**, 424. **R.**, **71**, 424, 454. (Majs. Warren,

Weitzel, and Merrill.) **LEGISLATION.**—Br. au. by act Apr. 7, 1869, **71**, 424, 428. Various acts relating to br. referred to, **78**, 1090, 1092.

OHIO R., at Paducah, Ky., and Metropolis, Ill. (Sp.) (Paducah & Illinois R. R. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS.**—**Approv.** Sept. 17, 1910, **11**, 1079.

OHIO R., Parkersburg, W. Va. (Sp.) **COMMERCE.**—Losses by collision with ps. of br.; \$45,900, **71**, 414, 429. \$30,000 raised by subscription, **71**, 412, 430. List of subscribers, **71**, 430. Petition to Congress to be reimbursed to the amount expended, **72**, 442. **ENGINEERS.**—Chief of Engineers. **Recom.** that the payment of increased cost caused by change of plan be provided for by the U. S. in the same manner as for the Newport and Cincinnati br., **72**, 441, 442. **BE.** on Ohio R. brs. **recom.** no change in this br., **71**, 414. **R.**, **71**, 411, 454. (Majs. Warren, Weitzel, and Merrill.) **LEGISLATION.**—Br. au. by act July 14, 1862, **71**, 411. Act July 11, 1871, constituting **BE.**, **71**, 61, 426. **PLANS.**—Description of br., **71**, 411. Cost of br., \$1,223,550, **71**, 414.

OHIO R., Parkersburg, W. Va. (S.) (Baltimore & Ohio R. B. Co.) **PLANS.**—Reconstr. of spans 35', 36', 37', and 40', **approv.** Jan. 15, 1901, **01**, 664.

OHIO R., Parkersburg, W. Va. (Sp.) (Parkersburg & Ohio Br. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS.**—Considered by a **BE.**, and **approv.** Jan. 9, 1907, **07**, 818.

OHIO R., Parkersburg, W. Va., and Belpre, Ohio (O.) (Baltimore & Ohio R. R. Co.—Parkersburg Branch R. R. Co.) **PLANS.**—Alterations to be completed on or before Dec. 1, 1908, **07**, 828.

OHIO R., between Parkersburg, W. Va., and Belpre, Ohio. (Sp.) (Parkersburg Br. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS.**—As amended, **approv.** Jan. 13, 1910 **10**, 1020.

OHIO R., Pt. Pleasant, W. Va. **ENGINEERS.**—Chief of Engineers. **R.**, **82**, 263, 1998. **BE.** **recom.** **approv.** of plans provided chan. span be changed to position suggested by coal exchange, and that the lowest part of br. be at least 40' above h. w., **82**, 2000. (Lt. Col. Comstock, Majs. Weitzel and Merrill.) **PLANS.**—Coal exchange at Pittsburgh **recom.** change of location in ps. proposed by the br. company, **82**, 2000. Modification accepted by company, **82**, 2000.

OHIO R., Pt. Pleasant, W. Va. (Sp.) (Kana-wha & Michigan Ry. Co.) **PLANS.**—Reconstr. of superstr. of chan. span **approv.** Feb. 23, 1906, **06**, 799. Reconstr. of the side spans **approv.** Mar. 10, 1908, **08**, 867.

OHIO R., Rochester, Pa. (Sp.) (Ohio River Br. Co.) **PLANS.**—Act Feb. 14, 1883, sec. 4, the plans and map were referred to a **BE.**, who **recom.** they be changed to provide chan. span 90' above l. w. and 800' long; modified plans in accordance **approv.** Nov. 9, 1895, **96**, 422.

OHIO R., Sewickley, Pa. (Sp.) (Corapolis & Sewickley Br. Co.) **LEGISLATION.**—Com-

pany au. to constr. br. under act Dec. 17, 1872; amending act Feb. 14, 1883. **PLANS.**—Modified plans conforming to the requirements of the **BE.** **approv.** July 11, 1899, **99**, 620.

OHIO R., Sewickley, Pa. (Sp.) (Allegheny County br.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS.**—Considered by a **BE.**, and **approv.** Feb. 6, 1908, **08**, 867.

OHIO R., Steubenville, Ohio. (Sp.) (Pittsburgh, Cincinnati, Chicago & St. Louis Ry. Co., successors of the Western Transportation Co.) **COMMERCE.**—Br. a serious obstr. to navigation, **71**, 402, 403. Losses by collision with the ps., **71**, 403, 429. Bad location of the br., **68**, 50, 316. Chan. contracted by riprap, **68**, 381. **ENGINEERS.**—Chief of Engineers. **Rs.**, **68**, 50; **89**, 369. **BE.** on Ohio R. brs. considered the Steubenville br. the most obstr. on the R., **71**, 403. **Recom.** that the chan. span be widened to 424', at an est. cost of \$200,414, **71**, 403, 404. Method of making the changes, **71**, 404. Total cost of present br., \$1,000,000, **71**, 425. (Majs. Warren, Weitzel, and Merrill.) Engineer in charge, Maj. G. K. Warren. **Rs.**, **68**, 316, 380. **LEGISLATION.**—Western Transportation Co. au. to constr. br. by act July 14, 1862, **71**, 426; **89**, 369. Act July 11, 1870, constituting a **BE.**, **70**, 67; **71**, 61, 426; **78**, 1088. **PLANS.**—Of Maj. Warren, increasing chan. span to 500' width, **68**, 50, 316. Draft of laws required, **68**, 50, 316. Reconstr. chan. span for double track during July and Aug., 1889; **approv.** Dec. 22, 1888, **89**, 369.

OHIO R., Steubenville, Ohio. (O.) (Pittsburgh, Cincinnati, Chicago & St. Louis Ry. Co.) **PLANS.**—Alterations to be completed within 2 years from Jan. 29, 1908, **08**, 874.

OHIO R., between Steubenville, Ohio, and Cross Creek Township, W. Va. (Sp.) (Steubenville Br. Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS.**—Considered by a **BE.**, and **approv.** June 29, 1903, **03**, 644, 645.

OHIO R., Wheeling, W. Va. (Sp.) (Wheeling & Harrisburg Ry. Co.) **ENGINEERS.**—Chief of Engineers. **Rs.**, **82**, 263, 1994; **84**, 269, 1773. **BE.** **recom.** modifications in plans submitted by the br. company, **82**, 1997. Modifications made and **approv.** by board, **84**, 1776. (Lt. Col. Comstock, Majs. Weitzel and Merrill.) **LEGISLATION.**—Br. au. by act Dec. 17, 1872, **82**, 1992. Supple. act Feb. 14, 1883, **84**, 1772. **PLANS.**—Description of span opening proposed by R. R. company, **82**, 1996. Modifications and **recom.** of the **BE.**, **82**, 1997. Accepted by the br. company, **82**, 1998. Plans as modified **approv.** by **BE.**, **84**, 1776.

OHIO R., Wheeling, W. Va. (Sp.) (Wheeling Br. Co.) **90**, 336. **LEGISLATION.**—Au. by acts Dec. 17, 1872, and Feb. 14, 1883; **90**, 337. **PLANS.**—Plan and location submitted, and **approv.** by Sec. of War. Oct. 26, 1889, **90**, 337.

OHIO R., Wheeling, W. Va., to Bridgeport, Ohio. (Sp.) **ENGINEERS.**—Chief of Engineers. **Rs.**, **70**, 67; **71**, 61. **BE.** on Ohio R. brs. did not **recom.** any changes in the Wheeling suspension

- br., 71, 407. **R.**, 71, 405, 408. (Majs. Warren, Weitzel, and Merrill.) **LEGISLATION**.—Br. au. by act Aug. 3, 1852, 71, 427. Act July 11, 1870, constituting **BE.**, 70, 67; 71, 61, 426. Various acts relating to br., referred to, 78, 1088, 1092. **PLANS**.—History of the Wheeling Br., 78, 1029. Description of br., 71, 405, 406. Orig. cost, \$161,594, 71, 407, 425. Destroyed by a hurricane in 1854; rebuilt at a cost of \$37,000, 71, 405, 407. Again rebuilt in 1860, at a cost of \$55,000, 71, 405, 407.
- OHIO R.**, Wheeling, W. Va., to Martins Ferry Ohio. (Sp.) (Wheeling & Harrisburg Ry. Co.) **LEGISLATION**.—Company au. to constr. br. by act Dec. 17, 1872; suppl. act Feb. 14, 1883. **PLANS**.—Orig. location approv. Dec. 10, 1883; amended location submitted Apr. 22, 1889; approv. May 18, 1889, 89, 371.
- OHIO R.** (Back R.), between Wheeling Isld., W. Va., and Ohio shore. (Sp.) (Back River Br. Co.) Au. act June 25, 1906. **PLANS**.—Approv. July 14, 1906, 07, 816.
- OHIO R.**, Williamstown, W. Va., to Marietta, Ohio. (Sp.) (Ohio River Br. & Ferry Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS**.—Conforming to requirements of **BE.** approv. Dec. 13, 1900, 01, 660.
- OHIO R.**, Williamstown, W. Va., to Marietta, Ohio. (Sp.) (Williamstown & Marietta Br. & Transportation Co.) Au. acts Dec. 17, 1872, and Feb. 14, 1883. **PLANS**.—Considered by **BE.**, and approv. June 25, 1901, 01, 661.
- OKANOGAN R.**, 12 m. n. of Brewster, Wash. (S.) (Great Northern Ry. Co.) **PLANS**.—Approv. Feb. 15, 1910, 10, 1027.
- OKANOGAN R.**, Okanogan, Wash. (Sp.) (Okanogan County br.) Au. act May 20, 1908. **PLANS**.—Approv. Jan. 8, 1909, 09, 913.
- OKANOGAN R.**, at Omak and Tonasket, Wash. (S.) (Brs. of Okanogan County.) **PLANS**.—Approv. Oct. 29, 1910, 11, 1084.
- OKANOGAN R.**, near Riverside, Wash. (S.) (Okanogan County br.) **PLANS**.—Approv. July 30, 1904, 05, 723.
- OKAW** (Kaskaskia) **R.**, near Baldwin, Ill. (S.) (Mobile & Ohio R. R. Co.) **PLANS**.—Rebuilding approv. May 17, 1906, and new plans in lieu thereof approv. Aug. 8, 1906, 07, 821.
- OLD R.**, Cal. (S.) (San Francisco & San Joaquin Valley Ry. Co.) **PLANS**.—Approv. Oct. 28, 1898, 99, 621.
- OLD R.**, at Torras, La. (O.) (Texas & Pacific Ry. Co.) **PLANS**.—Alterations to be completed within 10 months from Mar. 29, 1910, 10, 1031, 1032.
- OLD TURTLE CREEK** and **GRASSY SOUND CHAN.**, township of Middle Cape May County, N. J. (S.) (Wildwood & Delaware Bay Short Line R. R. Co.) **PLANS**.—Approv. June 11, 1912, 12, 1308.
- OLDMANS CREEK**, Pedricktown, N. J. (S.) (Br. of Salem and Gloucester Counties.) **PLANS**.—Rebuilding approv. Feb. 3, 1906, 06, 804.
- ONEMILE CREEK**, Ala. (Dr.) 08, 865.
- ONTONAGON R.**, Ontonagon, Mich. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) **PLANS**.—Approv. June 13, 1904, 04, 719.
- OOSTENAULA** and **COOSAWATEE RS.**, Ga. (A.) (2 R. R. and 2 county brs.) **PLANS**.—Brs. without a draw, and the ps. are too low, 89, 2797.
- OOSTENAULA R.**, Ga. (Dr.) 06, 797.
- OOSTENAULA R.**, Ga. (S.) (Southern Ry. Co.) **PLANS**.—Rebuilding approv. June 9, 1906, 06, 807.
- OOSTENAULA R.**, Gordons Ferry, Millers Ferry, and Printups Ferry, Ga. (S.) (Gordon County brs.) **PLANS**.—Approv. Nov. 18, 1904, 05, 725.
- OOSTENAULA R.**, Millers Ferry, Ga. (S.) (Gordon County br.) **PLANS**.—Approv. Mar. 12, 1912, 12, 1306.
- OPELOUSAS B.**, St. Martins Parish, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) **PLANS**.—Approv. May 23, 1906, 06, 807.
- ORANGE R.**, Buckingham Post Office, Fla. (S.) (Lee County br.) **PLANS**.—Br. to replace existing str. approv. Jan. 23, 1904, 04, 716.
- OREGON SLOUGH.** (See Columbia R.)
- ORONOKEN CREEK**, Beaver Dam, N. J. (S.) (Bridgeton & Millville Traction Co.) **PLANS**.—Approv. Jan. 17, 1902, 02, 586.
- ORRS ISLAND** and **GREAT ISLAND**, Me. (tidewater between). (S.) (Harpwell town br.) **PLANS**.—Reconstr. of existing br. approv. May 23, 1912, 12, 1307.
- OSAGE R.**, Mo. (S.) (St. Louis, Kansas City & Colorado R. R. Co.) **PLANS**.—Approv. Sept. 21, 1901, 02, 585.
- OSAGE R.**, near Linn Creek, Mo. (S.) (Linn Creek Br. Co.) **PLANS**.—Approv. May 5, 1909, 09, 918.
- OSAGE R.**, Osceola, Mo. (S.) (Kansas City, Osceola & Southern Ry. Co.) **PLANS**.—Approv. Nov. 23, 1896, on condition that the company constr. a pivot p. whenever so directed, 97, 531.
- OSAGE R.**, Tuscumbia, Mo. (S.) (Tuscumbia Br. Co.) **PLANS**.—Approv. Aug. 8, 1904, 05, 723.
- OSWEGO R.**, Oswego, N. Y. (S.) (City br.) **PLANS**.—Reconstr. approv. Nov. 17, 1908, 09, 916.
- OSWEGO R.**, Oswego, N. Y. (S.) (City br.) **PLANS**.—Reconstr. approv. Apr. 15, 1909, 09, 917.
- OSWEGO R.**, Oswego, N. Y. (S.) (New York Central & Hudson River R. R. Co.) **PLANS**.—Reconstr. approv. June 27, 1911, 11, 1090.
- OTTAWA R.**, Ohio. (S.) (Toledo, Ottawa Beach & Northern Ry. Co.) **PLANS**.—Approv. Feb. 23, 1911, 11, 1087.
- OUACHITA R.**, Ark. (Sp.) (Rock Island, Arkansas & Louisiana R. R. Co.) Au. act Dec. 15, 1905. **PLANS**.—Approv. Jan. 11, 1906, 06, 799.

OUACHITA R., between Ashley and Union Counties, Ark. (Sp.) (Eldorado & Bastrop Ry. Co.) Au. act Mar. 24, 1902. PLANS.—Approv. Oct. 9, 1902, **03**, 643.

OUACHITA and ARKANSAS RS., Camden and Pine Bluff, Ark. (Sp.) **83**, 271, 1606. LEGISLATION.—Br. au. act June 27, 1882, **83**, 271. PLANS.—Description of, **83**, 1605. Location of br. 10 m. below point specified in act June 27, 1882, **83**, 1606. Brs. partly completed before passage of act, **83**, 1607. Draw-span openings across Ouachita R. only 110' in place of 130', as required, **83**, 1607. Recom. by Capt. Handbury, that the matter of the length of drawbr. opening be allowed to remain in abeyance, **83**, 1608. Approv. by Sec. of War, **83**, 1610.

OUACHITA R., Camden, Ark. (Sp.) (Ouachita County br.) Au. act Mar. 2, 1911. PLANS.—Approv. Nov. 24, 1911, **12**, 1297.

OUACHITA R., near Columbia, La. (Sp.) (Houston, Central Arkansas & Northern R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 6, 1888; amending act Aug. 18, 1890. PLANS.—Amended plan approv. Nov. 25, 1890, **91**, 430.

OUACHITA R., at Columbia, Caldwell Parish, La. (Sp.) (Caldwell Parish br.) Au. act Jan. 18, 1905. PLANS.—Approv. Apr. 27, 1905, **05**, 721.

OUACHITA R., Desiard Street, Monroe, La. (Sp.) (City br.) LEGISLATION.—City au.

to constr. br. by act Feb. 8, 1897, **97**, 530. PLANS.—Approv. July 2, 1897, **97**, 530. Plans for constr. of timber cribwork between Monroe City br. and the Vicksburg, Shreveport & Pacific Ry. br., submitted Sept. 6, 1897; approv. Sept. 18, 1897, **98**, 531.

OUACHITA R., Monroe, La. (S.) (Vicksburg, Shreveport & Pacific Ry. Co.) PLANS.—Reconstr. approv. July 19, 1906, **07**, 820.

OUACHITA R., between town of Ouachita and mouth of Bayou Loutre, La. (Sp.) (Little Rock & Monroe Ry. Co.) Au. act Feb. 26, 1904. PLANS.—Approv. May 24, 1904, **04**, 712.

OVERPECK CREEK, Little Ferry, N. J. (S.) (West Shore R. R. Co. and New York Central & Hudson River R. R. Co.) PLANS.—Reconstr. approv. Feb. 7, 1902, **02**, 587.

OVERPECK CREEK, Ridgefield, N. J. (S.) (Bergen Turnpike Co.) PLANS.—Approv. Aug. 29, 1901, **02**, 584.

OVERPECK CREEK, Ridgefield Park, N. J. (O.) (New York, Susquehanna & Western R. R. Co.) PLANS.—Alterations to be completed on or before July 1, 1907, **07**, 829.

OYSTER R. (See Stony Creek, Conn.)

OYSTER CREEK, near Keyport, N. J. (O.) (Monmouth County br.) PLANS.—Alterations to be completed on or before 6 months from May 3, 1906, **06**, 809.

P.

PABLO CREEK, Fla. (O.) (Duval County br.) PLANS.—Br. to be raised 3', and to have a 25' opening on or before Sept. 1, 1899, **99**, 625.

PABLO CREEK, Fla. (O.) (Jacksonville & Atlantic Ry. Co.) PLANS.—Br. to be raised 3', and to have a 25' opening, on or before Sept. 1, 1899, **99**, 625.

PABLO CREEK, Fla. (O.) (Jacksonville, Mayport & Pablo Ry. Co.) PLANS.—Br. to be raised 3', and to have a 25' opening, on or before Sept. 1, 1899, **99**, 625.

PABLO CREEK, Duval County, Fla. (O.) (Duval County br.) PLANS.—Alterations to be completed on or before 4 months from May 1, 1909, **09**, 920.

PABLO CREEK, in Duval County, Fla. (S.) (Florida East Coast Ry. Co.) PLANS.—For alteration of central br. approv. Aug. 4, 1909, and modification thereof approv. Apr. 7, 1910, **10**, 1029.

PABLO CREEK (cut-off or canal connecting portions of it), Fla. (S.) (Florida East Coast Ry. Co.) PLANS.—Approv. Apr. 28, 1911, **11**, 1088.

PACHECO, ALHAMBRA, and CODELIA SLOUGHS, Cal. (S.) (Southern Pacific R. R. Co.) PLANS.—Reconstr. plans for brs. at these places approv. May 1, 1899, **99**, 622.

PAMLICO R., N. C. (A.) (1 R. R. and 3 county brs.) PLANS.—R. R. and 3 county brs. slightly interfere with navigation; would probably be provided with draws, should C. demand it, **89**, 2796.

PALIX R. (sec. 15, T. 13 N., R. 10 W., Willamette meridian), Wash. (S.) (Pacific County br.) PLANS.—Approv. June 2, 1911, **11**, 1089.

PAMLICO R., Washington, N. C. (S.) (Raleigh & Pamlico Sound R. R. Co.) PLANS.—Approv. Mar. 23, 1906, **06**, 805.

PAMLICO (Tar) R., Washington, N. C. (S.) (Beaufort County br.) PLANS.—Rebuilding approv. Nov. 16, 1907, **08**, 871.

PAMUNKEY R. and MABSCO CREEK, Va., White House. (A.) (Richmond & Danville and Alexandria & Fredericksburg R. R. Cos.) PLANS.—Draws too narrow, and vessels passing are swept against the sides, **88**, 2621.

PAMUNKEY R., New Castle Ferry, Va. (S.) (King William County br.) PLANS.—Modified plans approv. May 20, 1899, **99**, 622, 623.

PANTEGO CREEK. (See Pungo Creek.)

PARADISE CREEK, Va. (Dr.) **02**, 581.

PARSONAGE CREEK, near Baldwins, Long Isld., N. Y. (O.) (Hempstead town br.) PLANS.—Alterations to be completed on or

before 1 month from July 1, 1904; subsequently extended 6 months, **04**, 723. Alterations to be completed on or before 2 months from May 31, 1906, **06**, 809.

PASCAGOULA R., Jackson County, Miss. (S.) (Mobile, Jackson & Kansas City R. R. Co.) PLANS.—Approv. Sept. 10, 1895, **96**, 424.

PASCAGOULA R., Merrill, Miss. (S.) (Mobile, Jackson & Kansas City R. R. Co.) PLANS.—Modified plans approv. Sept. 9, 1901, **02**, 585.

PASCAGOULA R., Miss. (Dr.) **06**, 797; **08**, 865.

PASQUOTANK R., N. C. (S.) (Norfolk & Southern R. R. Co.) PLANS.—Rebuilding approv. Mar. 7, 1902, **02**, 587.

PASQUOTANK R., at Elizabeth City, N. C. (S.) (Camden Ferry Co.) PLANS.—Approv. Feb. 24, 1910, **10**, 1027.

PASSAGASSAWAUKEAG R., Belfast, Me. (S.) (Northern Maine Seaport Ry. Co.) PLANS.—Approv. June 27, 1905, **05**, 728.

PASSAIC R., N. J. (Dr.) **10**, 1019.

PASSAIC R., N. J. (S.) (New York Bay R. R. Co.) PLANS.—Approv. Mar. 31, 1900, **00**, 701.

PASSAIC R., N. J., and **NEWARK B.**, N. J. (Dr.) **02**, 581.

PASSAIC R., N. J. (S.) (Newark Plank Road Co.) PLANS.—Rebuilding approv. Apr. 11, 1901, **01**, 666.

PASSAIC R., N. J. (S.) (Central R. R. of New Jersey.) PLANS.—Approv. June 19, 1911. Temporary br. for use during reconstr. of existing br. approv. July 7, 1911, **12**, 1299. Instrument canceled Mar. 22, 1912. New plans approv. Mar. 22, 1912, **12**, 1306.

PASSAIC R., Avondale, N. J. (S.) (Br. of Bergen and Essex Counties.) PLANS.—Rebuilding approv. Mar. 12, 1904, **04**, 717.

PASSAIC R., Delawanna, Rutherford, and Lyndhurst, N. J. (O.) (Br. of Passaic and Bergen Counties.) PLANS.—Alterations to be completed on or before 3 years from June 29 and 30, 1906, **06**, 810.

PASSAIC R., Essex and Hudson Counties, N. J. (S.) (Br. of Essex and Hudson Counties—Newark Plank Road br.) PLANS.—Reconstr. approv. May 18, 1909, **09**, 918.

PASSAIC R., Newark, N. J. (S.) (Morris & Essex R. R. Co.) PLANS.—Rebuilding approv. Feb. 5, 1902, **02**, 586, 587.

PASSAIC R. (Center Street br.), at Newark and Harrison, N. J. (S.) (Pennsylvania R. R. Co., lessee of the United New Jersey R. R. & Canal Co.) PLANS.—Br. to replace existing str. approv. Apr. 6, 1910, **10**, 1029.

- PASSAIC R.**, from Bridge Street, Newark, to Harrison Avenue, Harrison, N. J. (S.) (Br. of Hudson and Essex Counties, N. J.) PLANS.—Reconstr. of existing br. approv. July 10, 1911, **12**, 1299.
- PASSAIC R.** (Belleville br.), between Newark and Passaic, N. J. (S.) (Br. of Bergen, Essex, and Hudson Counties.) PLANS.—Reconstr. approv. May 25, 1912, **12**, 1307.
- PASSAIC R.**, Newark, N. J. (S.) (Erie R. R. Co.) PLANS.—Reconstr. plans approv. Sept. 16, 1897, **98**, 533.
- PASSAIC R.**, Passaic, N. J. (S.) (Passaic and Bergen Counties br.) PLANS.—Submitted May 11, 1894; modified May 24 1894; approv. May 31, 1894, **94**, 428.
- PASSAIC R.**, Passaic, N. J. (S.) (Br. of Bergen and Passaic Counties.) PLANS.—Approv. Feb. 10, 1904, **04**, 716.
- PASSAIC R.**, Passaic, N. J. (S.) (Jersey City, Hoboken & Paterson Street Ry. Co.—temporary.) PLANS.—Approv. Apr. 25, 1904, **04**, 718.
- PASSAIC R.**, Passaic and East Passaic, N. J. (S.) (Brs. of Essex and Hudson Counties.) PLANS.—Reconstr. and temporary footbr. approv. July 26, 1906, **07**, 820.
- PASSAIC R.**, Rutherford, N. J. (S.) (Bergen and Passaic Counties br.) PLANS.—Modified plans approv. Aug. 14, 1896, **96**, 427.
- PATAPSCO R.**, Middle Branch, Spring Garden, Baltimore, Md. (S.) (Western Maryland Tidewater R. R. Co.) PLANS.—Approv. Feb. 13, 1903, **03**, 649.
- PATCHOGUE R.** (See Stony Creek, Conn.)
- PATCONG CREEK**, Steelmanville, Atlantic County, N. J. (O.) (Atlantic County br.) PLANS.—Alterations to be completed on or before Sept. 3, 1903, **03**, 651.
- PATCONG (Cedar Swamp) CREEK**, Steelmanville, N. J. (O. and A.) (Atlantic County br.) PLANS.—Reconstr. approv. June 13, 1904, **04**, 720.
- PATCONG CREEK**, Steelmanville, N. J. (S.) (Atlantic County br.) PLANS.—Reconstr. of existing br. approv. Nov. 10, 1911, **12**, 1302.
- PATUXENT R.**, Mount Calvert, near Bristol Landing, Md. (S. and Sp.) (Washington & Chesapeake Beach Ry. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Maryland, **92**, 405. PLANS.—Orig. plan approv. Apr. 26, 1892, **92**, 405. On Mar. 30, 1894, the company submitted plans for modification in constr. of draw and center p.; approv. Apr. 3, 1894, **94**, 428.
- PAW PAW R.**, Mich. (A.) (2 R. R. brs.) PLANS.—2 R. R. brs. slightly obstr. navigation, **89**, 2802.
- PAW PAW R.**, near Benton H., Mich. (O.) (Cleveland, Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Specified alterations to be completed on or before Apr. 1, 1902, **02**, 590, 591.
- PAW PAW R.**, near Benton H., Mich. (O.) (City of Benton H. and township of Benton—2 brs.) PLANS.—Specified alterations to be completed on or before Apr. 1, 1902, **02**, 591.
- PAW PAW R.**, Benton H., Mich. (O. and A.) (Cleveland, Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Specified alterations to be completed within 6 months from Mar. 11, 1901, **01**, 668.
- PAW PAW R.**, Benton H., Mich. (O. and A.) (Pere Marquette R. R. Co.) PLANS.—Alterations to be completed within 6 months from Mar. 18, 1901, **01**, 668.
- PAW PAW R.**, near Benton H., Mich. (A.) (Cleveland, Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Reconstr. in accordance with requirements approv. Dec. 20, 1901, **02**, 590.
- PAW PAW R.**, near Benton H., Mich. (O.) (Pere Marquette R. R. Co.—2 brs.) PLANS.—Alterations to be completed on or before Apr. 1, 1902, **02**, 591.
- PAW PAW R.**, Benton H. and Benton, Mich. (O. and A.) (City brs.) PLANS.—Alterations to be completed within 6 months from Mar. 11, 1901, **01**, 668.
- PAWTUCKET R.**, Providence, R. I. (A.) **88**, 2528. LEGISLATION.—Act of State Legislature, Jan., 1883, requiring reconstr. of the br. with a swing draw, with openings on each side of 80', **88**, 2529. PLANS.—New br. in process of constr., **88**, 2529.
- PAWTUCKET R.**, R. I. (A.) (Boston & Providence R. R. Co.) **88**, 2529. COMMERCE.—Obstr. caused by the br. to C. of Pawtucket, **88**, 2529. LEGISLATION.—Resolution of State Legislature, May 29, 1884, appointing a committee to R. upon brs. obstr. the R., **88**, 2530. PLANS.—Description of the br., **88**, 2529. Lt. Col. Elliott R. the available draw opening too narrow and that there should be 2, **88**, 2530.
- PAWTUCKET R.**, R. I. (Dr.) **11**, 1078.
- PAWTUCKET R.** (See Seeconk R.)
- PAWTUCKET (Seeconk) R.**, Indian Pt., Providence, R. I. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. approv. Feb. 14, 1902, **02**, 587.
- PEACE R.** (See Withlacoochee R.)
- PEARL R.**, Miss. (Sp.) (Marion County br.) LEGISLATION.—County au. to constr. br. by act June 18, 1897. PLANS.—Approv. July 1, 1897, **97**, 530.
- PEARL R.**, Miss. (Sp.) (Mississippi Central R. R. Co.) Au. act Jan. 18, 1905. PLANS.—Approv. Sept. 14, 1905, **06**, 799.
- PEARL R.**, Carthage, Miss. (S.) (Leake County br.) PLANS.—Rebuilding approv. Sept. 30, 1908, **09**, 915.
- PEARL R.**, Marion County, Miss. (Sp.) (New Orleans Great Northern R. R. Co.) Au. act Feb. 25, 1907. PLANS.—Approv. Nov. 6, 1907, **08**, 866.

- PEEKSKILL B.**, Peekskill, N. Y. (S.) (New York Central & Hudson River R. R. Co.) PLANS.—Reconstr. of center p. of draw span approv. Apr. 11, 1902, **02**, 588.
- PENASOFFKEE OUTLET**, connecting Penasoffkee Lake with the Withlacoochee R., Fla. (S.) (Sumter County br.) PLANS.—Approv. Nov. 22, 1909, **10**, 1025.
- PEND OREILLE R.**, Standpoint, Idaho. (Sp.) (Spokane International Ry. Co.) Au. act Feb. 18, 1905. PLANS.—Approv. Oct. 19, 1905, **06**, 799.
- PEND OREILLE R.**, near Box Canyon, Stephens County, Wash. (Sp.) (Idaho & Washington R. R. Co.) Au. act Aug. 16, 1911. PLANS.—Approv. Oct. 3, 1911, **12**, 1296.
- PENNYPACK CREEK**, Torresdale Avenue, Philadelphia, Pa. (S.) (City br.) PLANS.—Approv. June 23, 1894, **94**, 429.
- PENSAUKEN CREEK**. (See Schuylkill R.)
- PENSAUKEN CREEK**, N. J. (S.) (Camden & Suburban Ry. Co.) PLANS.—Approv. May 20, 1904, **04**, 719.
- PEQUONNOCK R.**, Bridgeport, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Submitted Apr. 15, 1896, objectionable; modified plans submitted Nov. 10, 1896; approv. Dec. 10, 1896, **97**, 533.
- PERDIDO R.**, near Holman Ferry, Fla. and Ala. (Sp.) (Escambia County, Fla., and Baldwin County, Ala., br.) LEGISLATION.—Counties au. to constr. br. by act Aug. 13, 1894, **95**, 474. PLANS.—Approv. Dec. 5, 1894. Br. completed. **95**, 474.
- PETALUMA CREEK**, Marion County, Cal. (S.) (Bay Counties Ry. Co.) PLANS.—Approv. Feb. 14, 1906, the instrument of approv. being modified by instrument dated Mar. 8, 1906, **06**, 804.
- PETALUMA CREEK**, near Petaluma, Cal. (S.) (San Francisco & North Pacific Ry. Co.) PLANS.—Approv. Nov. 21, 1903, **04**, 715.
- PETALUMA CREEK**, Sonoma County, Cal. (S.) (Northwestern Pacific R. R. Co.) PLANS.—Approv. June 3, 1911, **11**, 1089.
- PETIT JEAN, CACHE, ST. FRANCIS, ARKANSAS, SALINE, and POTEAU RS.** (A.) PLANS.—Brs. interfere with present or prospective imp. of the streams, **88**, 2635.
- PIKE CREEK**, Main Street, Kenosha, Wis. (S.) (City br.) PLANS.—Approv. June 14, 1901, **01**, 667.
- PINE ISLAND BAYOU**, near Beaumont, Tex. (O.) (Gulf, Colorado & Santa Fe Ry. Co.) PLANS.—Alterations to be completed on or before 6 months from July 16, 1908, **09**, 919.
- PINE LAKE**, near Charlevoix, Mich. (Sp.) (Chicago & North Michigan R. R. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, sec. 7, Michigan laws, and assent of board of supervisors, Charlevoix County, Mich. PLANS.—Approv. Sept. 4, 1891, **91**, 432.
- PINE LAKE** (s. arm of), S. Arm, Mich. (S.) (Town br.) PLANS.—Reconstr. approv. May 1, 1901, **01**, 666.
- PINE R.**, St. Clair, Mich. (S.) (Rapid Ry. Co.) PLANS.—Reconstr. plans approv. July 3, 1899, **99**, 623.
- PINE R.**, Charlevoix, Mich. (S.) (Town br.) PLANS.—Approv. Mar. 19, 1901, **01**, 665.
- PISCATAQUA R.**, Dover Pt., N. H. (S.) (Boston & Maine R. R. Co.) PLANS.—Reconstr. approv. May 6, 1907, **07**, 827.
- PISCATAQUA R.**, chan. between Kittery and Badgers Isld., Me. (S.) (Portsmouth, Kittery & York Street Ry. Co.) PLANS.—Approv. June 18, 1897, **97**, 534.
- PISCATAQUA R.**, at U. S. Navy Yard, between Portsmouth, N. H., and Kittery, Me. (Sp.) (Navy Dept. br.) Au. act Mar. 4, 1911. PLANS.—Approv. Oct. 30, 1911, **12**, 1296.
- PISCATAWAY CREEK**, Essex County, Va. (S.) (Essex County br.) PLANS.—Rebuilding approv. Nov. 4, 1908, **09**, 916.
- PLAQUEMINE BAYOU**, La. (O.) (Texas & Pacific Ry. Co.) PLANS.—Specified alterations required on or before Apr. 15, 1892, **91**, 434.
- PLAQUEMINE BAYOU**, Iberville, La. (O. and A.) (Iberville Parish br.) PLANS.—Alterations to be completed on or before Nov. 1, 1901, **01**, 668.
- PLAQUEMINE BAYOU**, Plaquemine, La. (S.) (Iberville Parish br.) PLANS.—Approv. Aug. 31, 1897, **97**, 535. General plans approv. Mar. 25, 1907, **07**, 826. Detailed plans approv. Aug. 22, 1907, **08**, 869. Notice dated Mar. 5, 1909, was given to remove cofferdam around s. p. within 30 days from date of service of notice, **09**, 919.
- PLAQUEMINE BRULE BAYOU**, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Reconstr. plans approv. Jan. 21, 1911, **11**, 1085.
- POCOMOKE R.** (See Christiana R., Wilmington, Del.)
- POINT JUDITH POND** (entrance to), South Kingston, R. I. (S.) (Sea View R. R. Co.) PLANS.—Approv. Feb. 14, 1906, **06**, 804.
- POINT PLEASANT and CARLONS ISLD.** (chan. between), Me. (O.) (Washington County R. R. Co.) PLANS.—Alterations to be completed on or before Dec. 31, 1904, **03**, 652.
- POQUONNOCK R.**, Bridgeport, Conn. (S.) (Congress Street Br. Commission.) PLANS.—Br. to replace existing str. approv. Aug. 12, 1908, **09**, 914.
- PORTAGE CANAL**, connecting Fox and Wisconsin Rs. near Portage City, Wis. (Sp., etc.) (See Fox R.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—New br. approv. Jan. 20, 1892, **92**, 403.
- PORTAGE LAKE**, between Houghton and Hancock, Mich. (Sp.) (Mineral Range R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 3, 1891, **99**, 618. PLANS.—As

per request in company's letter of Dec. 10, 1897, permission was given, Mar. 1, 1898, to rebuild the drawbr., 98, 537. Reconstr. plans approv. Sept. 15, 1898, 99, 618.

PORTAGE LAKE, Houghton and Hancock, Mich. (Sp.) (Houghton County br.) PLANS.—Reconstr. approv. Jan. 7, 1901, 01, 664. Rebuilding approv. Jan. 7, 1901. Reconstr. Houghton approach by the Copper Range Ry. Co. approv. Mar. 20, 1902, 02, 582.

PORTAGE LAKE, Houghton, Mich. (S.) (Mineral Range R. R. Co.) PLANS.—Reinforcement of existing br. approv. Dec. 27, 1911, 12, 1303.

PORTAGE R., Oak H., Ohio. (S.) (Toledo Port Clinton & Lakeside Ry. Co.) PLANS.—Approv. Aug. 17, 1903, 04, 714.

PORTAGE R., near Port Clinton, Ohio. (S.) (Lake Shore & Michigan Southern Ry. Co.) PLANS.—Br. to replace existing str. approv. Feb. 21, 1910, 10, 1027. Temporary br. during constr. of permanent br. approv. Nov. 28, 1911, 12, 1303.

PORTLAND H., Back Cove, Me. (Dr.) 02, 581.

PORTLAND H., entrance to Back Cove, Me. (O. and A.) (Portland City br. ("Turkey's"—Tukey—br.), highway.) PLANS.—Specified alterations required on or before Dec. 31, 1894, but on account of interference with dr. work, time extended to Dec. 31, 1895, and to Dec. 31, 1896, 95, 482. Reconstr. plans approv. Feb. 10, 1897; modified plans, reducing the draw opening from 70 to 67, approv. May 26, 1897, 97, 535. Alterations to be completed on or before July 1, 1901, 01, 668.

PORTLAND H., Me. (See Fore R. mouth.)

PORTLAND H., Me. (S.) (Portland & Cape Elizabeth Ry. Co.) PLANS.—Approv. Oct. 4, 1898, 99, 621.

PORTLAND H. (entrance to Back Cove), Me. (S.) (Grand Trunk Ry. system.) PLANS.—Reconstr. of existing br. approv. Mar. 27, 1912, 12, 1306.

PORTSMOUTH H., Portsmouth Navy Yard, N. H., and Kittery, Me. (S.) (Navy Dept. br.) PLANS.—Approv. Jan. 14, 1901, 01, 664.

POTEAU R., Choctaw Nation, near Fort Smith, Ark. (Sp.) (Fort Smith & Choctaw Br. Co.) LEGISLATION.—Company au. to constr. br. by acts June 18, 1888, and Mar. 2, 1889. PLANS.—Approv. June 18, 1889, 89, 372.

POTOMAC R. (See Miscellaneous Index, page 2040 of this index.)

POTOMAC R., E. Branch of. (See Anacostia R.)

POTOMAC R. (Long Br.) ENGINEERS.—Engineers in charge: Maj. N. Michler, 1867-71. Rs., 67, 521; 68, 891; 69, 494; 70, 519; 71, 974. Maj. O. E. Babcock, 1871. R., 71, 969. Maj. P. C. Hains, 1883-91. Rs., 83, 783; 84, 976; 85, 936; 86, 886; 87, 888; (Lt. Col.) 88, 782; 89, 986; 90, 1040, 1042; 91, 1248. Maj. C. E. L. B. Davis, 1892. R., 92, 1036. LEGISLATION.—

D. C. br. acts for 1805-1869, 69, 519. Acts Feb. 5, 1868, and June 21, 1870; transferred possession of Long Br. to the Baltimore & Potomac R. R. Co., subject to certain conditions, 70, 519. OPERATIONS.—1868. New draw built and minor repairs made, 68, 891. 1869-70. Floor renewed and minor repairs made, 70, 519. 1870-71. Br. damaged by a freshet, 1870; reconstr. by company, 71, 974. 1891-92. Br. rebuilt, 92, 1036. PLANS.—Baltimore & Potomac R. R. Co. submitted plans for reconstr. of that part of Long Br. over Washington chan., approv. July 28, 1891, 92, 1036. PROJECTS.—Br. built in 1808. History and description. 67, 521; 83, 783; 88, 2539; 90, 1042. Maj. Hains est., 1883, about \$1,500,000 to rebuild the br., 83, 785. Conditions, 1884. Obstr. to further imp. of Potomac R., 88, 2539. Br. a constant menace to Washington during season of ice, 87, 889. Lt. Col. Hains est., 1890, it would cost \$1,250,000 for separation of the wagon road from the R. R. on the n. side of the main chan. and the reconstr. of the br. over the main chan. of the R. on wider spans, 90, 1044. SURVEYS.—Investigation of the desirability of separating the wagon road from the R. R. on the n. side of the main chan. of the Potomac R., with est., au. by Senate's resolution, dated Mar. 7, 1890; R. made, 1890, by Lt. Col. Hains (see Projects), 90, 1042.

POTOMAC R., D. C. (Dr.) 10, 1019.

POTOMAC R. (Aqueduct Br.), Georgetown, D. C. APPROPRIATIONS.—1886, \$240,000, 88, 789. COMMERCE.—Br. an obstr. to C. interests of R., 88, 2541. CONTRACTS.—1888. C. Thomas, watchman's house and wooden sidewalk constr., \$495 for the first, and \$2.25 per l. f. for the second, 88, 795. Breen & Feely, embankment constr., 25¢ per c. y., and slope paving, 45¢ to \$1.34 per s. y., 88, 795. ENGINEERS.—Chief of Engineers. R., 76, 66, 331. Rs. on condition of br. in 1886, 86, 148; 87, 898; 88, 106; 89, 123. Engineer in charge: Maj. W. P. Craighill, 1876. R., 76, 331. Lt. Col. P. C. Hains, 1886-89. Rs., 88, 789, 2541; 89, 989. Assistant: Lt. T. Turtle. R., 76, 332. LEGISLATION.—History of, 86, 931. Senate resolution of Feb. 25, 1886, calling for an ex. of condition of br. and its safety when the aqueduct is filled with water, 86, 148. Purchase and reconstr. of br. au. by act June 21, 1886, 88, 789, 790. OPERATIONS.—1887-88. Removal of old and erection of new br. nearly completed, 88, 792. 1888-89. Reconstr. work completed, 89, 989, 990. PLANS.—General description of, 86, 932. Condition of br. in 1886, 86, 933. Repairs required, 86, 947. General features of proposed reconstr., 88, 790. Recom. br. as an aqueduct be discontinued and that draw be provided, 88, 2541, 2542. PROJECTS.—Description of br., 76, 332. SURVEYS.—Ex., with R. upon the condition of the Aqueduct Br. over the Potomac R., au. by Senate's resolution, Feb. 3, 1876; made, 1876, by Maj. Craighill (R. fav. to thorough repair and adjustment), 76, 332. Maps. 76, 332.

POTOMAC R., Georgetown, D. C. (Leased by the Alexandria Canal Co.) APPROPRIATIONS.—1894,¹ \$51,070, **95**, 4099. 1896, \$65,000, **96**, 3886. Total, \$116,070. CONTRACTS.—1894. Shailer & Schniglau Co., repairing br., \$33,765, **95**, 4092. 1897. Houston Contracting Co., reconstr. p. No. 4, \$29,997.50, **97**, 3990. Contract annulled May 27, 1898, **98**, 3573. ENGINEERS.—Chief of Engineers. **Rs.**, **95**, 484; **96**, 429; **97**, 536; **98**, 539; **99**, 626; **00**, 703. Engineers in charge: Maj. N. Michler, 1868-71. **Rs.**, **68**, 892; **69**, 495; **70**, 519; **71**, 975. Maj. C. E. L. B. Davis, 1895. **Rs.**, **95**, 4085. Maj. C. J. Allen, 1896-1900. **Rs.**, **96**, 3883, 3887; (Lt. Col.) **97**, 3987; **98**, 3571; **99**, 3777; **00**, 5123. LEGISLATION.—Au. by act July 27, 1868, **68**, 892. OPERATIONS.—1869. Br. completed and opened to the public, **69**, 495. 1894-96. Br. repaired, **95**, 4094; **96**, 3884. 1896-97. Reconstr. of p. No. 4 in progress, **97**, 3988. 1897-98. Reconstr. of p. No. 4 continued, but because of war with Spain work was suspended and contractor requested to block up p. and make br. as stable as possible. As the contractor refused to comply, the work was done with hired labor. **98**, 3573. 1899-00. Work in progress on p. No. 4, **00**, 5124. PROJECTS.—Maj. Davis est., 1893, \$51,070 to make the necessary repairs to the br., **95**, 4090. Maj. Allen est., 1895, \$65,000 to reconstr. p. No. 4, **96**, 3888. SURVEYS.—Ex. of the ps. of the Aqueduct Br., with statement of expend. made since it became joint property of the U. S. and D. C., au. by Senate's resolution of Jan. 21, 1893; **R.** made, 1895, by Maj. Davis (see Projects), **95**, 4085.

POTOMAC R., Georgetown, about 3 m. above. (Little Falls Br., Chain.) ENGINEERS.—Engineers in charge: Maj. N. Michler, 1867-71. **Rs.**, **67**, 521; **68**, 892; **69**, 495; **70**, 520; **71**, 975. Maj. O. E. Babcock, 1871-77. **Rs.**, **71**, 969; (Col.) **76**, ii, 690; **77**, ii, 1066. OPERATIONS.—1869. 2 spans rebuilt, 8 others repaired, and minor work done, **69**, 495. 1870-71. Damaged by freshet, 1870, repaired, **71**, 969. 1875-76. Repairs made, **76**, ii, 690. PROJECTS.—Br. in a dilapidated condition and only by the most careful attention on the part of the watchman could accidents be avoided, **67**, 521. TRAFFIC.—Large quantities of produce and thousands of head of cattle reach the Georgetown and Washington markets by this br., **68**, 892.

POTOMAC R., Georgetown, D. C. (Sp.) (Proposed.) ENGINEERS.—Chief of Engineers. **Rs.**, **82**, 263, 2013; **87**, 104, 905. Engineers in charge: S. T. Abert, U. S. C. E. **Rs.**, **82**, 2014, 2022, 2027. Lt. Col. P. C. Hains. **Rs.**, **87**, 898. LEGISLATION.—Br. au. by act Feb. 23, 1881, Congress app. \$140,000 therefor, **82**, 2012. Purchase of Aqueduct Br. au. at \$85,000, but found to be impracticable, **82**, 2012, 2018. Recom. legislation, **86**, 931; **87**, 899. Act June 21, 1886, providing for purchase and reconstr. of br., **87**, 899. PLANS.—Location discussed, **82**, 2015,

2023. Requirements of brs., **82**, 2024, 2027, 2033. Proposals received, **82**, 2023, 2026. Est. of cost, **82**, 2032. General description of Aqueduct Br. completed in 1868, **86**, 932; **87**, 898. Plans of new br., **87**, 902-908.

POTOMAC R., Little Falls. (Iron.) APPROPRIATIONS.—1872, \$100,000, **73**, 1159. CONTRACTS.—1872. S. R. Dickson, iron br. (bid within limit of app.), **73**, 1159. Contract annulled, **74**, ii, 392. 1873. Clark, Reeves & Co., br., **74**, ii, 392. ENGINEERS.—Engineers in charge: Col. O. E. Babcock, 1873-77. **Rs.**, **73**, 110, 1159; **74**, ii, 392; **75**, ii, 813; **77**, ii, 1070. Lt. Col. T. L. Casey, 1880. **R.**, **80**, 2342. Col. A. F. Rockwell, 1881-84. **Rs.**, **81**, 2715; **82**, 2738; **83**, 2101; **84**, 2346. Lt. Col. J. M. Wilson, 1885-86. **Rs.**, **85**, 2509; **86**, 2085. OPERATIONS.—1873. Old wooden span of this br. removed by Canal Co., **73**, 1159. 1873-74. Br. constr., **74**, ii, 392. 1874-75. 1,504' hand-rail placed and br. painted, **75**, ii, 813. 1880. Br. painted and roadway removed, **80**, 2342. 1881-82. Extensive repairs made, **81**, 2715; **82**, 2738. 1882-83. Guard timbers renewed and painted, **83**, 2101. 1884-86. Repairs made, **84**, 2346; **85**, 2509; **86**, 2085.

POTOMAC R., Shepherdstown, W. Va. (Sp.) (Norfolk & Western R. Co.) Au. act Feb. 5, 1907. PLANS.—Approv. June 26, 1907, **07**, 819.

POTOMAC R., Washington, D. C. (Memorial Br.) APPROPRIATIONS.—1899, \$5,000, **99**, 3779 (sur.). ENGINEERS.—Chief of Engineers. **Rs.**, **86**, 892; **98**, 540; **99**, 42, 627; **00**, 43, 704. BE. constituted by S. O. No. 30, Feb. 5, 1900, to consider and report upon the relative merits of the plans submitted for a br. to be constr. over the Potomac R. at Washington, D. C., as a memorial to American patriotism. **R.**, **00**, 5127. (Lt. Col. C. J. Allen, Maj. T. W. Symons, Capt. D. D. Gaillard, and S. White and Jas. G. Hill.) Engineers in charge: Maj. P. C. Hains, 1885, 1890. **Rs.**, **86**, 892; (Lt. Col.) **90**, 1045. Lt. Col. C. J. Allen, 1898-. **Rs.**, **98**, 3573; **99**, 3779; **00**, 5125. PHYSICAL CHARACTERISTICS.—Description of borings for site of br., **98**, 3576. PROJECTS.—Maj. Hains est., 1886, it would cost \$609,543 or \$650,000 to build a br. over the Potomac R., **86**, 895. Capt. Symons est., 1886, \$1,000,000 or \$1,500,000 to build a br. over the Potomac R. from Observatory Hill to Arlington, **86**, 896. Lt. Col. Hains est., 1890, \$3,591,000 to build a suspension br. at the place designated, **90**, 1047. Maj. Davis est., 1892, \$803,990 to constr. a br., plans similar to the ones prepared by Col. Hains, 1896, **98**, 3592. Lt. Col. Allen est., 1898, \$1,385,000 to build the br. at the place designated, **98**, 3598. Description of the main features of the various designs submitted for a memorial br., **00**, 5134-5142. BE., 1900, est. \$4,860,000, or 32% more than Mr. Burr's est. (\$3,680,672), by adopting Mr. Burr's design, with certain recom. and modifications, for a memorial br. across the Potomac R., **00**, 5146. SURVEYS.—Ex. as to the wisdom of constr. a U. S. br. with a suitable draw and approaches, from

¹ District of Columbia.

a point at or near the foot of New York or New Hampshire Avenue, on the public grounds, across the Potomac R. and Annapolis Isld. to a point on the U. S. National Cemetery grounds at Arlington, with est., au. by Senate resolution May 24, 1886; **R.** made, 1886, by Maj. Hains (see Projects), **86**, 893. **Ex.** in regard to the most suitable kind of br. from foot of New York Avenue across the Potomac R. to Arlington, with est., au. by Senate resolution Feb. 20, 1890; **R.** made, 1890, by Lt. Col. Hains (see Projects), **90**, 1045. Under Senate bill 796, secs. 2 and 3, 52d Cong., 1st sess., Dec. 14, 1891, Maj. Davis was ordered to give his views in reference to the plans and specifications, and submit plan of the proposed br. between U. S. Naval Observatory grounds and Arlington estate property (see Projects), **98**, 3592. Necessary surs., soundings, and borings, and securing designs and ests. for a memorial br. from the most convenient point of the Naval Observatory grounds, Washington, D. C., or adjacent thereto, across the Potomac R. to the most convenient point of the Arlington estate property, Va., au. act June 4, 1897; made, 1898, by Lt. Col. Allen (**R.** fav. to a further study of the subject; see Projects), **98**, 3574. History of previous ex. for a memorial br., **98**, 3590. Continuing ex. for a memorial br. across the Potomac R., and making or securing designs, calculations, and ests. for same, from the most convenient point of the Naval Observatory grounds or adjacent thereto across the Potomac R. to the most convenient point of the Arlington estate property, au. act Mar. 3, 1899, **99**, 3779. Maps. **90**, 1046.

POTOMAC R., "Three Sisters," near Washington, D. C. (Sp., etc.) (Washington & Arlington Ry. Co.) **LEGISLATION**.—Company au. to constr. br. by act Feb. 28, 1891, **92**, 405. **PLANS**.—Approv. Apr. 27, 1892, **92**, 405.

POTOMAC R., Washington, D. C. (Sp.) (Baltimore & Potomac R. R. Co.—Long Br.) Au. act Feb. 12, 1901. **PLANS**.—Constr. of br. to replace existing str. approv. Oct. 25, 1901, **02**, 582.

POTOMAC R., between Long Br. and Aqueduct Br., Washington, D. C. (Sp.) (U. S. highway br.) Au. acts Feb. 12, 1901, and July 1, 1902. **PLANS**.—Location approv. Aug. 1, 1902, and plans approv. Jan. 13, 1903, **03**, 643.

POTOMAC R., E. Branch of the. (A.) **APPROPRIATIONS**.—1887, \$110,000, **87**, 913. 1888, \$60,000, **88**, 798. Total, \$170,000. **CONTRACTS**.—1887. Broton Br. & Mfg. Co., br. constr., \$105,000, **88**, 795. 1890. W. Rothwell, watchman's house, \$333; guard fence, \$1.96 per s. y.; painting through spans, \$549, and wooden sidewalk constr., \$1.10 per l. f., **90**, 1050. W. H. Mohler, slope paving, \$2 per s. y.; curbing, \$1.48 per l. f.; gutters, 45¢ per s. y.; and riprap, 80¢ per c. y., **90**, 1050. **ENGINEERS**.—Chief of Engineers. **Es.**, **87**, 105, 340, 917; **88**, 106; **89**, 123; **90**, 110. **BE.** convened by S. O. No. 61, C. of E., 1887, to consider br. the E. Branch of the Potomac R. **R.**, **87**, 923. (Lt. Cols. Wilson and Hains and Maj. Lydecker.) Engineer in charge: Lt. Col. P. C. Hains, 1887-90. **Es.**, **87**, 911; **88**, 795, 798; **89**,

90; **90**, 1048. **LEGISLATION**.—Alterations in plan of br. au. by act May 14, 1888, **88**, 797. **OPERATIONS**.—1887-88. Work begun on e. approach. Operations suspended pending settlement of controversy with Baltimore & Potomac R. R. Co. **88**, 796. 1888-89. Operations resumed under amended plan, **89**, 992, 993. 1889-90. Br. completed; unexpended balance, \$14,000, used for necessary work not contracted for, **90**, 1049. **PROJECTS**.—Description of br., **87**, 912, 915, 918, 924; **88**, 796. **SURVEYS**.—Maps. **89**, 992.

POTOMAC R., Powder Mill Branch. (Wooden br.) 1878. Br. having been washed away, was towed back and replaced, **78**, ii, 1351.

POTSBURY CREEK, Fla. (0.) (St. Johns County br.) **PLANS**.—Specified alterations required on or before June 1, 1894, were completed, **94**, 431.

POUTEAU R. (See Petit Jean R.)

POWELLS CREEK, Va. (Dr.) **07**, 815.

POWELLS R., near Agee Post Office, Tenn. (Sp.) (Campbell County br.) Au. act Feb. 20, 1908. **PLANS**.—Approv. Apr. 24, 1908, **08**, 867.

POWELLS CREEK. (See Neabsco Creek.)

POWOW R., between Amesbury and Salisbury, Mass. (Sp.) (Berlin Iron Br. Co., afterwards committed to the commissioners of Essex County.) **91**, 427. **PLANS**.—Berlin Iron Br. Co. submitted plan for draw 56' wide, Mar. 11, 1889; approv. Mar. 23, 1889; being unsatisfactory to the towns, a plan for a leaf draw 35' wide was approv. Apr. 10, 1889. Essex County commissioners submitted plan for a pivot draw, instead of the leaf draw, Aug. 25, 1890; approv. Sept. 2, 1890. **91**, 427.

PROVIDENCE R., Point Street, Providence, R. I. (S.) (City br.) **PLANS**.—Rebuilding approv. May 18, 1905, **05**, 727.

PUGET SOUND, LAKES UNION and WASHINGTON (waterway connecting). (S.) (Brs. of the city of Seattle, Wash.—2.) **PLANS**.—2 temporary brs. approv. May 4, 1910, **10**, 1029.

PUGET SOUND and LAKES UNION and WASHINGTON, waterway connecting at city of Seattle, near Rass Place and Jesse Avenue, Wash. (Crossing canal and occupation of U. S. property sanctioned, act Mar. 22, 1912.) (S.) (Northern Pacific Ry. Co.) **PLANS**.—Approv. Aug. 16, 1911, **12**, 1300.

PUGET SOUND and LAKE WASHINGTON CANAL, Fremont Avenue, Seattle, Wash. (S.) (Seattle Electric Co.) **PLANS**.—Reconstr. approv. May 29, 1902, **02**, 589. Temporary trestle approv. Oct. 6, 1910, **11**, 1083.

PUGET SOUND and LAKE WASHINGTON CANAL, at 13th Avenue, Seattle, Wash. (S.) (City br.) **PLANS**.—Constr. of draw approv. Oct. 27, 1909, and the instrument of approv. modified Nov. 30, 1909, **10**, 1025.

PUGET SOUND and LAKE WASHINGTON CANAL and SALMON R., near Main Street, Seattle, Wash. (S.) (Great Northern Ry. Co.) **PLANS**.—Approv. July 3, 1909, **10**, 1023.

- PUNGO and PANTEGO CREEKS, N. C. (S.)** (Beaufort County brs.) PLANS.—Approv. Sept. 20, 1907, **08**, 870.
- PUNGO R., Bellhaven, N. C. (S.)** (Norfolk & Southern R. R. Co.) PLANS.—Approv. Aug. 31, 1906, **07**, 821.
- PUYALLUP R., Pierce County, Wash. (S.)** (Seattle-Tacoma Interurban Ry.) PLANS.—Approv. Aug. 13, 1901, **02**, 584.
- PUYALLUP R., Kelly Street, Puyallup, Wash. (S.)** (Puget Sound Electric Ry.) PLANS.—Approv. Apr. 17, 1908, **08**, 872.
- PUYALLUP R., near Tacoma, Wash. (S.)** (Oregon & Washington R. R. Co.) PLANS.—Approv. Dec. 21, 1906. Modified plans in lieu thereof approv. Dec. 9, 1907. **08**, 871.
- PUYALLUP R., Tacoma, Wash. (S.)** (Milwaukee & Puget Sound Ry. Co.) PLANS.—Approv. Mar. 15, 1909, **09**, 917.
- PUYALLUP R., S. 21st Street, Tacoma, Wash. (S.)** (City br.) PLANS.—Approv. Feb. 9, 1903, **03**, 648.
- PUYALLUP R., near Tacoma, Wash. (S.)** (Oregon & Washington R. R. Co.) PLANS.—Approv. Dec. 21, 1906, **07**, 824.
- PUYALLUP R., near Tacoma, Wash. (S.)** (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Approv. July 16, 1906, **07**, 820.
- PUYALLUP R., Tacoma, Wash. (S.)** (City br.) PLANS.—Approv. May 29, 1901, **01**, 666.
- PUYALLUP R., Tacoma, Wash. (S.)** (Northern Pacific Ry. Co.) PLANS.—Approv. Apr. 17, 1906, **06**, 806.
- PUYALLUP R., Tacoma, Wash. (S.)** (Oregon-Washington R. R. & Navigation Co.) PLANS.—Approv. Dec. 9, 1907, and modified plans July 21, 1911. Instrument dated Dec. 9, 1907, canceled. **12**, 1300.

Q.

QUANTICO CREEK. (See Neabsco Creek.)

QUANTICO CREEK, Va. (Dr.) **07**, 815.

QUINCY B., Quincy, Ill. (S.) (Chicago, Burlington & Quincy R. R. Co.) **PLANS.**—Reconstr. plans approv. Nov. 20, 1897, **98**, 533.

QUINNIPIAC R. (See Coscob, etc.)

QUINNIPIAC R., Conn. (Dr.) **02**, 581.

QUINNIPIAC R., Grand Avenue Crossing, New Haven, Conn. (O.) (City br.) **PLANS.**—Requiring a draw span with 70' opening, measured at right angles to the chan., to be completed on or before Dec. 31, 1896, **95**, 483.

QUINNIPIAC R., Middletown Avenue, New Haven, Conn. (S.) (Shore Line Electric Ry. Co. **PLANS.**—Approv. Feb. 7, 1911, **11**, 1086.

R.

- RACCOON CREEK, N. J.** (See Schuylkill R.)
- RACCOON CREEK, Bridgeport, N. J.** (S.) (Gloucester County br.) PLANS.—Br. to replace existing str. approv. Sept. 12, 1903, **04**, 714.
- RACCOON CREEK, Swedesboro, N. J.** (S.) (Gloucester County br.) PLANS.—Approv. May 31, 1911, **11**, 1089.
- RAHWAY R., N. J.** (S.) (Sound Shore R. R. Co.) PLANS.—Modified plans approv. Feb. 27, 1896, **96**, 426.
- RAHWAY R., Middlesex and Union Counties, N. J.** (S.) (New Jersey Short Line R. R. Co.) PLANS.—Approv. Aug. 22, 1905, **06**, 801.
- RAHWAY R., Lawrence Street, Rahway, N. J.** (S.) (Union County br.) PLANS.—Approv. May 23, 1912, **12**, 1307.
- RAINY R., Minn.** (Sp.) (Minnesota & Ontario Br. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 9, 1900. PLANS.—Approv. June 22, 1900, **00**, 699.
- RAINY R., International Falls, Minn.** (Sp.) (International Br. & Terminal Co.) Au. acts Feb. 7, 1903, and May 20, 1908. PLANS.—Approv. Sept. 1, 1909, **10**, 1020.
- RAINY R., Pithers Pt., Itaska County, Minn.** (Sp.) (Rainy River Br. Co.) Au. act Apr. 6, 1906. PLANS.—Approv. Jan. 8, 1907, **07**, 818.
- RANCOCAS CREEK, Delanco, N. J.** (S.) (Burlington County br.) PLANS.—Reconstr. plans approv. June 25, 1900, **00**, 701.
- RANCOCAS R., N. J.** (See Schuylkill R., etc.)
- RANCOCAS R., Bridgeboro, N. J.** (S.) (Burlington County br.) PLANS.—Reconstr. approv. June 21, 1909, **09**, 918.
- RANCOCAS R., Centerton, N. J.** (S.) (Burlington County br.) PLANS.—Br. to replace existing str. approv. Sept. 3, 1903, **04**, 714.
- RANCOCAS R., Delanco, N. J.** (S.) (Pennsylvania R. R. Co.) PLANS.—Approv. July 28, 1904, **05**, 723.
- RANCOCAS R., S. (Lumberton) Branch, Hainesport, N. J.** (S.) (Burlington County br.) PLANS.—For reconstr. of br. approv. July 10, 1895, **95**, 479.
- RANCOCAS R., Hainesport, Burlington County, N. J.** (S.) (Burlington County br.) PLANS.—Rebuilding approv. Jan. 10, 1903, **03**, 647.
- RANCOCAS R., Hainesport, N. J.** (S.) (Pennsylvania R. R. Co.) PLANS.—Approv. Jan. 9, 1911, **11**, 1085.
- RANCOCAS R., Washington Street, Mount Holly, N. J.** (S.) (Burlington County br.) PLANS.—Approv. July 27, 1904, **05**, 723.
- RANTOWLES CREEK, S. C. (O.)** (Charleston and Colleton Counties br.) PLANS.—Completion of required alterations reports on Jan. 25, 1899, **99**, 625.
- RANTOWLES CREEK, S. C. (O.)** (Br. of Charleston and Colleton Counties.) PLANS.—Alterations to be completed within 4 months from May 18, 1909, **09**, 920.
- RARITAN R., N. J., and tributaries.** (Dr.) **06**, 797.
- RARITAN R., Perth Amboy and South Amboy, N. J.** (S. and O.) (Middlesex County br.) PLANS.—Approv. May 31, 1902; rebuilding approv. June 20, 1905, **05**, 728. Alterations to be completed Dec. 15, 1906, **06**, 809.
- RARITAN R., Perth Amboy and South Amboy, N. J.** (S.) (New York & Long Branch R. R. Co.) PLANS.—Approv. Oct. 19, 1905, **06**, 803.
- RARITAN R., between South Amboy and Perth Amboy, N. J.** (S.) (Jersey Central Traction Co.) PLANS.—Approv. Dec. 24, 1909, **10**, 1026.
- RED BANK CREEK, near New Bethlehem, Pa.** (S.) (Fairmount Coal Co.) PLANS.—Approv. Nov. 12, 1908, **09**, 916.
- RED LAKE, East Grand Forks, Polk County, Minn.** (S.) (Polk County br.) PLANS.—Approv. Apr. 18, 1902, **02**, 588.
- RED LAKE R., Fisher, Polk County, Minn.** (S.) (Polk County br.) PLANS.—Approv. Mar. 10, 1902, **02**, 587.
- RED LAKE R., at Thief River Falls, Minn.** (Sp.) (Minneapolis, St. Paul & Sault Ste. Marie Ry. Co.) Au. act Apr., 1904. PLANS.—Approv. Sept. 2, 1904, **05**, 720.
- RED R., at or near Alexandria, La.** (Sp.) (Shreveport & Red River Valley Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 12, 1900. PLANS.—Approv. June 15, 1900, **00**, 698. Protection works approv. Dec. 11, 1902, **03**, 643.
- RED R., Upper Falls, near Alexandria, La.** (Sp.) (Houston, Central Arkansas & Northern R. R. Co.) BE. constituted by S. O. No. 82, Dec. 1, 1890. (Maj. A. M. Miller, Capt. J. H. Willard, and Capt. H. S. Taber.) LEGISLATION.—Company au. to constr. br. by act Aug. 6, 1888; amending act Aug. 18, 1890. PLANS.—Amended plan, protests made against the location referred to a BE., and upon its recom. of Dec. 16, 1890, was approv. Dec. 29, 1890, **91**, 430.
- RED R., near Alexandria, La.** (S.) (Missouri Pacific Ry. Co.) PLANS.—Reconstr. plans approv. Dec. 14, 1910, **11**, 1085.

RED R., Alexandria to Pineville, La. (Sp.) (Alexandria & Pineville Br. Co.) Au. act June 6, 1900. PLANS.—Approv. Aug. 8, 1900, **01**, 659. Protection work for the draw span approv. Feb. 9, 1903, **03**, 644.

RED R., Grand Ecure, La. (O.) (Natchitoches Ry. & Constr. Co., and Natchitoches Parish.) PLANS.—Alterations to be completed on or before Apr. 30, 1904, subsequently waived for a reasonable period, **04**, 721.

RED R., Okla. and Tex., 7 m. e. of Denison, Tex. (Sp.) (William Kenefick.) Au. act Jan. 28, 1910. PLANS.—Approv. Mar. 25, 1910, **10**, 1021.

RED R., Shreveport, La. (A.) PLANS.—Formation of sand bar under draw of br. an obstr. to navigation. No action taken for its removal by br. au. **87**, 339, 2671.

RED R., Shreveport, La. (Sp.) (Shreveport Br. & Terminal Co.) Au. act Apr. 30, 1902. PLANS.—Approv. Nov. 19, 1902, **03**, 643. Modified plans, in lieu of these heretofore approv. were approv. Jan. 11, 1905, **05**, 720.

RED R., at Shreveport, La. (Sp.) (City br.) Au. act Feb. 3, 1905. PLANS.—As amended, approv. Jan. 17, 1910, **10**, 1020.

RED R., Texas Street, Shreveport, La. (Sp.) (City br.) Au. act Feb. 3, 1905. PLANS.—Approv. Jan. 17, 1910, and new plans for br. at Jones instead of Texas Street approv. Apr. 12, 1911, **11**, 1080.

RED R., near Texarkana, Ark. (Sp.) (Texarkana & Fort Smith R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Jan. 20, 1897. PLANS.—Approv. Aug. 22, 1899, **99**, 620.

RED R., Turnbolls Isld., La. (Sp.) (Texas & Pacific Ry. Co.) Au. act Mar. 3, 1901. PLANS.—Approv. Sept. 4, 1901, **02**, 581, 582.

RED R. (Little), near Searcy, Ark. (S.) (White County br.) PLANS.—Approv. Sept. 16, 1910 **11**, 1083.

RED R. (Little), near Judsonia, Ark. (S.) (St. Louis, Iron Mountain & Southern Ry. Co.) PLANS.—Approv. Sept. 24, 1910, **11**, 1083.

RED RIVER OF THE NORTH, Drayton, N. Dak. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. by acts Feb. 28, 1900, **00**, 697; Jan. 16, 1911. PLANS.—Approv. Apr. 18, 1900, **00**, 697. Approv. Mar. 28, 1911, **11**, 1080.

RED RIVER OF THE NORTH, N. Dak. (Dr.) **11**, 1078.

RED RIVER OF THE NORTH, Fargo, N. Dak. (Sp.) (Fargo & Moorhead Steel Ry. Co.) Au. act May 6, 1910. PLANS.—Approv. Apr. 26, 1911, **11**, 1081.

RED RIVER OF THE NORTH, Des Mers Avenue, Grand Forks, Dak. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. by act May 21, 1888. PLANS.—Providing for trestlework approach on w. side of R., approv. Jan. 3, 1889; modification substituting filling for trestlework, approv. June 11, 1889, **89**, 370.

RED RIVER OF THE NORTH, Minnesota Avenue, Grand Forks, Dak. (Sp.) (City br.) LEGISLATION.—City au. to constr. br. by act May 21, 1888; amending act Mar. 1, 1889, **89**, 371. PLANS.—Approv. May 29, 1889, **89**, 371.

RED RIVER OF THE NORTH, Marshall County, Minn., and Walsh County, N. Dak. (Sp.) (Minneapolis, St. Paul & Sault Ste. Marie Ry. Co.) Au. act Jan. 24, 1905. PLANS.—Approv. Mar. 14, 1905, **05**, 721.

REDWOOD CREEK, Cal. (S.) (Redwood city br.) PLANS.—Approv. Feb. 11, 1910, **10**, 1027.

RICE CREEK, Fla. (S.) (Jacksonville, Tampa & Key West Ry. Co.) PLANS.—Reconstr. plans approv. July 22, 1899, **99**, 623.

RICES PT., chan. e. of, Duluth, Minn. (A.) PLANS.—P. built by the Eastern Minnesota Ry. Co. encroaching upon the chan., mayor of Duluth notified, but no action taken, **89**, 2798.

RIDLEY CREEK, near Chester, Pa. (See Schuylkill R.) (S.) (Baltimore & Ohio R. Co.) PLANS.—Reconstr. approv. Mar. 2, 1907, **07**, 825.

RIDLEY CREEK, Delaware County, Pa. (S.) (Chester & Philadelphia Ry. Co.) PLANS.—Approv. Aug. 10, 1910, **11**, 1082.

RIGOLETS, LA. (Dr.) **08**, 865.

RIO GRANDE R., Brownsville, Tex. (Sp.) (Brownsville & Gulf Ry. Co.) Au. acts May 20 and May 22, 1908. PLANS.—Approv. May 21, 1909, **09**, 913, 914.

RIO GRANDE R., between Laredo, Tex., and Nuevo Laredo, Mexico. (Sp.) (National Railways of Mexico.) Au. act Jan. 27, 1910. PLANS.—Approv. May 27, 1910, **10**, 1022.

ROANOKE R., near Weldon, N. C. (Sp.) (Northampton & Halifax Br. Co.) Au. act May 16, 1906. PLANS.—Approv. July 30, 1906, **07**, 816, 817.

ROCK CREEK, Massachusetts Avenue extended, Washington, D. C. (See Potomac R.) APPROPRIATION.—1897 (sur.), \$2,000, **98**, 3624. ENGINEERS.—Chief of Engineers. **R., 98**, 541. Engineer in charge: Capt. D. D. Gallard, 1898. **R., 98**, 3606. PROJECTS.—Capt. Gallard est., 1897, \$568,545 for the st. arch br., and \$199,204 for the steel br., **98**, 3612, 3622. Description of proposed br., **98**, 3610, 3614, 3616. SURVEYS.—Plans and est. of cost of erecting a st. arch br., and also a steel br. with st. foundations, over Rock Creek on the line of Massachusetts Avenue extended, the full width of said avenue, au. by act Mar. 3, 1897; made, 1897, by Capt. D. D. Gallard (see Projects), **98**, 3606.

ROCK CREEK, Pennsylvania Avenue, Washington, D. C. (See Potomac R.) (Br. No. 6, iron.) ENGINEERS.—Chief of Engineers. **R., 77**, 124. BE.¹ constituted by S. O. No. 8, dated Feb. 2, 1877, to ex. into the propriety of certain modifications of the Rock Creek Br., convened at Washington, Feb. 7, and at New

¹ Q. M. Gen. M. C. Meigs (designer and builder of Rock Creek Br.) resents criticisms. Letters, **77**, ii, 1093.

- York, Apr. 7, 1877. **Rs.**, 77, ii, 1099. (Col. Z. B. Tower, Lt. Cols. H. G. Wright and Q. A. Gillmore.) Engineers in charge: Maj. N. Michler, 1867-70. Col. O. E. Babcock, 1873-77. **Rs.**, 73, 1166; 74, ii, 400; 75, ii, 815; 76, ii, 694; 77, ii, 1095. Lt. Col. T. L. Casey, 1877-79. **Rs.**, 77, ii, 1103; 78, 1351; 79, 1885. Col. G. H. Elliot. 1892-94. **Rs.**, 92, 3361; 93, 4290; 94, 3203. Maj. J. G. D. Knight, 1895. **R.**, 95, 4105. Capt. D. D. Gaillard, 1896-97. **Rs.**, 96, 3914; 97, 3999. Capt. T. A. Bingham, 1898. **R.**, 98, 3630. Lt. Col. A. M. Miller, 1899-. **Rs.**, 99, 3785; 00, 5196. Assistant: T. B. Samo. **Rs.**, 67, 550; 68, 909; 69, 506; 70, 525. **LEGISLATION.**—Au. requested, 1873, by Col. Babcock to prevent further use of br. No. 6 over Rock Creek as a thoroughfare, except for use of pedestrians, and the cars of the Washington & Georgetown R. R., for such time to enable them to build a br. for their R. R., 73, 1166. Act Mar. 3, 1875, provided for removal, within 1 year from Mar. 2, 1875, of the Washington & Georgetown R. R. from br. No. 6, 75, ii, 815, 816. **OPERATIONS.—1867.** Br. No. 6 scraped and painted and some ornamental pieces, which had become detached, replaced, 67, 550. **1867-68.** New sidewalk built and masonry abutments repaired, 68, 909, **1869-75.** Br. painted and floor repaired, 69, 506; 75, ii, 815. **1878-80.** Br. repaired 78, 1351; 79, 1885; 80, 2345. **1892-93.** Wooden superstr. renewed 93, 4290. **1893-94.** Br. painted 94, 3203. **1894-95.** Br. repaired, 95, 4105. **1895-96.** New floor placed in br., 96, 3914. **1898-99.** Br. painted 99, 3785. **1899-00.** Floor renewed and br. painted 00, 5196. **PROJECTS.**—Col. Babcock est. 1876, \$70,000 to alter the Rock Creek Br. 76, ii, 694; 77, ii, 1098. Description of br. No. 6, 77, ii, 1096, 1099. Col. Casey est., 1877, \$75,000 to alter the road and footway over Rock Creek Br., 77, ii, 1104. **SURVEYS.**—Maps. 77, ii, 1100.
- ROCK R.,** Moline, Ill. (O.) (City br.) **ENGINEERS.**—Chief of Engineers. **R.**, 96, 428. **PLANS.**—Alterations required within 6 months from May 22, 1895. New hearing was granted, pending which the time of completion expired. New notice served requiring alteration to be made in one of the three methods described and be completed on or before Aug. 31, 1896. 96, 428.
- ROCK HOLE CREEK,** Md. (See Traceys Creek.)
- ROCKY R.,** Ohio. (S.) (New York, Chicago & St. Louis R. R. Co.) **PLANS.**—Rebuilding approv. May 16, 1906, 06, 807.
- ROCKYHOCK CREEK,** Chowan County, N. C. (S.) (County br.) **PLANS.**—Approv. June 7, 1910, 10, 1030.
- RONDOUT CREEK,** Kingston Station, N. Y. (S.) (West Shore R. R. Co. and New York Central & Hudson River R. R. Co.) **PLANS.**—Reconstr. approv. Jan. 30, 1902, 02, 586.
- ROOT R.,** Racine, Wis. (S.) (Chicago & North Western Ry. Co.) **PLANS.**—Br. to replace existing str. approv. Nov. 21, 1903, 04, 715.
- ROOT R.,** Herrick and Lafayette Avenues, Racine, Wis. (S.) (City br.) **PLANS.**—Approv. May 28, 1907, 07, 827.
- ROOT R.,** Main Street, Racine, Wis. (S.) (City br.) **PLANS.**—Rebuilding approv. Feb. 16, 1906, 06, 804.
- ROUGE R.,** Delray, Mich. (S.) (Detroit & Lime Northern Ry. Co.) **PLANS.**—Modified plans approv. Nov. 26, 1897, 98, 534.
- ROUGE R.,** Delray, Mich. (S.) (Solvay Process Co.) **PLANS.**—Approv. June 28, 1902, 02, 589.
- ROUGE R.,** near Detroit, Mich. (S.) (Wabash R. R. Co.) **PLANS.**—For new br. submitted Nov. 3, 1892; approv. Feb. 16, 1893, on condition that the old br. and central p. be removed, 93, 468.
- ROUGE R.,** Dix Avenue, Mich. (O. and S.) (Ecorse and Springwells Townships' br.) **PLANS.**—Br. to be removed or provided with a draw of 85' on or before May 15, 1900, 00, 702. Approv. Feb. 5, 1901, 01, 664.
- ROUGE R.,** Fort Street, Mich. (Ecorse and Springwells Townships' br.) **PLANS.**—For new br. approv. Jan. 5, 1900, 00, 700.
- ROUGE R.,** Oakwood, Mich. (S.) (Detroit, Monroe & Toledo Short Line Ry. Co.) **PLANS.**—Approv. Apr. 12, 1904, 04, 717.
- ROUGE R.,** River Road Crossing, Wayne County, Mich. (S.) (Ecorse and Springwells Townships' br.) **PLANS.**—Approv. Aug. 27, 1895, on condition that a chan. be dr. through one of the draw passages to communicate with the R. chan. above and below, 95, 480.
- RUNYANS CREEK,** N. C. (S.) (Washington & Plymouth R. R. Co.) **PLANS.**—Approv. Aug. 22, 1901, 02, 584.

S.

SABINE-NECHES CANAL, Port Arthur, Tex. (S.) (Port Arthur Pleasure Pier Co.) PLANS.—Reconstr. of existing temporary br. approv. Aug. 9, 1911, **12**, 1300.

SABINE R., La. and Tex. (Dr.) **08**, 865.

SACHEM BROOK, Quincy, Mass. (S.) (State br.) PLANS.—Approv. Oct. 18, 1905, **06**, 802.

SACRAMENTO R., Cal. (S.) (Br. of Mr. J. E. Terry.) PLANS.—Approv. Dec. 27, 1902, **03**, 647.

SACRAMENTO R., Balls Ferry, Shasta County, Cal. (S.) (County br.) PLANS.—Approv. Dec. 8, 1896, **97**, 533.

SACRAMENTO R., Butte City, Cal. (A.) PLANS.—Br., if built at the locality contemplated, would form a serious obstr. to navigation **88**, 2652.

SACRAMENTO R., Butte City, Cal. (S.) (Glenn County br.) PLANS.—Approv. Jan. 4, 1893; completion of br. reported on June 22, 1893, **93**, 467. Approv. Sept. 6, 1904, **05**, 724.

SACRAMENTO R., Chico Landing, Cal. (S.) (Northern Electric Ry. Co.) PLANS.—Approv. Apr. 29, 1907, **07**, 827. Permission for constr. of temporary br. granted June 24, 1911, **11**, 1090. Permission for reconstr. of temporary br. granted May 3, 1912, **12**, 1307.

SACRAMENTO R., Colusa, Cal. (S.) (Colusa County br.) PLANS.—Reconstr. plans approv. July 20, 1899, **99**, 623.

SACRAMENTO R., Grand Isld., Cal. (S.) (Sacramento County br.) PLANS.—Approv. Feb. 20, 1905, **05**, 726.

SACRAMENTO R., Hamilton and Chico, Cal. (S.) (Br. of Butte and Glenn Counties.) PLANS.—Approv. Feb. 26, 1908, **08**, 872.

SACRAMENTO R., Knights Landing, Cal. (S.) (Southern Pacific R. R. Co.) PLANS.—Rebuilding approv. Dec. 3, 1901, **02**, 586.

SACRAMENTO R., Meridian, Cal. (S.) (Northern Electric Ry. Co.) PLANS.—Approv. Mar. 19, 1912, **12**, 1306.

SACRAMENTO R., Sacramento, Cal. (S.) (California Pacific R. R. Co.) PLANS.—Reconstr. plans approv. June 11, 1895, **95**, 479.

SACRAMENTO R., at M Street, Sacramento, Cal., to town of Washington, Cal. (S.) (Northern Electric Ry. Co.) PLANS.—Approv. July 7, 1910, **11**, 1081.

SACRAMENTO R., Tehama, Cal. (O. and A.) (Southern Pacific Co. and Central Pacific R. R. Co.) PLANS.—Specified alterations to be completed on or before Dec. 31, 1898, **98**, 428. Plans approv. Feb. 23, 1898, **98**, 537. Rebuilding remainder of br. approv. May 22, 1901, **01**, 666.

Alterations to be completed on or before Dec. 31, 1911, **10**, 1032.

SACRAMENTO R., C Street, Tehama, Cal. (S.) (County br.) PLANS.—Approv. Feb. 8, 1910, and modified plans approv. May 9, 1910, **10**, 1030.

SACRAMENTO R., between Washington, at D or Ann Streets, and the city of Sacramento, Cal. (S.) (Southern Pacific Co.) PLANS.—Reconstr. of an existing br. approv. Apr. 1, 1910, **10**, 1029.

SAG B. and **SAG H. COVE**, N. Y. (inlet connecting). (S.) (Suffolk County br.) PLANS.—Rebuilding approv. Aug. 29, 1900, **01**, 662.

SAGINAW R., near Bay City, Bay County, Mich. (S.) (Interurban Ry. Co.) PLANS.—Modified plan and map of new location approv. Jan. 15, 1896, **96**, 425.

SAGINAW R., Bay City, Mich. (S.) (Detroit & Mackinac Ry. Co.) PLANS.—Approv. Feb. 18, 1896, **96**, 426.

SAGINAW R., near Bay City, Mich. (S.) (Michigan Central R. R. Co.) PLANS.—Approv. Aug. 3, 1904, **05**, 723.

SAGINAW R., Bay City, Mich. (S.) (Bay City Terminal Ry. Co.—Grand Trunk Ry. system.) PLANS.—Approv. July 19, 1911, **12**, 1299. Modified plans approv. Jan. 13, 1912. Instrument dated July 19, 1911, revoked, **12**, 1304.

SAGINAW R., Bristol Street, Saginaw, Mich. (A.) (Central Br. Co.) **95**, 480. PLANS.—Br. damaged by cyclone in Sept., 1894, and repaired without lawful au.; complaint made that br. was an obstr. to navigation; permission given company to allow the constr.; approv. Nov. 16, 1894, to remain temporarily on condition that all obstrs. be removed by the opening of spring navigation, and the br. be reconstr. by that time, **95**, 480.

SAGINAW R., Court Street, Saginaw, Mich. (S.) (City br.) PLANS.—Approv. Mar. 2, 1898, **98**, 534.

SAGINAW R., Saginaw, Mich. (S.) (City br.) PLANS.—Approv. Sept. 4, 1903, in lieu of approv. given June 9, 1902, to plans previously presented, **04**, 714.

SAGINAW R., Center Street, Saginaw, Mich. (S.) (City br.) PLANS.—Approv. Aug. 23, 1904, **05**, 723.

SAGINAW R., Genessee Avenue, Saginaw, Mich. (S.) (City br.) PLANS.—Rebuilding approv. June 9, 1902, **02**, 589.

SAGINAW R., 6th Street, Saginaw, Mich. (S.) (City br.) PLANS.—Approv. Aug. 23, 1904, **05**, 723.

ST. AUGUSTINE CREEK. (See Ashley R.)

ST. AUGUSTINE CREEK, Ga. (Dr.) **06**, 797.

ST. AUGUSTINE CREEK, on line of Savannah & Tybee R. R., Ga. (O.) (Central of Georgia Ry. Co.) PLANS.—Alterations to be completed within 3 months from Oct. 23, 1902, **03**, 652.

ST. CHARLES R., between Boston and Cambridge, at Cottage Farm, Mass. (S.) (New York Central & Hudson River R. R. Co., lessee of Boston & Albany R. R.) PLANS.—Reconstr. plans approv. Jan. 30, 1911, **11**, 1086.

ST. CLAIR LAKE, Northwest Corner, Mich. (S.) (Rapid R. R. Co.) PLANS.—Embankment, trestle, and drawbr. approv. Jan. 25, 1898, **98**, 534.

ST. CROIX R., between Burnett County, Wis., and Pine County, Minn. (Sp.) (Minneapolis, St. Paul & Sault Ste. Marie Ry. Co.) Au. act Aug. 10, 1911. PLANS.—Approv. Sept. 14, 1911, **12**, 1296.

ST. CROIX R., Hudson, Wis. (Sp.) (Br. of H. L. North, W. E. Webster, and H. J. Anderson.) Au. act Feb. 18, 1911. PLANS.—Approv. Aug. 17, 1911, **12**, 1295.

ST. CROIX R., Wis. and Minn. (Dr.) **09**, 912.

ST. CROIX R., Stillwater, Minn. (S.) **COMMERCE**.—Br. would not materially obstr. navigation, **76**, ii, 315. **ENGINEERS**.—Chief of Engineers. **Rs.**, **76**, i, 92. Approv. recom. of Maj. Farquhar, **76**, ii, 313. **LEGISLATION**.—Br. au. by Minnesota, **76**, ii, 315. PLANS.—Description of br., **76**, ii, 315. Maj. Farquhar recom. br. be raised 2'. **R.**, **76**, ii, 315. Approv. by Sec. of War, **76**, ii, 314.

ST. CROIX R., Wis. and Minn. (Sp.) (Chippewa Falls & Western Ry. Co.) **LEGISLATION**.—Au. by act Apr. 28, 1884, **84**, 270. PLANS.—Approv. May 8, 1884, **84**, 271.

ST. CROIX R., Wis. and Minn. (from e. bank in St. Croix County, Wis., to w. bank in Washington County, Minn.). (Sp.) (Wisconsin Central Ry. Co.) Au. act Mar. 12, 1911; reenacted Aug. 17, 1911. PLANS.—Approv. Sept. 9, 1911, **12**, 1296.

ST. CROIX R., Osceola, Wis. (Sp.) (Village br.) **LEGISLATION**.—Village au. to constr. br. by act Aug. 27, 1894. PLANS.—Approv. Sept. 23, 1895, **96**, 422.

ST. CROIX R., between Taylors Falls, Minn., and St. Croix Falls, Wis. (Sp.) (Village br.) Au. act Mar. 26, 1910. PLANS.—Reconstr. approv. May 27, 1910, and modification of permit approv. June 21, 1910, **10**, 1023.

ST. FRANCIS LAKE, near Lake City, Ark. (Sp.) (Jonesboro, Lake City & Eastern R. R. Co.) **LEGISLATION**.—Company au. to constr. br. by act June 16, 1898. PLANS.—Approv. Aug. 8, 1898, **98**, 532.

ST. FRANCIS LAKE, at or near Lake City, Ark. (Sp.) (St. Francis Br. & Turnpike Co.) **LEGISLATION**.—Company au. to constr. br.

by act Mar. 6, 1896. PLANS.—Approv. Aug. 24, 1897, **97**, 531.

ST. FRANCIS R. (See Petit Jean R.)

ST. FRANCIS R., Ark. (O.) (St. Louis, Arkansas & Texas R. R. Co.) PLANS.—Alterations required by Sept. 1, 1889, **89**, 377. Notice served as to alterations required, **90**, 342.

ST. FRANCIS R., Ark. (Dr.) **07**, 815.

ST. FRANCIS R., Ark. (Sp.) (St. Louis, Iron Mountain & Southern Ry. Co.) Au. act Aug. 15, 1911. PLANS.—Approv. Sept. 1, 1911, **12**, 1296.

ST. FRANCIS R., where secs. 21 and 28, T. 19 N., R. 9 E., Clay County, Ark., touches said R. (Sp.) (Campbell Lumber Co.) Au. act Feb. 23, 1906. PLANS.—Approv. May 31, 1906, **06**, 800.

ST. FRANCIS R., Fisk, Mo. (Sp.) (Br. of Butler and Stoddard Counties.) Au. act May 6, 1910. PLANS.—Approv. Apr. 24, 1911, **11**, 1081.

ST. FRANCIS R., below Kennett, Mo. (A.) (Paragould Southeastern R. R. Co.) PLANS.—Br., constr. without au., being an unreasonable obstr., the Atty. Gen. instituted proceedings, under sec. 10, act Sept. 19, 1890, against the company; plans providing for a draw in the br. approv. Mar. 26, 1895, **95**, 481.

ST. FRANCIS R., in Lee County, Ark. (Sp.) (Memphis, Helena & Louisiana Ry. Co.) Au. act Feb. 18, 1903. PLANS.—Approv. Apr. 20, 1903, **03**, 644.

ST. FRANCIS R., Madison, Ark. (Sp.) (St. Francis County br.) Au. act Jan. 16, 1908. PLANS.—Approv. Mar. 10, 1908, **08**, 867.

ST. FRANCIS R., at Marked Tree, Ark. (Sp.) (Poinsett County br.) Au. act Feb. 2, 1904. PLANS.—Approv. July 6, 1905, **06**, 798.

ST. FRANCIS R., near Parkin, Ark. (Sp.) (St. Louis, Iron Mountain & Southern Ry. Co.) Au. act Feb. 19, 1910. PLANS.—Reconstr. approv. Mar. 15, 1910, **10**, 1021.

ST. FRANCIS R., at or near St. Francis, Ark. (Sp.) (A. R. Vanmatre.) Au. act Mar. 3, 1903. PLANS.—Approv. Mar. 26, 1903, **03**, 644.

ST. JOHNS R., at Cooks Ferry, near outlet of Lake Harney, Fla. (Florida East Coast Ry. Co.) PLANS.—Approv. Jan. 11, 1911, **11**, 1085.

ST. JOHNS R., Buffalo Bluff, Fla. (Sp., etc.) (Jacksonville, Tampa & Key West Ry. Co.) **LEGISLATION**.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Florida. PLANS.—New br. approv. July 20, 1892, **92**, 407.

ST. JOHNS R., foot of Lake Monroe, Fla. (S.) (Jacksonville, Tampa & Key West Ry. Co.) PLANS.—Reconstr. plans approv. June 1, 1893, **93**, 469.

ST. JOHNS R., Fla. (Dr.) **03**, 642; **11**, 1078.

ST. JOHNS R., Geneva Ferry, Orange County, Fla. (S.) (Orange County brs.) PLANS.—Approv. Dec. 21, 1911, **12**, 1303.

- ST. JOHNS R.**, Palatka, Fla. (S.) (Jacksonville, St. Augustine & Indian River Ry. Co.) PLANS.—Reconstr. of br. submitted Sept. 1, 1894; modified Sept. 20, 1894; approv. Oct. 9, 1894, **95**, 477.
- ST. JOHNS R.**, Palatka, Fla. (S.) (Putnam County br.) PLANS.—Approv. Feb. 6, 1909, **09**, 917.
- ST. JONES R.** (See Christiana R. and—.)
- ST. JOSEPH H.**, St. Joseph, Mich. (A.) (Ry.) COMMERCE.—Br. a serious obstr. to navigation, **76**, ii, 317. ENGINEERS.—BE. convened at St. Joseph, Mich., June 10, 1875. Recom. modifications of br., **76**, ii, 317. (Majs. Houston, Gillespie, and Mansfield.) PLANS.—Description of br., **76**, ii, 316.
- ST. JOSEPH R.**, near mouth, Mich. (A. and O.) (Chicago & West Michigan Ry. Co.) **89**, 375; **90**, 340; **92**, 411; **93**, 471. LEGISLATION.—Sec. of War approv., May 17, 1889, recom. that the alterations being made in the draw be put to trial, **89**, 375, 2801. PLANS.—On Dec. 4, 1888, alterations were ordered, and a draw with openings of 100' each constr. Removal of obstrs. in draw, required by Apr. 30, 1889, **89**, 375, 2801; **90**, 340. Removal of obstrs. to 15' on or before May 15, 1892, and also constr. of an addl. draw on or before Nov. 1, 1892, **92**, 411. On company's protest, after removal of obstr., Sec. of War deferred constr. of n. draw; alterations made in 1888 and 1891, approv. Feb. 9, 1893, **93**, 471.
- ST. JOSEPH R.**, near St. Joseph, Mich. (A.) (Ry.) PLANS.—Description of br., **88**, 2585. Capt. Lockwood proposed to replace the existing s. draw with a pivot draw having clear openings of 100', **88**, 2585.
- ST. JOSEPH R.**, St. Joseph to Benton H., Mich. (A.) PLANS.—3 wooden brs., more or less an obstr. to navigation, **89**, 2801, 2802.
- ST. JOSEPH R.**, Mich. (S.) (St. Joseph Valley Ry. Co.) PLANS.—Approv. Mar. 11, 1897, **97**, 533.
- ST. JOSEPH R.**, St. Joseph, Mich. (Sp.) (Indiana, Illinois & Iowa R. R. Co.) Au. act Feb. 18, 1901: PLANS.—Approv. Feb. 27, 1901, **01**, 660.
- ST. JOSEPH R.**, near its mouth, Berrien County, Mich. (Sp.) (Berrien County br.) Au. act Mar. 2, 1905. PLANS.—Approv. Mar. 23, 1905, **05**, 721.
- ST. JOSEPH R.**, State Street, St. Joseph, Mich. (Sp.) (City br.) Au. act Mar. 6, 1908. PLANS.—Approv. Mar. 20, 1908, **08**, 867.
- ST. JOSEPH R.**, Wayne Street, St. Joseph, Mich. (S.) (City br.) PLANS.—Reconstr. approv. Mar. 24, 1908, **08**, 872.
- ST. LAWRENCE R.**, near Hogansburg, N. Y. (Sp.) (Northern New York R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Mar. 2, 1897. PLANS.—Approv. Aug. 21, 1897, **97**, 531.
- ST. LAWRENCE R.**, Morristown, N. Y. (Sp.) (St. Lawrence Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 9, 1893, **94**, 425. PLANS.—Approv. Feb. 6, 1894, **94**, 425. Modified plans approv. Aug. 29, 1895, **95**, 476.
- ST. LOUIS B.**, between Rices Pt. and Connors Pt., Duluth H., Minn. (S.) (Great Northern Ry. Co.—Interstate br.) PLANS.—Reconstr. approv. Apr. 1, 1907, **07**, 826.
- ST. LOUIS B.**, between Duluth, Minn., and Superior, Wis. (S.) (Northern Pacific Ry. Co.) PLANS.—Reconstr. approv. Jan. 22, 1907, **07**, 824.
- ST. LOUIS R.**, Connors Pt., Wis., to Rices Pt., Minn. (Sp.) (Duluth & Superior Br. Co.) LEGISLATION.—Company au. to constr. br. by act Apr. 24, 1894; amending act Aug. 4, 1894, **95**, 475. PLANS.—Temporary br. approv. Dec. 15, 1894, **95**, 477. Approv. Apr. 10, 1895, **95**, 475.
- ST. LOUIS R.**, Duluth, Minn., to Superior, Wis. (S.) (Superior Rapid Transit Ry. Co., and the Duluth Street Ry. Co.) PLANS.—Temporary pile and trestle br. approv. Nov. 23, 1895, **96**, 425. Temporary pile and trestle br. approv. Nov. 20, 1896, **97**, 533.
- ST. LOUIS R.**, between Duluth, Minn., and Superior, Wis. (Sp.) (Northern Pacific Ry. Co.—Grassy Pt. br.) Au. act Jan. 3, 1887. PLANS.—Br. to replace existing str. approv. May 10, 1909, **09**, 913.
- ST. LOUIS R.**, near Duluth, Minn., and Superior, Wis. (Sp.) (Interstate Transfer Ry. Co.) Au. act Feb. 20, 1908. PLANS.—Approv. Mar. 16, 1908, **08**, 867.
- ST. LOUIS R.**, about 12 m. above Superior, Wis. and Minn. (Sp., etc.) (Superior Belt Line & Terminal Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 24, 1891, **92**, 403. PLANS.—Duluth, Red Wing & Southern R. R. Co. relinquished its right, granted by act Feb. 24, 1891, to the other beneficiary of the act whose modified plans were approv. Dec. 26, 1891, **92**, 403.
- ST. LOUIS R.**, from Grassy Pt., Minn. (O.) (St. Paul & Duluth Ry. Co.) PLANS.—Alterations required by Sept. 1, 1889, **89**, 376. Notice served as to required alteration; Atty. Gen. notified that the alterations were not made in the required time, **90**, 342.
- ST. LOUIS R.**, at Rices Pt., Minn., and Connors Pt., Wis. (S.) (Northern Pacific Ry. Co.) PLANS.—Reconstr. approv. Mar. 24, 1906, **06**, 805.
- ST. LOUIS R.**, Minn. and Wis. (Sp.) (Northern Pacific R. R. Co.) ENGINEERS.—BE. convened to consider and R. upon plan and location of br., **85**, 1928. Board recom. approv. of plans with following modifications: Omission of open span between the draw span and Rices Pt., and that the company shall constr., whenever required, a draw near the Wisconsin shore, **85**, 1930. (Lt. Col. Poe, Majs. Mackenzie and

- Allen.) **LEGISLATION**.—Br. au. by act Feb. 27, 1873, **85**, 293. Requirements of act, **85**, 1927. **PLANS**.—Reason for change in location proposed by R. R. company, **85**, 1925, 1927. Plan described as proposed by R. R. company, **85**, 1929. Modifications recom. by BE., **85**, 1930. Draw on Wisconsin side subsequently provided for, **85**, 1935.
- ST. LOUIS R.**, Wis. (Sp.) (Wisconsin & New Duluth Br. Co.) **LEGISLATION**.—Company au. to constr. br. by act Mar. 2, 1895. **PLANS**.—Modified plans approv. Feb. 27, 1896, **96**, 423.
- ST. LUCIE R.**, Fla. (Dr.) **03**, 642.
- ST. LUCIE R.**, Fla. (S.) (Jacksonville, St. Augustine & Indian River Ry. Co.) **PLANS**.—Approv. Aug. 15, 1893, **93**, 471.
- ST. LUCIE R.**, Kitchens and Fosters Pts., Fla. (S.) (Florida East Coast Ry. Co.) **PLANS**.—Reconstr. approv. May 13, 1905, **05**, 727.
- ST. MARKS R.** and **LITTLE ST. MARKS R.**, Fla. (S.) (Apalachicola Northern R. R. Co.) **PLANS**.—Approv. Dec. 29, 1905, **06**, 803.
- ST. MARTINS R.**, near Bishopville, Md. (O.) (Worcester County br.) **PLANS**.—Alterations to be completed on or before June 30, 1910, **10**, 1032.
- ST. MARYS FALLS CANAL**. (See St. Marys R.)
- ST. MARYS R.**, Ga. and Fla. (Sp.) (Florida Central & Peninsular R. R. Co.) **LEGISLATION**.—Constr. au. Feb. 14, 1893, **93**, 464. **PLANS**.—Approv. Mar. 28, 1893, **93**, 464.
- ST. MARYS R.**, near Folkston, Ga. (Sp.) (Atlantic Coast Line R. R. Co.) Au. act Dec. 23, 1880. **PLANS**.—Br. to replace existing str. approv. Mar. 2, 1908, **08**, 867.
- ST. MARYS R.** and **ST. MARYS FALLS CANAL**, at the rapids of the St. Marys R., Mich. (Sp.) (Sault Ste. Marie Br. Co.) **88**, 308; **91**, 3869. **LEGISLATION**.—Constr. au. by act July 8, 1882, **88**, 2461; **91**, 3869. **PLANS**.—Lt. Col. Poe approv. location of br. as proposed, **88**, 2458.
- SAKONNET** or **SEACONNET R.**, Tiverton, R. I. (O.) (Old Colony R. R. Co.) **PLANS**.—Specified alterations required on or before July 1, 1894. On July 1, 1894, further specified alterations required. **93**, 474.
- SAKONNET R.**, R. I. (Dr.) **02**, 581; **11**, 1078.
- SAKONNET R.**, R. I. (See Sakonnet R.—p. 120 of this Index.) (Stone br.)
- SAKONNET R.**, Tiverton, R. I. (A. and O.) (New York, New Haven & Hartford R. R. Co.) **98**, 538; **99**, 624. **PLANS**.—Specified alterations to be completed on or before May 1, 1899, **98**, 538. Proceedings were instituted against company; plans in accordance with specified requirements approv. Jan. 16, 1899, **99**, 624.
- SAKONNET R.**, Tiverton and Portsmouth, R. I. (S.) (State br.—st. br.) **PLANS**.—Reconstr. approv. Feb. 28, 1905, **05**, 726.
- SALEM CREEK**, Course Landing, N. J. (O.) (Salem County br.) **PLANS**.—Alterations to be completed on or before July 1, 1908, **07**, 829.
- SALEM R.** (See Schuylkill R.)
- SALINE R.** (See Petit Jean R.)
- SALINE R.**, Ashley and Bradley Counties, Ark. (S.) (Little Rock & Southern Ry. Co.) **PLANS**.—Approv. Oct. 5, 1905, **06**, 802.
- SALKAHATCHIE R.** (See Ashley R.)
- SALMON B. WATERWAY**, w. of the U. S. Canal Reservation, in the vicinity of 34th Avenue NW., Seattle, Wash. (S.) (Washington R. R. Co.) **PLANS**.—Approv. Jan. 17, 1910, **10**, 1026.
- SALMON B. WATERWAY**, w. of the U. S. Canal Reservation, in the vicinity of 34th Avenue NW., Seattle, Wash. (S.) (Great Northern Ry. Co.) **PLANS**.—Approv. Jan. 17, 1910, **10**, 1026.
- SALMON R.**, East Haddon, Conn. (S.) (Moodus & East Hampton Ry. Co.) **PLANS**.—Approv. Aug. 20, 1900, **01**, 662.
- SALMONS ISLD. THOROFARE**, N. J. (S.) (Long Beach Turnpike Co.) **PLANS**.—Approv. Mar. 14, 1912, **12**, 1306.
- SALT R.**, Shepherdsville, Ky. (S.) (Bullitt County br.) **PLANS**.—Approv. Aug. 29, 1905, **06**, 801.
- SALT R.**, Shepherdsville, Ky. (S.) (Louisville & Nashville R. R. Co.) **PLANS**.—Reconstr. approv. June 30, 1909, **09**, 919.
- SALT R.**, near West Point, Ky. (S.) (Louisville, St. Louis & Texas Ry. Co.) **PLANS**.—Modified plans approv. May 15, 1893, **93**, 469.
- SALT R.**, West Point, Ky. (S.) (Illinois Central R. R. Co.) **PLANS**.—Reconstr. approv. Apr. 27, 1909, **09**, 918.
- SALT R.**, West Point, Ky. (S.) (Br. of Hardin and Jefferson Counties.) **PLANS**.—Approv. July 19, 1911, **12**, 1299.
- SAMMAMISH R.** (Squak Slough) below Bothell, Wash. (O.) (King County br.) **PLANS**.—Alterations to be completed on or before Oct. 1, 1909, **09**, 919.
- SANALICUM CREEK**. (See Whatcum Creek.)
- SAN BERNARDO R.**, Tex. (S.) (St. Louis, Brownsville & Mexico Ry. Co.) **PLANS**.—Approv. Oct. 6, 1905, **06**, 802.
- SAN BERNARD R.**, Churchills Ferry, Tex. (S.) (Brasoria County br.) **PLANS**.—Approv. Nov. 7, 1893; reported completed, **94**, 426.
- SAN BERNARDO R.**, Hinkle Ferry, Tex. (S.) (Brasoria County br.) **PLANS**.—Approv. Aug. 14, 1911, **12**, 1300.
- SANDUSKY B.**, Ohio. (Sp., etc.) (Lake Shore & Michigan Southern Ry. Co.) **LEGISLATION**.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Ohio, **92**, 403. **PLANS**.—Orig. plans approv. Jan. 16, 1892, **92**, 403. Modified plans approv. Nov. 23, 1892, **93**, 466.

SAN FRANCISCO, CAL., Channel Street waterway at 3d and Kentucky Streets. (S.) (City br.) PLANS.—Approv. Nov. 23, 1903, **04**, 715.

SAN FRANCISCO B., Dumbarton or Potrero Pt., Cal. (S.) (Southern Pacific Co.) PLANS.—Approv. Nov. 14, 1906, **07**, 823.

SAN FRANCISCO B., Dumbarton Pt., Cal. (S.) (Southern Pacific Co.) PLANS.—Approv. Nov. 24, 1906; modified plans approv. June 2, 1909, **09**, 916.

SAN GABRIEL (Los Angeles) **R.**, Long Beach, Cal. (O.) (San Pedro, Los Angeles & Salt Lake R. R. Co.) PLANS.—Alterations to be completed on or before 9 months from Dec. 11, 1906, **07**, 829.

SAN JACINTO R., Tex. (S.) (Houston, Beaumont & New Orleans R. R. Co.) PLANS.—Approv. Feb. 4, 1903, **03**, 648.

SAN JACINTO R., near Stafford, Tex. (S.) (Harris County br.) PLANS.—Approv. Apr. 25, 1908, **08**, 872.

SAN JOAQUIN R., Cal. (S.) (Alameda & San Joaquin R. R. Co.) PLANS.—Approv. Sept. 23, 1895, **96**, 424.

SAN JOAQUIN R., Cal. (S.) (Central Pacific R. R. Co.) PLANS.—Reconstr. of br. submitted Apr. 19, 1895; modified May 7, 1895; approv. May 21, 1895, **95**, 478.

SAN JOAQUIN R., Brandts Ferry, Cal. (S.) (San Joaquin County br.) PLANS.—Approv. July 18, 1900, **01**, 661.

SAN JOAQUIN R. (Burns Cut-off), Cal. (S.) (San Joaquin County br.) PLANS.—Approv. Jan. 2, 1901, **01**, 664.

SAN JOAQUIN R., near Dospalos, Cal. (S.) (Merced County br.) PLANS.—Approv. June 7, 1904, **04**, 719.

SAN JOAQUIN R., Durhams Ferry, Cal. (S.) (County br.) PLANS.—Approv. Jan. 2, 1901, **01**, 664.

SAN JOAQUIN R., Garwood Ferry Crossing, Cal. (S.) (San Joaquin County br.) PLANS.—Approv. Jan. 3, 1893, **93**, 467.

SAN JOAQUIN R., near Grayson, Cal. (S.) (Stanislaus County br.) PLANS.—Approv. Sept. 29, 1892; completion of br. reported on June 10, 1893, **93**, 466.

SAN JOAQUIN R., Hills Ferry, Cal. (S.) (Stanislaus and Merced Counties' br.) PLANS.—Approv. July 27, 1899, **99**, 623. New plans approv. May 27, 1901, **01**, 666.

SAN JOAQUIN R., at Roberts and Rough and Ready Islds., Cal. (S.) (San Joaquin County br.) PLANS.—Approv. Feb. 23, 1906, **06**, 804.

SAN JOAQUIN R., near Stockton, Cal. (S.) (San Francisco & San Joaquin Valley R. R. Co.) PLANS.—Approv. Sept. 1, 1898, **99**, 620.

SAN JUAN H., Porto Rico. (Sp.) (Behn Bros.) Au. act Feb. 25, 1909. PLANS.—Approv. Apr. 29, 1909; modified plans approv. Oct. 21, 1909, **10**, 1020.

SAN LEANDRO B., Alameda, Cal. (S.) (Southern Pacific Co.) PLANS.—Rebuilding approv. Aug. 7, 1903, **04**, 713.

SAN LEANDRO B., chan. connecting with San Francisco B. between Alameda and Bay Farm Isld., Alameda County, Cal. (S.) (Alameda County br.) PLANS.—Br. to replace existing str. approv. Sept. 22, 1902, **03**, 646.

SAN RAFAEL CREEK, Marin County, Cal. (S.) (Bay Counties Ry. Co.) PLANS.—Approv. July 14, 1906, **07**, 820.

SAN SEBASTIAN R., St. Augustine, Fla. (S.) (Florida East Coast Ry. Co.) PLANS.—Approv. Sept. 3, 1904, **05**, 723, 724.

SANTEE R., S. C. (A.) (Northeastern R. R. Co.) PLANS.—Capt. Bixby recom. draw-span openings of the br. be provided with suitable fenders, 88, 2548.

SANTEE R., about 17 m. below mouth of Congaree R., Ga. (S.) (Manchester & Augusta R. R. Co.) PLANS.—Approv. June 20, 1893, **93**, 470.

SANTEE R., near Ferguson, S. C. (Sp.) (Santee River Cypress Lumber Co.) Au. act Feb. 6, 1909. PLANS.—Approv. Apr. 14, 1909, **09**, 913.

SANTEE R., at St. Stephens and Gourdin, S. C. (O.) (Atlantic Coast Line R. R. Co.) PLANS.—Alterations to be completed on or before 3 months from Sept. 1, 1909, **10**, 1031.

SATILLA R., Ga. (See Ogeechee R.)

SAUGATUCK R., Westport, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Rebuilding approv. Apr. 2, 1904, **04**, 717.

SAUGUS R., Mass. (S.) (Metropolitan Park Commission of Mass.) PLANS.—Approv. Mar. 16, 1899, **99**, 622.

SAUGUS R., between Revere and Lynn, Mass. (S.) (Metropolitan Park Commission.) PLANS.—Modified plans approv. May 6, 1903, **03**, 650.

SAUGUS R., between Revere and Lynn, Mass. (S.) (State br.) PLANS.—Approv. Feb. 13, 1904, to be in lieu of plans approv. May 6, 1903, **04**, 716.

SAUGUS R., Lynn, Mass. (S.) (Boston & Maine R. R. Co.) PLANS.—Reconstr. of existing br., including temporary pile br. alongside existing br., approv. Feb. 23, 1911, **11**, 1087.

SAUGUS R., between Saugus and Lynn, Mass. (S.) (Lynn & Boston R. R. Co.) PLANS.—Reconstr. approv. Mar. 14, 1899, **99**, 622.

SAUGUS R., between Lynn and Saugus, Mass. (S.) (Essex County br.) PLANS.—Reconstr. of existing br., including temporary br. without draw, approv. Jan. 11, 1912, **12**, 1304.

SAVANNAH R. (See Ashley R.)

SAVANNAH R., Augusta, Ga. (O.) (Southern Ry. Co.) PLANS.—Alterations to be completed on or before Jan. 1, 1905; subsequently extended to Jan. 1, 1906, **04**, 720.

- SAVANNAH R.**, Augusta, Ga. (O.) (City br.) PLANS.—Alterations to be completed on or before Jan. 1, 1905; subsequently extended to Jan. 1, 1906, **04**, 720.
- SAVANNAH R.**, at 5th Street, Augusta, Ga. (S.) (City br.) PLANS.—Replacing a former br. approv. July 14, 1909, **10**, 1023.
- SAVANNAH R.**, near Augusta, Ga. (A. and O.) (Charleston & Western Carolina Ry. Co.) PLANS.—Conforming to specified requirements approv. June 10, 1899, **99**, 624. Specified alterations required on or before Nov. 1, 1899, **99**, 625.
- SAVANNAH R.**, below Augusta, Ga. (O.) (Port Royal & Augusta Ry. Co.) PLANS.—Specified alterations required on or before Nov. 1, 1891, **91**, 435.
- SAVANNAH R.**, near Augusta, Ga. (S.) (Port Royal & Augusta Ry. Co.) PLANS.—Erection of certain strs. for protection of this br. and for training the chan. through the draw span approv. June 20, 1894, **94**, 429.
- SAVANNAH R.**, below Augusta, Ga. (O.) (Charleston & Western Carolina Ry. Co.) PLANS.—Alterations to be completed on or before Sept. 1, 1902, for alteration "1," and on or before Jan. 1, 1903, for alteration "2," **02**, 591.
- SAVANNAH R.**, between Hutchinson Isld. and the mainland, Ga. (Sp.) (Georgia & Alabama Ry. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 2, 1899. PLANS.—Approv. Mar. 11, 1899, **99**, 619.
- SAVANNAH R.**, at Hutchinson Isld., Savannah, Ga. (O. and S.) (Seaboard Air Line Ry. Co.) PLANS.—Alterations to be completed within 18 months from Feb. 21, 1907. Time subsequently extended to July 1, 1909. **07**, 829. Reconstr. approv. Nov. 12, 1908, **09**, 912.
- SAVANNAH R.**, Savannah, Ga. (Sp.) (Atlantic Coast Line R. R. Co.) PLANS.—Reconstr. approv. May 21, 1909, **09**, 914.
- SAVANNAH R.**, near Sisters Ferry, Effingham County, Ga. (Sp.) (South Bound R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 7, 1890, **91**, 429. PLANS.—Approv. Nov. 4, 1890, **91**, 429.
- SAWYER CREEK**, Oshkosh, Wis. (S.) (City br.) PLANS.—Reconstr. plans approv. Jan. 17, 1899, **99**, 621.
- SCHUYLKILL R.**, at Filbert Street, Philadelphia, Pa. (S.) (Br. (B) of Pennsylvania R. R. Co.) PLANS.—Widening br. (B) approv. Mar. 25, 1910, **10**, 1028.
- SCHUYLKILL R.**, Grays Ferry, Philadelphia, Pa. (S.) (Philadelphia, Wilmington & Baltimore R. R. Co.) PLANS.—Rebuilding approv. Feb. 8, 1901, **01**, 665.
- SCHUYLKILL R.**, Norristown and Bridgeport, Pa. (S.) (Philadelphia & Western Ry. Co.) PLANS.—Approv. Apr. 8, 1911, **11**, 1088.
- SCHUYLKILL R.**, Pa. (Dr.) **02**, 581.
- SCHUYLKILL R.**, Philadelphia, Pa. (S.) (City br.) PLANS.—Approv. Apr. 17, 1897, **97**, 534.
- SCHUYLKILL R.**, Philadelphia, Pa. (Sp. and A.) COMMERCE.—Large and increasing. Br. a serious obstr. to navigation, H. Doc. 62, 43d Cong., 1st sess. LEGISLATION.—Br. au. by Congress, H. Doc. 62, 43d Cong., 1st sess.
- SCHUYLKILL R.**, Market Street, Philadelphia, Pa. (S.) (Market Street Elevated Passenger Ry. Co.) PLANS.—Approv. Jan. 30, 1903, **03**, 548.
- SCHUYLKILL R.**, Passyunk Avenue, Philadelphia, Pa. (S.) (City br.) PLANS.—Approv. Dec. 21, 1901, **02**, 586. Modified plans in lieu thereof approv. Feb. 11, 1908, **08**, 871.
- SCHUYLKILL R.**, Philadelphia, Pa. (S.) (Pennsylvania R. R. Co.) PLANS.—Reconstr. of fenders of existing br. approv. Apr. 10, 1912, **12**, 1307.
- SCHUYLKILL R.**, at Philadelphia, Pa.; **RAN-COCAS R.**, N. J.; **RACCOON CREEK**, N. J.; **SALEM CREEK**, N. J.; **THE NORTH BRANCH OF THE SUSQUEHANNA**, Pa.; **THE THOROUGHFARE BETWEEN CAPE MAY AND GREAT BAY AT ATLANTIC CITY**, N. J.; and **ACROSS FRANKFORD, PENSANKEN, WOODBURY, MANTUA, DARBY, RIDLEY, and CHESTER CREEKS**, N. J. PLANS.—Description, **88**, 2612.
- SCHUYLKILL R.**, at Swedeland and Ivy Rock, Pa. (S.) (Upper Merion & Plymouth R. R. Co.) PLANS.—Approv. Apr. 7, 1910, and modified plans approv. May 27, 1910, **10**, 1029.
- SCOTCH BONNET THOROFARE**, N. J. (See Great Chan.)
- SCOTTS CREEK**, at Hospital and Pinner Pts., Va. (S.) (Atlantic Coast Line R. R. Co.) PLANS.—Reconstr. approv. July 6, 1908, **09**, 914.
- SCOTTS CREEK**, Norfolk County, Va. (S.) (Norfolk & Carolina R. R. Co.) PLANS.—Approv. Jan. 9, 1895. Br. completed. **95**, 477.
- SCUPPERNONG R.**, near Columbia, N. C. (S.) (Virginia & Carolina Coast R. R. Co.) PLANS.—Approv. Apr. 20, 1906, **06**, 806.
- SCUPPERNONG R.**, Tyrrell County, N. C. (O.) (County brs.) PLANS.—Required a 40' draw in each br. to be completed without delay after the money to pay the expenses thereof should be deposited with the county commissioners, **99**, 625.
- SEATTLE** (canal waterway), Wash. (S.) (Seattle-Tacoma Ry. Co.) PLANS.—Approv. Aug. 12, 1901, **02**, 584.
- SEATTLE H.**, e. and w. waterways, Wash. (S.) (Seattle Electric Co.) PLANS.—Approv. Aug. 15, 1908, **09**, 914.
- SEBASTIAN R.**, Fla. (Dr.) **03**, 642.
- SEBASTIAN R.**, near its mouth, Fla. (S.) (Br. of Brevard and St. Lucie Counties.) PLANS.—Approv. Nov. 26, 1910, **11**, 1085.
- SEEKONK** (Pawtucket) R., Providence, R. I. (S.) (City br.) PLANS.—Reconstr. of br., in place of "central or red" br., approv. Feb. 5, 1895, **95**, 478.

- SEEKONK (Pawtucket) R.**, Providence, R. I. (S.) (Providence Terminal Co.) PLANS.—
Approv. Apr. 7, 1906, **06**, 805.
- SEINE R.**, France. (See Thames R., England.)
- SERRITOS SLOUGH**, Long Beach, Cal. (S.)
(Long Beach Consolidated Gas Co.) PLANS.—
Approv. Apr. 28, 1911, **11**, 1088.
- SEVERN R.**, Me. (Dr.) **02**, 581.
- SEVERN R.**, Md. (Dr.) **11**, 1078.
- SEVERN R.**, near Annapolis, Md. (S.) (Anne
Arundel County br.) PLANS.—Rebuilding
approv. Aug. 24, 1904, **05**, 723.
- SHAKIT (Salt) CREEK and CURRY CREEK**
(Roberts B.), near Venice, Fla. (S.) (Seaboard
Air Line Ry. Co.) PLANS.—2 brs. approv.
May 16, 1911, **11**, 1089.
- SHALLOW CREEK**, Md. (See Jones Creek.)
- SHEBOYGAN R.**, Sheboygan, Wis. (Sp., etc.)
(Milwaukee, Lake Shore & Western Ry. Co.)
LEGISLATION.—Company au. to constr. br.
under act Sept. 19, 1890, sec. 7, and by act of
Wisconsin Legislature. PLANS.—New br.
approv. Dec. 23, 1891, **92**, 402.
- SHEBOYGAN R.**, Sheboygan, Wis. (S.) (City
br.) PLANS.—Br. to replace existing br. approv.
Jan. 26, 1909, **09**, 917.
- SHEBOYGAN R.**, Sheboygan, Wis. (S.) (Chi-
cago & North Western Ry. Co.) PLANS.—
Approv. Apr. 27, 1905, **05**, 726. Approv. Feb. 17,
1906, **06**, 804.
- SHEEPS COT R.**, at mouth of Dyers R., Sheep-
scot, Me. (O.) (Br. of town of New Castle.)
PLANS.—Alterations to be completed by Mar.
1, 1908. Time extended to July 1, 1908. **08**, 873,
874.
- SHEEPS COT R.**, Edgemont, Me. (S.) (Town
br.) PLANS.—Approv. Feb. 17, 1904, **04**, 717.
- SHEEPS COT R.**, Wiscasset and Edgcomb, Me.
(S.) (Lincoln County br.) PLANS.—Approv.
Aug. 7, 1905, **06**, 801.
- SHINNECOCK and PECONIC CANAL**, Suf-
folk County, N. Y. (S.) (Suffolk County br.)
PLANS.—Approv. June 11, 1907, **07**, 828.
- SHREWSBURY R.**, between Little Silver and
Branchport, N. J. (New York & Long Branch
R. R. Co.) PLANS.—Reconstr. of existing br.
approv. Jan. 9, 1912, **12**, 1304.
- SHREWSBURY R.**, Highland Beach, N. J.
(Sp.) (Navesink R. R. Co.) LEGISLATION.—
Company au. to constr. br. under act Sept. 19,
1890, sec. 7, and act of New Jersey. PLANS.—
Modified plan approv. Dec. 2, 1891, **92**, 401.
- SHREWSBURY R.**, N. J. (Dr.) **06**, 797.
- SHREWSBURY R.**, Seabright, N. J. (S.)
(Monmouth County br.) PLANS.—Rebuilding
approv. Dec. 8, 1900, **01**, 663.
- SHREWSBURY R.**, S. Branch (Oceanport
Creek), Oceanport, N. J. (O.) (New York &
Long Branch R. R. Co.) PLANS.—Alterations
to be made in either of 2 methods described on
or before Sept. 1, 1896; time extended to May 1,
1897, **96**, 428.
- SHUMAC CREEK**, near Belhaven, N. C. (S.)
(Br. of F. A. Emerick.) PLANS.—Approv.
Dec. 12, 1905, **06**, 803.
- SINEPUXENT B.**, Me. (Dr.) **05**, 719.
- SINEPUXENT B.**, Ocean City, Md. (S.)
(Baltimore, Chesapeake & Atlantic Ry. Co.)
PLANS.—Reconstr. approv. Feb. 28, 1907, **07**,
825.
- SIXMILE CREEK**, Duval County, Fla. (S.)
(County br.) PLANS.—Br. to replace an exist-
ing str. approv. May 4, 1910, **10**, 1029.
- SIXMILE CREEK**, Hillsboro County, near
Tampa, Fla. (S.) (County br.) PLANS.—
Approv. Dec. 14, 1910, **11**, 1085.
- SKAGIT R.**, Mount Vernon, Skagit County,
Wash. (Sp., etc.) (County br.) LEGISLA-
TION.—County au. to constr. br. under act
Sept. 19, 1890, sec. 7, and act of Washington.
PLANS.—Modified plans approv. July 25, 1892,
92, 407.
- SKAGIT R.**, near Mount Vernon, Wash. (S.)
(Great Northern Ry. Co.) PLANS.—Rebuild-
ing approv. Feb. 2, 1906, **06**, 804.
- SKAGIT R.**, near Mount Vernon, Wash. (S.)
(State and county br.) PLANS.—Approv. Nov.
17, 1911, **12**, 1302.
- SKAGIT R.**, near Mount Vernon, Wash. (S.)
(Bellingham & Skagit Ry. Co.) PLANS.—
Approv. Nov. 17, 1911, **12**, 1303. Instrument
dated Nov. 17, 1911, revoked Feb. 16, 1912. New
plans approv. Feb. 16, 1912. **12**, 1305.
- SKAGIT R.**, Sedro-Woolley, Wash. (S.) (Ska-
git County br.) PLANS.—Approv. Feb. 15,
1911, **11**, 1087.
- SKAGIT R.**, N. Fork (sec. 10, T. 33 N., R. 3 E.,
Willamette meridian), Wash. (S.) (Skagit
County br.) PLANS.—Approv. Mar. 28, 1911,
11, 1088.
- SKAMOKAWA CREEK**, Wash. (S.) (Wah-
kiakum County br.) PLANS.—Approv. July
30, 1894, **94**, 429.
- SKIPANON R.**, Ore. (Dr.) **02**, 581.
- SLOUGHS ON LINE OF ABERDEEN-
MONTESANO ROAD**, Chehalis County,
Wash. (S.) (Chehalis County brs.) PLANS.—
Approv. Sept. 11, 1905, **06**, 802.
- SMALL CREEK** (arm of Norwalk H.), Conn.
(S.) (Harbor View Realty Co.) PLANS.—
Approv. Dec. 28, 1907, **08**, 871.
- SMITH CREEK**, at Oriental, and **ADAMS
CREEK**, at Winthrop, N. C. (S.) (Virginia &
Carolina Coast R. R. Co.) PLANS.—Approv.
Dec. 12, 1906, **07**, 824.
- SMITH CREEK**, N. C. (S.) (Atlantic Coast
Line Ry. Co.) PLANS.—Rebuilding approv.
June 13, 1906, **06**, 808.
- SMITH CREEK**, Va. (Dr.) **02**, 581.
- SMITHS COVE WATERWAY**, at W. Gar-
field Street, Seattle, Wash. (S.) (City br.)
PLANS.—Temporary br. approv. May 4, 1910,
10, 1029.

SMITHS COVE WATERWAY, Seattle, Wash. (S.) (City br.) PLANS.—Approv. Sept. 6, 1910, **11**, 1083.

SNAKE R., between Lewiston, Idaho, and Concord, Wash. (Sp.) (Lewiston-Concord Br. Co.) LEGISLATION.—Company au. to constr. br. by act Feb. 15, 1898. PLANS.—Submitted Nov. 26, 1897; modified July 6, 1898; approv. Aug. 24, 1898, **98**, 532.

SNAKE R., Nome City, Alaska. (Sp.) (Capé Nome Transportation, Br. & Development Co.) LEGISLATION.—Company au. to constr. br. by act May 4, 1900, **00**, 698. PLANS.—Approv. May 21, 1900, **00**, 698.

SNAKE R., at Ontario, Oreg. (Sp.) (Malheur County br.) Au. act Feb. 3, 1910. PLANS.—Approv. May 5, 1910, **10**, 1022.

SNAKE R., Payette, Idaho. (Sp.) (Snake R. Br. Commission.) Au. act Mar. 4, 1911. PLANS.—Approv. Aug. 25, 1911, **12**, 1295, 1296.

SNAKE R., near Texas Ferry, Wash. (Sp.) (Oregon Ry. & Navigation Co.) LEGISLATION.—Company au. to constr. br. by act July 9, 1888, **89**, 370. PLANS.—Approv. Feb. 19, 1889. Br. completed Apr. 30, 1889. **89**, 370.

SNODGRASS SLOUGH, Cal. (S.) (Sacramento Southern R. R. Co.) PLANS.—Approv. Apr. 12, 1910, **10**, 1029.

SNOHOMISH R., Everett, Wash. (Sp., etc.) (Land River Imp. Co. of Everett.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—Approv. June 2, 1892, **92**, 406.

SNOHOMISH R., Everett, Wash. (S.) (Seattle & Montana R. R. Co.) PLANS.—Approv. Oct. 10, 1901, **02**, 585.

SNOHOMISH R., Everett, Wash. (S.) (City br.) PLANS.—Approv. Jan. 7, 1904, **04**, 716. Reconstr. approv. Aug. 21, 1906, **07**, 821.

SNOHOMISH R., n. of Everett, Wash. (S.) (Great Northern Ry. Co.) PLANS.—Modified plans approv. July 13, 1911, in lieu of approv. of Oct. 10, 1901, covering location and plans of br. proposed by Seattle & Montana R. R. Co. Instrument approv. Oct. 10, 1901, revoked, **12**, 1299.

SNOHOMISH R. (sec. 32, T. 29 N., R. 5 E.) and Ebey Slough (sec. 4, T. 28 N., R. 5 E.), Willamette meridian, Wash. (Sp., etc.) (Snohomish, Skykomish & Spokane Ry. & Transportation Co.) LEGISLATION.—Company au. to constr. brs. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—Approv. Oct. 30, 1891. Br. across Ebey Slough reported completed in accordance with approv. plan, but br. across Snohomish R. had but 1 clear draw opening of 99', instead of 2 of 100' each, as required. R. dated Apr. 4, 1892. **92**, 400.

SNOHOMISH R., Snohomish, Wash. (Sp., etc.) (City br.) LEGISLATION.—City au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington, **92**, 400. PLANS.—Approv. July 22, 1891. Completion of br. reported on Dec. 5, 1891. **92**, 400.

SNOHOMISH R., near Snohomish City, Wash. (Sp., etc.) (St. Paul, Minneapolis & Manitoba Ry. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington, **92**, 407. PLANS.—Modified plan approv. July 28, 1892, **92**, 407.

SNOHOMISH R., at Snohomish, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Reconstr. existing br. approv. July 13, 1909, **10**, 1023.

SNOQUALMIE R., Cherry Valley, Wash. (S.) (King County br.) PLANS.—Approv. Jan. 24, 1906, **06**, 803.

SNOQUALMIE R., Novelty, Wash. (S.) (King County br.) PLANS.—Approv. Sept. 14, 1899, **00**, 699.

SNOQUALMIE R., Wash. (S.) (Snohomish County br.) PLANS.—Approv. June 9, 1896, **96**, 426.

SNOQUALMIE R., near Tolt, Wash. (S.) (King County br.) PLANS.—Approv. Nov. 22, 1899, **00**, 700. Approv. Apr. 8, 1902, **02**, 588.

SOMERS COVE, Md. (Dr.) **08**, 865.

SONOMA CREEK, Sonoma County, Cal. (S.) (Bay Counties Ry. Co.) PLANS.—Approv. July 16, 1906, **07**, 820.

SOPCHOPPY R. (See Ocklockonee R.)

SOUTH B., Elk R., between Bay City and Laidlaw, Wash. (Sp., etc.) (Chehalis County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—Modified plan approv. Aug. 15, 1892, **92**, 408.

SOUTH CREEK, near Aurora, N. C. (S.) (Washington & Vandemere R. R. Co.) PLANS.—Approv. July 26, 1906, **07**, 820.

SOUTH CREEK, Aurora, N. C. (S.) (Beaufort County br.) PLANS.—Approv. Sept. 16, 1910, **11**, 1083.

SOUTH FORKED DEER R., Tenn. (A.) (2 R. R. and 5 county brs.) PLANS.—Removal of such of the brs. as are unused recom., and the insertion of draws in the others, **88**, 2554.

SOUTH FORKED DEER R., Bells Depot, Tenn. (O.) (Louisville & Nashville R. R. Co.) PLANS.—Specified alterations required within 6 months from Nov. 21, 1895. Alterations completed. **96**, 428.

SOUTH R., Md. (Dr.) **07**, 815.

SOUTH R., N. J. (O. and S.) (Raritan River R. R. br.) **89**, 376. PLANS.—Alterations required by June 1, 1889; time extended to July 11, 1889, then to July 21, 1889; no action taken, **89**, 377. Reconstr. approv. Jan. 29, 1910, **10**, 1026.

SOUTH R., Sayreville and South River, N. J. (S.) (Raritan River R. R. Co.) PLANS.—Reconstr. approv. July 19, 1907, **08**, 868.

SOUTH R., Union Street, Salem, Mass. (S.) (City br.) PLANS.—Approv. Oct. 18, 1910, **11**, 1084.

SOUTH SLOUGH, Coos County, Oreg. (S.) (Coos County br.) PLANS.—Approv. Dec. 12, 1908, **09**, 916.

SPA CREEK, Md. (Dr.) 09, 912.

SPOKANE R., near Coeur d'Alene, Idaho. (S.) (Northern Pacific Ry. Co.) PLANS.—Approv. Apr. 7, 1905, 05, 726.

SPOKANE R., near Gibbs, Idaho. (S.) (Idaho & Western Ry. Co.—Chicago, Milwaukee & Puget Sound Ry. Co.) PLANS.—Approv. Dec. 14, 1910, 11, 1085. Modification of instrument approv. Jan. 26, 1911, 11, 1086.

SPUYTEN DUYVIL CREEK, N. Y. (O.) (New York Central & Hudson River R. R. Co.) PLANS.—Specified alterations required, on or before Dec. 1, 1891, 91, 435. Plans for new br. approv. Aug. 28, 1894, 94, 430. Plans for temporary br. approv. Nov. 22, 1897, 98, 534.

SQUAK SLOUGH (Sammamish R.), near Redmond, Wash. (S.) (King County br.) PLANS.—Rebuilding approv. Mar. 19, 1909, 09, 917.

STATEN ISLAND SOUND, Arthur Kill. (Sp.) COMMERCE.—Dimensions of tows, 87, 2633; 88, 2424. Height of vessel masts, 87, 2634. ENGINEERS. Chief of Engineers. Rs., 87, 337, 2637; 88, 308, 2421. BE. R. of board of 1886, 87, 2632. Convened at New York City, Apr. 10, 1888, by S. O. Nos. 8 and 9, to ex. and R. upon Staten Isl. Br. R., 88, 2423, 2429. (Col. Casey and Lt. Cols. Robert and Hains.) Minority R., 88, 2426. (Maj. King and Capt. Maguire.) LEGISLATION.—Br. au. by act June 16, 1886, 87, 337. Act au. constr. of br. at Arthur Kill, 88, 2425. PLANS.—Description of alterations as proposed by the board; 88, 2425. Description of plans proposed, 87, 2635.

STATEN ISLAND SOUND, Westfield, N. Y. (Sp.) ENGINEERS.—Chief of Engineers. R., 88, 308. BE. convened at New York City, Apr. 10, 1888, by S. O. Nos. 8 and 9, to ex. and R. upon constr. of a br. at Westfield, N. Y., across Staten Isl. Sound. R., 88, 2430. (Col. Casey, Lt. Cols. Robert and Hains, Maj. King, and Capt. Maguire.) LEGISLATION.—Au. by Senate bill 1850, 88, 2430. PLANS.—Board R. adversely to a draw and recom. a cantilever br. of 3 bays, the center bay to be not less than 900' in the clear, with a clear height over the chan. way at m. h. w. of 150', 88, 2430.

STEAMBOAT R., Minn. (S.) (St. Paul, Minneapolis & Manitoba Ry. Co.) PLANS.—Approv. Mar. 14, 1898, 98, 534.

STEAMBOAT SLOUGH, near Marysville, Wash. (S.) (Great Northern Ry. Co.) PLANS.—Rebuilding approv. Feb. 2, 1906, 06, 804.

STEAMBOAT (or Schell) SLOUGH, Sonoma County, Cal. (O.) (California Northwestern Ry. Co.) PLANS.—Alterations to be completed on or before Sept. 15, 1906, 06, 809.

STEELE BAYOU, at Lakeside, Magnolia, Willette, Catchings, Griffin, Scott, and Mauny, Miss. (S.) (Issaquena County brs.) PLANS.—For 7 brs. approv. May 5, 1911, 11, 1089.

STEILACOOM CREEK WATERWAYS. (See Wilton Waterway.)

STILLAGUAMISH R., Wash. (S.) (Snohomish County br.) PLANS.—Approv. July 13, 1894, 94, 429.

STILAGUAMISH R., near Arlington, Wash. (S.) (Seattle & International Ry. Co.) PLANS.—Approv. June 14, 1901, 01, 867.

STILAGUAMISH R., near Arlington, Wash. (S.) (Marysville & Northern Ry. Co.) PLANS.—Approv. Sept. 29, 1905, 06, 802.

STILAGUAMISH R., near Arlington, Wash. (S.) (Marysville & Arlington Ry. Co.) PLANS.—Approv. Feb. 6, 1908, 08, 871.

STILAGUAMISH R., near Florence, Wash. (S.) (Snohomish County br.) PLANS.—Approv. Mar. 3, 1904, 04, 717. Approv. July 14, 1909, 10, 1023.

STILAGUAMISH R., near Norman, Wash. (S.) (Snohomish County br.) PLANS.—Approv. July 26, 1911, 12, 1300.

STILAGUAMISH R., near Silvana, Wash. (S.) (Great Northern Ry. Co.) PLANS.—Reconstr. approv. July 27, 1904, 05, 722.

STILAGUAMISH R., near Stanwood, Wash. (S.) (Snohomish County br.) PLANS.—Approv. Sept. 24, 1908, 09, 915.

STILAGUAMISH R., Thomle Ferry, near Florence, Wash. (S.) (Snohomish County br.) PLANS.—Approv. May 25, 1906, 06, 807.

STONE HOUSE COVE, Curtis B., Md. (A.) (Anne Arundel County br.) PLANS.—Proceedings instituted; turntable p. with 30' opening on each side required on or before Dec. 31, 1899; reconstr. plans in accordance approv. Aug. 10, 1899, 99, 624, 626.

STONY CREEK, at Branford, **WEST R.,** at Guilford, **EAST and HAMMONASSET RS.,** at Madison, **MENUNKETESUCK and PAT-CHOGUE RS.,** near Westbrook, and **OYSTER B.,** at Old Saybrook, Conn. (S.) (Shore Line Electric Ry. Co.) PLANS.—Approv. Aug. 9, 1909, 10, 1024.

STURGEON B., Wis. (S.) (Ahnapee & Western Ry. Co.) PLANS.—Approv. Apr. 30, 1894, 94, 428.

STURGEON B., Wis. (O.) (Sturgeon Bay Br. Co.) PLANS.—Required substantial work to replace the p. protection and to protect the abutments with suitable lines of fender piling on or before Mar. 15, 1900, 00, 702.

STURGEON B., at Sturgeon B., Wis. (O.) (Sturgeon Bay Br. Co. and Ahnapee & Western Ry. Co.) PLANS.—Alterations to be completed on or before 1 year from Apr. 8 and 16, 1907, the dates of service of notices on the companies, 07, 829.

STURGEON B. (chan. across), Wis. (S.) (City br.) PLANS.—Reconstr. of pile trestle approach to existing br. approv. Mar. 14, 1912, 12, 1306.

SULLIVANS ISLD., Charleston H., across cove, S. C. (S.) (Mount Pleasant & Seaview City R. R. Co.) PLANS.—Approv. Apr. 18, 1893,

- 93, 469. Company ordered, Feb. 20, 1894, to remove some piles and a swing br. from the center p., to be done within 30 days; afterwards extended to 60 days, 94, 431.
- SULPHUR R., Ark. (Sp.)** (Texarkana & Shreveport R. R. Co.) LEGISLATION.—Company au. to constr. br. by act May 28, 1894, 95, 474. PLANS.—Approv. Oct. 16, 1894, 95, 474.
- SULPHUR R., Ark. (Sp.)** (Kansas City Southern Ry. Co.) Au. Feb. 8, 1897. PLANS.—Approv. Mar. 25, 1901, 01, 660.
- SUMMER CREEK, Middletown, Conn. (S.)** (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. plans approv. Sept. 6, 1910, 11, 1083.
- SUNFLOWER R., near Baird Station, Miss. (Sp.)** (Southern R. R. Co. in Mississippi, successors to Georgia Pacific R. R. Co.) Au. act Mar. 3, 1887. PLANS.—Approv. Oct. 9, 1911, 12, 1296.
- SUNFLOWER R., Learton, Miss. (Sp.)** (Sunflower County br.) Au. act June 28, 1906. PLANS.—Approv. Aug. 15, 1906, 07, 817.
- SUNFLOWER and YAZOO RS. (Sp.)** (Georgia Pacific R. R. Co.) 88, 309, 2488. LEGISLATION.—Br. au. by act Mar. 3, 1887, 88, 2488. PLANS.—Capt. Willard approv. of proposed br. dimensions with the recom. that draw opening be increased from 115' in the clear to 125', 88 2488.
- SUSQUEHANNA R. (See Christiana R., Wilmington, Del., etc.)**
- SUSQUEHANNA R., N. Branch of. (See Schuylkill R.)**
- SUSQUEHANNA R., Havre de Grace, Md. (S.)** (Baltimore & Ohio R. R. Co.) PLANS.—Rebuilding approv. June 19, 1907, 07, 828. Reconstr. approv. July 27, 1908, 09, 914.
- SUSQUEHANNA R., Havre de Grace, Md. (S.)** (Havre de Grace & Perryville Br. Co.) PLANS.—Reconstr. approv. Oct. 22, 1908, 09, 915.
- SUSQUEHANNA R., between Havre de Grace and Perryville, Md. (S.)** (Philadelphia, Baltimore & Washington R. R. Co.) PLANS.—Br. to replace existing str. approv. Apr. 28, 1904, 04, 718.
- SUWANEE R., Fla. (S.)** (Suwanee & San Pedro R. R. Co.) PLANS.—Approv. Aug. 9, 1901, 02, 584.
- SUWANEE R., Fla. (S.)** (Atlantic Coast Line R. R. Co.) PLANS.—Approv. Apr. 15, 1905, 05, 726.
- SUWANEE R., Bradford, Fla. (S.)** (Br. of Lafayette and Suwanee Counties.) PLANS.—Approv. July 16, 1906, 07, 820.
- SUWANEE R., Dowling Park, Fla. (S.)** (Br. of Lafayette and Suwanee Counties.) PLANS.—Approv. Jan. 11, 1912, 12, 1304.
- SUWANEE R., Lurayville, Fla. (S.)** (Br. of Lafayette and Suwanee Counties.) PLANS.—Approv. Oct. 12, 1906, 07, 822.
- SWAN CREEK, Toledo, Ohio. (S.)** (Lake Shore & Michigan Southern Ry. Co.) PLANS.—Reconstr. plans approv. Sept. 15, 1896, 97, 531.
- SWAN CREEK, Toledo, Ohio. (S.)** (Lima & Toledo Traction Co.) PLANS.—Approv. Mar. 2, 1908, 08, 872.
- SWAN CREEK, Green Street, Toledo, Ohio. (S.)** (City br.) PLANS.—Approv. Mar. 31, 1905, 05, 726.
- SWAN CREEK, Monroe Street, Toledo, Ohio. (S.)** (Lake Shore & Michigan Southern Ry. Co.) PLANS.—Approv. Aug. 1, 1907, 08, 868.
- SWIFT CREEK, Vanceboro, N. C. (O.)** (Craven County br.) PLANS.—Alterations to be completed on or before Jan. 1, 1904, 04, 721.
- SWIFT CREEK (at Vanceboro) and BRICES CREEK, N. C. (S.)** (Craven County br.) PLANS.—Approv. Aug. 3, 1907, 08, 869.
- SWIFTS R., Onset, Mass. (S.)** (Middleboro, Wareham & Buzzards Bay Street Ry. Co.) PLANS.—Approv. July 18, 1901, 02, 583.
- SWINOMISH SLOUGH, Wash. (O.)** (Seattle & Northern R. R. Co.) PLANS.—Required alterations to be completed on or before Jan. 1, 1891; time informally extended to Apr. 1, 1891. Officer in charge reported that the work would probably be completed by Oct. 9, 1891, 91, 433.
- SWINOMISH SLOUGH, near La Conner, Wash. (S.)** (Skagit County br.) PLANS.—Approv. Mar. 6, 1907, 07, 825.
- SWINOMISH SLOUGH, Skagit County, Wash. (Sp., etc.)** (County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington, 92, 404. PLANS.—Approv. Apr. 21, 1892, 92, 404.

T.

- TACOMA**, across the ship chan., Wash. (S.) (Tacoma city br.) PLANS.—Approv. Sept. 29, 1893. Upon the city's application of Oct. 30, 1893, the Sec. of War au., Nov. 15, 1893, certain modifications of the specified conditions respecting the location of ps. 94, 426.
- TACOMA** (city waterway), Wash. (S.) (Oregon & Washington R. R. Co.) PLANS.—Approv. Dec. 28, 1907, 08, 871. Modified plans approv. Jan. 20, 1910, 10, 1026. Further modification approv. Feb. 9, 1911, 11, 1086.
- TACOMA CITY WATERWAY**, S. 11th Street, Tacoma, Wash. (S.) (City br.) PLANS.—Reconstr. approv. Jan. 11, 1907, 07, 824.
- TACOMA, WASH.** (Dr.) 11, 1078.
- TALLAHATCHIE R.**, Miss. (Sp.) (Quitman County br.) Au. act Mar. 3, 1905. PLANS.—Approv. May 21, 1906, 06, 800.
- TALLAHATCHIE R.**, near Ashwood Landing, Miss. (S.) (Leflore County br.) PLANS.—Approv. Oct. 29, 1909, 10, 1025.
- TALLAHATCHIE R.**, near Minter City, Miss. (S.) (Leflore County br.) PLANS.—Approv. Oct. 26, 1911, 12, 1302.
- TALLAHATCHIE R.**, Philipp, Miss. (Sp.) (Delta Cooperage Co., and the Yazoo & Mississippi Valley R. R. Co.) LEGISLATION.—Company au. to constr. br. by act May 28, 1896. PLANS.—Approv. June 1, 1897, 97, 530; and Oct. 14, 1911, 12, 1296.
- TALLAHATCHIE R.**, Shell Mound, Miss. (S.) (Leflore County br.) PLANS.—Approv. Dec. 14, 1910, 11, 1085.
- TALLAHATCHIE R.**, near Swan Lake, Miss. (Sp.) (Tallahatchie County br.) LEGISLATION.—County au. to constr. br. by act Mar. 1, 1900. PLANS.—Approv. June 25, 1900, 00, 698.
- TANNERS CREEK**, near Norfolk, Va. (S.) (Norfolk Ry. & Light Co.) PLANS.—Approv. Feb. 15, 1900, 00, 700.
- TANNERS CREEK**, near Norfolk, Va. (S.) (Norfolk & Atlantic Terminal Co.) PLANS.—Approv. Jan. 18, 1899, 99, 621.
- TANNERS CREEK**, Va. (A.) (Tanners Creek Drawbr. Co.) PLANS.—Proceedings having been instituted against the company, reconstr. plans, providing for an increased width of draw opening, and to be in lieu of changes required in notice dated May 16, 1896, approv. June 23, 1896, 96, 427.
- TANNERS CREEK**, Va. (Dr.) 02, 581; 07, 815.
- TAR R.** (See Pamlico R.)
- TAR R.**, Greenville, N. C. (S.) (Pitt County br.) PLANS.—Approv. Oct. 7, 1907, 08, 870.
- TAR R.**, Pillsboro Landing, N. C. (S.) (Pitt County br.) PLANS.—Approv. June 7, 1904, 04, 719.
- TAR R.**, Tarboro, N. C. (Sp., etc.) (Albemarle & Raleigh R. R. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of North Carolina. PLANS.—New br. approv. Aug. 8, 1892, 92, 408.
- TAR R.**, Tarboro, and Bells Br., 13 m. above Tarboro, N. C. (O. and S.) (Edgecombe County brs.) PLANS.—Each br. to have a draw span, with clear openings of 30', to be placed over the middle chan., the openings parallel with current and draws easily worked, to be completed on or before Feb. 1, 1896, 95, 483. Reconstr. plans for the Tarboro br. approv. June 5, 1896, 96, 426.
- TAR R.**, Washington, N. C. (S.) (Washington & Vandemere R. R. Co.) PLANS.—Approv. Sept. 7, 1904, 05, 724.
- TAUNTON GREAT R.**, between Dighton and Berkley, Mass. (S.) (Bristol County br.) PLANS.—Reconstr. plans approv. Aug. 11, 1896, 96, 427.
- TAUNTON GREAT R.**, between Fall R. and Somerset, Mass. (S.) (Bristol County br.) PLANS.—Reconstr. of existing br. approv. Jan. 22, 1912, 12, 1304.
- TAUNTON R.**, Mass. (Dr.) 11, 1078.
- TAUNTON R.**, Mass., Somerset to Fall R. (O.) (Old Colony R. R. Co.) 88, 2659; 89, 374; 90, 340. LEGISLATION.—Referred to Dept. of Justice with request that action be taken as prescribed by law, 80, 375. Notice served as to alterations required, 90, 340. PLANS.—Maj. Livermore recom. placing draw protection parallel to the current, and increasing the draw opening, 88, 2659. Alterations required by May 1, 1889. No action taken. 89, 375.
- TAUNTON R.**, at Fall R., Mass. (S.) (State br.) PLANS.—Approv. June 2, 1906, 06, 807.
- TAUNTON R.**, Somerset, Mass. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Approv. May 9, 1906, 06, 806.
- TAUNTON R.**, Taunton, Mass. (S.) (City br.) PLANS.—Rebuilding approv. Aug. 24, 1903, 04, 714.
- TAYLORS BAYOU**, Tex. (S.) (Jefferson County br.) PLANS.—Approv. June 30, 1896, 96, 426. Reconstr. plans, to replace the one destroyed by storm, approv. Mar. 28, 1898, 98, 535.
- TAYLORS BAYOU**, near Port Arthur, Tex. (S.) (Jefferson County br.) PLANS.—Approv. Apr. 14, 1904, 04, 718.

- TAYLORS BAYOU** (br. in place of that at 7th Street Road), Port Arthur, Tex. (S.) (Jefferson County br.) PLANS.—New br. at new location approv. Mar. 6, 1911, **11**, 1087.
- TCHOUTACABOUFFA R.**, below Morris Ferry, Miss. (S.) (Harrison County br.) PLANS.—Approv. Aug. 27, 1908, **09**, 915.
- TCHULA LAKE**, Mileston, Miss. (S.) (Holmes County br.) PLANS.—Approv. Sept. 14, 1909, **10**, 1024.
- TCHULA LAKE**, near Marksville, Miss. (S.) (Holmes County br.) PLANS.—Approv. Oct. 20, 1910, **11**, 1084.
- TECHE BAYOU**, Bayside Plantation, near Jeanerette, La. (S.) (H. Shelby Sanders. PLANS.—Approv. June 1, 1907, **07**, 828.
- TECHE BAYOU**, Breaux Br., St. Martinville, La. (S.) (St. Martin Parish br.) PLANS.—Approv. July 8, 1898, **98**, 536.
- TECHE BAYOU**, near Breaux Br., La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Approv. Apr. 4, 1906, **06**, 805.
- TECHE BAYOU**, Bullards Cove, La. (S.) (St. Martin Parish br.) PLANS.—Approv. Sept. 11, 1899, **00**, 698.
- TECHE BAYOU**, Calumet Plantation, La. (S.) (Daniel Thompson's br.) PLANS.—Approv. May 5, 1898, **98**, 535.
- TECHE BAYOU**, Centerville, La. (S.) (Br. of Messrs. Mariero, Schwan & Mariero.) PLANS.—Br. to replace existing str. approv. Mar. 20, 1906, **06**, 805.
- TECHE BAYOU**, near Charenton, La. (S.) (Iberia, St. Mary & Eastern R. R. Co.) PLANS.—Approv. Dec. 8, 1911, **12**, 1303.
- TECHE BAYOU**, Franklin, La. (S.) (St. Mary Park Association.) PLANS.—Modified plans approv. May 7, 1903, **03**, 650.
- TECHE BAYOU**, Jeanerette, La. (S.) (Town br.) PLANS.—Approv. Nov. 13, 1896, **97**, 532.
- TECHE BAYOU**, near Leonville, La. (S.) (Morgan's Louisiana & Texas R. R. & S. S. Co.) PLANS.—Approv. June 11, 1906, **06**, 807.
- TECHE BAYOU**, near Loreauville, La. (S.) (Adrien Gonsoulin's br.) PLANS.—Approv. July 26, 1894, **94**, 429.
- TECHE BAYOU**, New Iberia, La. (S.) (Mrs. Catherine Erath.) PLANS.—Approv. Sept. 8, 1903, **04**, 714.
- TECHE BAYOU**, near Oaklawn Plantation, St. Mary Parish, La. (S.) (Iberia, St. Mary & Eastern R. R. Co.) PLANS.—Approv. Apr. 6, 1912, **12**, 1307.
- TECHE BAYOU**, in parish of St. Mary, La. (S.) (Shadyside Co., Ltd.) PLANS.—Approv. July 13, 1911, **12**, 1299.
- TECHE BAYOU**, Ruth Plantation, St. Martin Parish, La. (S.) (R. Martin Sugar Co., Ltd.) PLANS.—Approv. Apr. 20, 1899, **99**, 622.
- TECHE BAYOU**, St. Johns Plantation, St. Martin Parish, La. (S.) (J. B. Levert's br.) PLANS.—Approv. Sept. 11, 1899, **00**, 699.
- TECHE BAYOU**, St. Martin Parish, La. (S.) (J. B. Levert's br.) PLANS.—Approv. Apr. 28, 1897, **97**, 534.
- TECHE BAYOU**, St. Martin Parish, La. (S.) (Br. of Frank O. Broussard.) PLANS.—Approv. Oct. 23, 1905, **06**, 803.
- TECHE BAYOU**, near St. Martinville, La. (S.) (Keystone Plantation, John Peters, agent.) PLANS.—Reconstr. plans approv. Aug. 18, 1896, **96**, 427.
- TECHE BAYOU**, St. Martinville, St. Martin Parish, La. (S.) (City br.) PLANS.—Approv. July 28, 1897, **97**, 534.
- TECHE BAYOU**, Sarah Plantation, La. (S.) (Iberia Parish br.) PLANS.—Approv. May 21, 1907, **07**, 827.
- TECHE BAYOU**, Sorrell Plantation, La. (S.) (J. N. Pharr & Sons, Ltd.) PLANS.—Approv. May 22, 1907, **07**, 827.
- TECHE BAYOU**, near Wyche Plantation, La. (S.) (New Iberia, St. Martin & Northern R. R. Co.) PLANS.—Approv. Sept. 3, 1908, **09**, 915.
- TECHE BAYOU**, La. (S.) (New Iberia & Northern R. R. Co.) PLANS.—Approv. July 20, 1910, **11**, 1082.
- TENNESSEE R.** (Dr.) **02**, 581.
- TENNESSEE R.** (See Ohio R.)
- TENNESSEE R.** (O.) LEGISLATION.—Notice served upon the East Tennessee, Virginia & Georgia and the Memphis & Charleston R. R. companies as to required alterations, **90**, 339.
- TENNESSEE R.**, Chattanooga. (Sp.) (Memphis & Charleston R. R. Co.) **88**, 309, 2513. LEGISLATION.—Br. au. by act Feb. 28, 1887, **88**, 2510. PLANS.—Modified plans submitted, giving 270' in the clear, would afford no obstacle to existing navigation, **88**, 2512.
- TENNESSEE R.**, between W. 6th and 19th Streets, Chattanooga, Tenn. (Sp.) (Hamilton County br.) Au. act Feb. 15, 1911. PLANS.—Approv. July 31, 1911, **12**, 1295.
- TENNESSEE R.**, Douglas Street, Chattanooga, Tenn. (Sp.) (Hamilton County br.) Au. act Feb. 15, 1911. PLANS.—Approv. July 31, 1911, **12**, 1295.
- TENNESSEE R.**, Danville, Tenn. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Reconstr. plans approv. June 14, 1898, **98**, 536.
- TENNESSEE R.**, Decatur, Ala. (S.) (Southern Ry. Co.) PLANS.—Reconstr. approv. Sept. 8, 1900, **01**, 662.
- TENNESSEE R.**, Florence, Ala.; Decatur, Ala.; Bridgeport, Ala.; Johnsonville, Tenn.; and Gilbertsville, Ky. (A.) (5 brs.) **88**, 2638. PLANS.—Lt. Col. Barlow reported that the interests of navigation required the abatement or material modification of the Florence br., and that the draw spans of the brs. at Bridgeport, Johnsonville, and Gilbertsville should be enlarged to 150' in the clear, **88**, 2640.
- TENNESSEE R.**, Florence, Ala. (O.) (East Tennessee, Virginia & Georgia Ry. Co.)

- PLANS.—Specified alterations required and completed by Sept. 1, 1891, **91**, 435.
- TENNESSEE R.**, Florence, Ala.; Johnsonville, Tenn.; and Gilbertsville, Ky. (A.) (Memphis & Charleston R. R.; Nashville, Chattanooga & St. Louis R. R.; and Chesapeake, Ohio & Southwestern R. R.) **88**, 2562. PLANS.—Maj. King recom. removal and relocation of the draws in these brs., **88**, 2563. Tabular statement of brs. on the Tennessee and Cumberland Rrs., **88**, 2565.
- TENNESSEE R.**, Florence, Ala. (O.) (Memphis & Charleston R. R. Co.) PLANS.—Alterations required by June 1, 1889; time extended to Dec. 1, 1889, **89**, 374.
- TENNESSEE R.**, Gilbertsville, Ky. (Sp.) (Chicago, St. Louis & New Orleans R. R. Co.—Illinois Central R. R.) Rebuilding au. act Mar. 17, 1904. PLANS.—Rebuilding approv. Apr. 28, 1904, **04**, 712.
- TENNESSEE R.**, Johnsonville, Tenn. (Sp., etc.) (Nashville, Chattanooga & St. Louis Ry. Co.) **90**, 340; **92**, 401; **93**, 472. LEGISLATION.—Company au. to constr. new br. under acts Aug. 11, 1888, and Sept. 19, 1890, sec. 4, **90** 340; **92**, 401. PLANS.—Proceedings being begun anew under the above acts, plans for new br., to replace the old one, approv. Nov. 19, 1891. New br. to be completed and such portions of old str. as would obstr. navigation removed on or before Nov. 15, 1894; modified plans for altering old br. approv. Apr. 13, 1893. **92**, 401; **93**, 472.
- TENNESSEE R.**, Knoxville, Tenn. (Sp.) (Marietta & North Georgia R. R. Co., successors to the Knoxville Southern R. R. Co.) LEGISLATION.—Company au. to constr. br. by act Aug. 9, 1890; amended as to time within which the br. was to be commenced and completed by act July 26, 1892, **93**, 463. OPERATIONS.—On Feb. 8, 1893, br. reported completed, **93**, 463. PLANS.—Knoxville Southern R. R.'s plan approv. Feb. 27, 1890. Modified plans of the Marietta & North Georgia R. R. Co. approv. Sept. 29, 1892, but merger of companies not recognized. **93**, 463.
- TENNESSEE R.**, Knoxville, Tenn. (Sp.) (Knox County br.) LEGISLATION.—County au. to replace existing str. by act Mar. 28, 1896. PLANS.—To replace the existing str. approv. June 13, 1896, **96**, 424.
- TENNESSEE R.**, London, Tenn. (A.) (Southern Ry. Co.) PLANS.—Reconstr. approv. Mar. 13, 1905, **05**, 728.
- TENNESSEE R.** (Little), near Niles Ferry, Tenn. (O.) (Marietta & North Georgia Ry. Co.) PLANS.—Specified alterations required on or before Jan. 1, 1892, **91**, 435.
- TENNESSEE R.** (Little Tennessee) **R.**, Niles Ferry, Tenn. (O. and A.) (Atlanta, Knoxville & Northern Ry. Co.) PLANS.—Alterations to be completed on or before 1 year after Apr. 8, 1901, **01**, 668.
- TENNESSEE R.**, at Oats Isld. and Mullens Cove, Marion County, Tenn. (Sp.) (Memphis-Chattanooga R. R.—Southern Ry. system.) Au. act Feb. 1, 1905. PLANS.—Approv. Apr. 13, 1905, **05**, 721.
- TENNESSEE R.**, Perryville, Tenn. (Sp.) (Tennessee Midland R. R. Co.) LEGISLATION.—Au. by act May 14, 1888. PLANS.—Revised plan and location submitted and approv. by the Sec. of War, Aug. 21, 1889, **90**, 336.
- TENSAS R.**, Daniels Ferry, La. (Sp.) (The New Orleans, Natchez & Fort Scott R. R. Co.) LEGISLATION.—Au. by act Mar. 1, 1889. PLANS.—Plan and location submitted and approv. by Sec. of War, Dec. 19, 1889, **90**, 337.
- TENSAS R.**, near Daniels Ferry, La. (S.) (New Orleans & Northwestern R. R. Co.) PLANS.—Rebuilding approv. Oct. 29, 1908, **09**, 916.
- TENSAS R.**, Ala. (Dr.) **08**, 865.
- TENSAS R.**, near Mobile, Ala. (S.) (Louisville & Nashville R. R. Co.) PLANS.—Reconstr. plans approv. Sept. 28, 1899, **00**, 699.
- TERREBONNE BAYOU**, Presque Isle Plantation, near Houma, La. (S.) (Br. of parish of Terrebonne, La.) PLANS.—Approv. Aug. 25, 1911, **12**, 1301.
- THAMES R.**, England, and **SEINE R.**, France. PROJECTS.—Description of brs. crossing both Rs., **75**, ii, 228.
- THAMES R.**, entrance to Long and Clarks Cove, Conn. (S.) (Norwich & Worcester R. R. Co.) PLANS.—Openings to be left at these localities (between Allens Pt. and Groton) approv. July 11, 1898, **98**, 536.
- THAMES R.**, near New London, Conn. (Sp.) **BE. R.**, **84**, 1770. (Col. Newton, Lt. Col. Elliot, and Maj. McFarland, U. S. Army, and Capt. Phythian and Comdr. Mahan, U. S. Navy.) LEGISLATION.—Br. au. by act Mar. 3, 1883, **84**, 269. PLANS.—The following modifications were recom. by BE. and approv. by Sec. of War: Br. to be raised to leave a clear height of 30' at h. w.; draw to be provided with suitable p. rests; steam fog signal and suitable lights to be attached to the br., **84**, 1770.
- THAMES R.**, at New London, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Br. to replace an existing str. approv. Feb. 10, 1910, **10**, 1027.
- THAMES R.**, Smiths Cove, New London, Conn. (O.) (Central Vermont Ry. Co. and New London R. R. Co.) PLANS.—Alterations to be completed within 30 days from June 17 and 18, 1903, **03**, 652.
- THOROFARE** (inside), Albany Avenue, Atlantic City, N. J. (S.) (Atlantic County br.) PLANS.—Approv. Jan. 3, 1901, **01**, 664. Reconstr. of existing br. approv. June 5, 1912, **12**, 1307.
- THOROUGHFARE**, Atlantic City, N. J. (S.) (West Jersey & Seashore R. R. Co.) PLANS.—Approv. Feb. 24 1906 **06**, 804

- THOROUGHFARE** (inside), Ventnor, N. J. (S.) (Atlantic County br.) PLANS.—Replacing existing str. approv. July 30, 1908, 09, 914.
- THOROUGHFARE** (Gould Lake or Joe Gould Narrows), Minn. (S.) (Bass Brook town br.) PLANS.—Approv. Aug. 25, 1909, 10, 1024.
- THREE-MILE CREEK**, Ala. (A.) (Mobile County br.) PLANS.—Change to drawbr. approv. Apr. 24, 1893, 93, 473.
- THREE-MILE CREEK**, Ala. (Dr.) 08, 865.
- THREE-MILE CREEK**, near Mobile, Ala. (A.) (Mobile & Birmingham Ry. Co.) PLANS.—Proceedings having been instituted against the R. R. company, alteration plans were approv. Nov. 29, 1893, on condition that the existing obstr. be removed by Feb. 11, 1894; time extended to May 11 and July 31, 1894, 94, 430.
- THREE-MILE CREEK**, near Mobile, Ala. (S.) (Mobile County br.) PLANS.—Approv. Jan. 18, 1900, 00, 700.
- THREE-MILE CREEK**, Laurent Plantation, Mobile County, Ala. (S.) (Mobile Terminal & Ry. Co.) PLANS.—Approv. Oct. 3, 1911, 12, 1301.
- TILLAMOOK R.**, near mouth of Trask R., Oreg. (S.) (Tillamook County br.) PLANS.—Approv. May 14, 1909, 09, 918.
- TITABAWASSEE R.**, Saginaw, Mich. (S.) (Saginaw County br.) PLANS.—Br. to replace existing str. approv. Apr. 21, 1908, 08, 872.
- TITABAWASSEE R.**, on line between secs. 18 and 19, T. 12 N., R. 4 E., Mich. (S.) (Saginaw County br.) PLANS.—Approv. Dec. 24, 1909, 10, 1026.
- TOLAY CREEK**, Sonoma County, Cal. (S.) (Bay Counties Ry. Co.) PLANS.—Approv. July 14, 1906, 07, 820.
- TOMBIGBEE R.**, Miss. (Sp.) (Monroe County br.) LEGISLATION.—County au. to constr. br. by act July 7, 1898. PLANS.—Modified plans approv. Nov. 3, 1898, 99, 618.
- TOMBIGBEE R.**, Columbus, Miss. (S.) (Mobile & Ohio R. R. Co.) PLANS.—Rebuilding approv. Sept. 12, 1904, 05, 724.
- TOMBIGBEE R.**, near Fulton, Miss. (S.) (Itawamba County br.) PLANS.—Approv. Mar. 31, 1905, 05, 726.
- TOMBIGBEE R.**, near Ironwood Bluff, Miss. (Sp.) (Itawamba County br.) Au. act Feb. 4, 1911. PLANS.—Approv. July 13, 1911, 12, 1295.
- TOMBIGBEE R.**, Stones Ferry, Tenn. (Sp.) (Alabama, Tennessee & Northern R. R. Co.) Au. act Jan. 14, 1907. PLANS.—Approv. Jan. 25, 1907, 07, 818.
- TOMBIGBEE R.**, Waverly, Miss. (Sp.) (Georgia Pacific R. R. Co.) 88, 309, 2508. LEGISLATION.—Br. au. by act Mar. 3, 1887, 88, 2508. PLANS.—Br. as proposed not considered an obstr. to navigation, 88, 2508.
- TOUTLE R.**, near Castle Rock, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Approv. July 9, 1910, 11, 1081.
- TOWN CREEK**, N. C. (A.) (County br.) PLANS.—Capt. Bixby recom. the insertion of a draw span of 40' clear be required, 88, 2546.
- TOWN CREEK**, N. C. (S.) (Brunswick County br.) PLANS.—Approv. Oct. 15, 1909, 10, 1024.
- TOWN CREEK**, Brunswick County, N. C. (A.) PLANS.—Draw opening or the removal of the br. recom., 88, 2543.
- TOWN CREEK**, between Navassa and Southport, N. C. (Sp.) (Wilmington, Brunswick & Southern R. R. Co.) Au. act May 6, 1910. PLANS.—Approv. Apr. 12, 1910, 10, 1021.
- TOWN R.**, Quincy, Mass. (S.) (Fallon Bros.) PLANS.—Approv. Mar. 4, 1908, 08, 872.
- TOWNSEND GUT**, Me. (Dr.) 04, 710.
- TOWNSEND GUT**, Townsend, Me. (S.) (Town br.) PLANS.—Approv. May 1, 1896, 96, 426.
- TRACEYS CREEK** and **ROCK HOLE CREEK**, at head of Herring B., vicinity of Tracings Landing, Md. (S.) (Anne Arundel County brs.) PLANS.—Approv. May 11, 1907, 07, 827.
- TRADEWATER R.**, Ky. (Sp.) (Ohio Valley R. R. Co.) 88, 309. LEGISLATION.—Br. au. by act Feb. 21, 1887, 88, 2472. PLANS.—Description of proposed br., 88, 2473. Maj. Stickney reported that the br., when finished as proposed, would present no material obstacle to navigation, 88, 2473.
- TRAIL CREEK**, Franklin Street, Michigan City, Ind. (A. and Sp.) (City br.) 89, 2803; 90, 338. LEGISLATION.—Constr. au. by acts June 29, 1888, 89, 2803; and Apr. 22, 1890, 90, 338. PLANS.—If properly constr., and particularly if maneuvered by steam, this br. would not obstr. navigation to any great extent, 89, 2803. Plan and location submitted, and approv. by Sec. of War, June 4, 1890, 90, 338.
- TRAIL CREEK**, 6th Street, Michigan City, Ind. (A.) (City br.) PLANS.—Partly obstr. navigation, 89, 2803.
- TRAIL CREEK**, Michigan City, Ind. (S.) (Michigan Central R. R. Co.) PLANS.—Rebuilding approv. Mar. 4, 1902, 02, 587.
- TRAIL CREEK** (Michigan City inner H.), Ind. (S.) (Laporte County br.) PLANS.—Approv. Aug. 19, 1901; modified plans providing for change of location of superstr. approv. Nov. 11, 1901, 02, 584.
- TRAIL CREEK**, Franklin Street, Michigan City, Ind. (S.) (Laporte County br.) PLANS.—Reconstr. approv. Oct. 27, 1906, 07, 822.
- TRASK R.** (See Tillamook R.)
- TRENT R.**, Jones County, N. C. (S.) (Jones County br.) PLANS.—Rebuilding approv. Oct. 30, 1908, 09, 916.
- TRENT R.**, Newbern, N. C. (O.) (Atlantic & North Carolina R. R. Co.) PLANS.—Specified alterations required on or before Sept. 1, 1894; time extended to Apr. 1, 1895, 94, 431.

TRENT R., Newbern, N. C. (S.) (Craven County br.) PLANS.—Approv. Oct. 26, 1897, 98, 533.

TRENT R., near Pollokville, N. C. (S.) (Atlantic Coast Line br.) PLANS.—Reconstr. plans of pivot p. of draw approv. Aug. 2, 1898, 98, 536. Protection of center p. approv. July 11, 1901, 02, 583. Alterations to be completed within 9 months from July 22, 1907; time extended for 60 days, 08, 873.

TRENT R., Pollokville, N. C. (S.) (Jones County br.) PLANS.—Reconstr. approv. Sept. 13, 1906, 07, 822.

TRENT R., Pollokville, N. C. (S.) (John L. Roper Lumber Co.) PLANS.—Approv. Nov. 20, 1906, 07, 823.

TRINITY R., Tex. (S.) (Houston, Beaumont & New Orleans R. R. Co.) PLANS.—Approv. Jan. 30, 1903, 03, 648.

TRINITY R., Tex. (S.) (Beaumont, Sour Lake & Western Ry. Co.) PLANS.—Approv. Aug. 7, 1906, 07, 820. Modified plans in lieu thereof approv. Oct. 31, 1907, 08, 871.

TRINITY R., 5 m. below Dallas, Tex. (S.) (Dallas County br.) PLANS.—Br. to replace an existing str. approv. May 3, 1910, 10, 1029.

TRINITY R., Houston Street, in Dallas, and Lancaster Avenue, in Oak Cliff, Tex. (S.) (Dallas County br.) PLANS.—Approv. Sept. 29, 1910, 11, 1033.

TRINITY R., Hutchins Crossing, 16 m. s. of Dallas, Tex. (S.) (County br.) PLANS.—Approv. Feb. 2, 1911, 11, 1086.

TRINITY R., Liberty County, Tex. (S.) (Gulf, Colorado & Santa Fe Ry. Co.) PLANS.—Approv. July 6, 1901, 02, 583.

TRINITY R., Malloy Crossing, 24 m. s. of Dallas, Tex. (S.) (County br.) PLANS.—Approv. Feb. 1, 1911, 11, 1086.

TRINITY R., above Marianna, Tex. (S.) (Houston, East & West Texas Ry. Co.) PLANS.—Reconstr. plans approv. May 8, 1897, 97, 534.

TRINITY R., Wilmer Crossing, 21 m. s. of Dallas, Tex. (S.) (County br.) PLANS.—Approv. Feb. 2, 1911, 11, 1086.

TROUT CREEK, Fla. (O.) (Florida Central & Peninsular R. R. Co.) PLANS.—To so arrange the draw span and remove piles as to give a clear passage through the draw span, alterations to be and were completed by July 20, 1891, 91, 435.

TROUT CREEK, near Dinsmore, Fla. (S.) (Duval County br.) PLANS.—Approv. Mar. 16, 1910, 10, 1023.

TROUT CREEK, near Jacksonville, Fla. (S.) (Duval County br.) PLANS.—Rebuilding approv. Dec. 28, 1907, 08, 871.

TROUT CREEK, on the Lem Turner Road, Duval County, Fla. (S.) (County brs.) PLANS.—Approv. June 11, 1912, 12, 1308.

TUG FORK. (See Big Sandy R.)

TUG FORK, of Big Sandy R., at or near Williamson, W. Va. (Sp.) (Williamson & Pond Creek R. R. Co.) Au. act May 11, 1912. PLANS.—Approv. June 7, 1912, 12, 1298.

TULLS CREEK, Tulls, N. C. (O.) (Currituck County br.) PLANS.—Specified alterations required to be and were completed by June 1, 1892, 92, 411. Alterations to be completed within 5 months from Aug. 20, 1902, 02, 590.

TUOLUMNE R., near Tuolumne City Ferry, Cal. (S.) (Stanislaus County br.) PLANS.—Approv. Oct. 30, 1903, 04, 715.

TYGARTS VALLEY R., W. Va. (S.) (Buckhannon & Northern R. R. Co.) PLANS.—Approv. Jan. 9, 1904, 04, 716.

U.

U. S. CANAL. (See Muskingum R.)

U. S., FOX R., John Street, Appleton, Wis.
(S.) (City br.) PLANS.—Reconstr. plans.
approv. Oct. 10, 1896, **97**, 532.

V.

VERMILION R., Abbeville, La. (S.) (Vermilion Parish br.) PLANS.—Reconstr. plans approv. Sept. 23, 1895, **96**, 425.

VERMILION (Bayou) R., Abbeville, La. (S.) (Southern Pacific Co., on line of Iberia & Vermilion R. R.) PLANS.—Approv. Aug. 9, 1901, **02**, 584.

VERMILION BAYOU, Dormas Broussard Crossing, La. (S.) (Lafayette Parish br.) PLANS.—Reconstr. approv. Apr. 4, 1907, **07**, 826.

VERMILION (Bayou) R., D. O. Broussard's Crossing, La. (S.) (Vermilion Parish br.) PLANS.—Approv. Aug. 29, 1901, **02**, 584

VERMILION (Bayou) R., Perry, La. (S.) (Vermilion Parish br.) PLANS.—Approv. Dec. 3, 1901, **02**, 586.

VERMILION R., at Vermilion, Ohio. (S.) (New York Central Lines.) PLANS.—Rebuilding approv. Mar. 24, 1910, **10**, 1028.

VINCENT BAYOU, Slidell, La. (S.) (St. Tammany Parish br.) PLANS.—Approv. Apr. 3, 1907, **07**, 826.

W.

WABASH R., near Merom, Ind. (Sp.) 82, 263, 2011. LEGISLATION.—Br. au. by act June 30, 1879, 82, 263. PLANS.—Approv. of, recom. by Chief of Engineers, 82, 2011.

WABASH R. (A.) (1, Main Street br. at La Fayette; 2, Lake Erie & Western R. R. br. at Lafayette; 3, Wabash, St. Louis & Pacific R. R. br. at Attica; 4, Chicago & Great Southern R. R. br. at Attica; 5, Indiana, Bloomington & Western R. R. br. at Covington, and Columbus & St. Louis R. R. br. near Lodi, Ind.) 88, 2556. PLANS.—Maj. Miller reported all these brs. complete obstrs. to S. S. navigation at and above a medium stage of water, and recom. insertion of draw spans over the h.-w. chan. of 60' width in the clear, 88, 2557.

WABASH R., near Mount Carmel, Ill. (Sp.) (Evansville, Mount Carmel & Northern Ry. Co.) Au. act June 30, 1906. PLANS.—Approv. Dec. 22, 1906, 07, 818.

WABASH R., near Mount Carmel, Ill. (Sp.) (Leonard J. Hackney and Frank L. Littleton—Evansville, Mount Carmel & Northern Ry. Co.) Au. act Apr. 15, 1910. PLANS.—Approv. May 10, 1910, 10, 1022.

WABASH R., near Riverton, Ind. (Sp.) (Indianapolis Southern R. R. Co.) Au. act June 30, 1879. PLANS.—Reconstr. approv. Feb. 8, 1910, 10, 1021.

WABASH R., in Vigo County, Ind. (Sp.) (Southern Indiana Ry. Co.) Au. act Apr. 7, 1904. PLANS.—Approv. Oct. 28, 1904, 05, 720.

WABASH and WHITE Rs., Ind. (A.) 88, 2647' 90, 341. PLANS.—List of brs. without draws and forming total obstrs. at high stages, 88, 2648. Maj. Stickney recom. it be made optional with the br. owners whether they insert a draw and guard p. or raise their brs. enough to obtain 20' clearance between the lower chord and h.-w. mark, 88, 2648.

WACCAMAW R., Conway, S. C. (S.) (Conway & Seashore R. R. Co.) PLANS.—Approv. June 22, 1903, 03, 650.

WACCAMAW R., near Conway, S. C. (Sp.) (Horry County br.) Au. act Feb. 15, 1911. PLANS.—Approv. Apr. 21, 1911, 11, 1080, 1081.

WALLACE CREEK, S. C. (S.) (Colleton County br.) PLANS.—Approv. Aug. 8, 1902, 03, 645.

WALLUSKI R., Oreg. (Sp., etc.) (Clatsop County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Oregon. PLANS.—Modified plans approv. Oct. 26, 1891, 92, 400.

WAPPINGER CREEK, N. Y. (O.) (New York Central & Hudson River R. R. Co.) PLANS.—Alterations to be completed on or before 6 months from Oct. 22, 1906, 07, 828.

WAPPINGER CREEK, New Hamburg, N. Y. (S.) (New York Central & Hudson River R. R. Co.) PLANS.—Approv. Feb. 7, 1907, 07, 825.

WAPPOO CREEK, S. C. (O.) (Klaren Br. Co.) PLANS.—Alterations to be made within 4 months from Mar. 30, 1910, 10, 1032.

WAPPOO CUT, St. Andrews Parish to James Isld., S. C. (S.) (Wappoo Br. Co.) PLANS.—Approv. Sept. 22, 1898, after change made in location, 99, 620.

WARDS CREEK, Carteret County, N. C. (County br.) PLANS.—Approv. July 19, 1910, 11, 1082.

WAREHAM R., at Narrows, Wareham, Mass. (S.) (New Bedford & Onset Street Ry. Co.) PLANS.—Approv. July 10, 1901, 02, 583.

WARM SPRINGS CREEK and COYOTE CREEK, near Alviso, Cal. (S.) (Southern Pacific Co.) PLANS.—Rebuilding approv. Aug. 17, 1903, 04, 714. Substitute plans approv. Sept. 8, 1904, 05, 724.

WARREN R., R. I. (Sp.) (Warren town br.) Au. act Apr. 15, 1910. PLANS.—Approv. May 24, 1910, 10, 1022.

WARRIOR R., Fosters Ferry, Ala. (S.) (Tuscaloosa County br.) PLANS.—Approv. July 19, 1899, 99, 623.

WARRIOR R., Tuscaloosa County, Ala. (Sp., etc.) (Mobile & Ohio R. R. Co.) 97, 530. LEGISLATION.—Company au. to constr. br. by act June 11, 1896, 97, 530. PLANS.—Approv. Aug. 19, 1897, 97, 530.

WARRIOR R., Tuscaloosa to Northport, Ala. (O.) (Tuscaloosa County br.) PLANS.—Requiring a draw to be placed in br. between p. No. 1 and p. No. 2 to give a clear opening of 90'; to be completed on or before Dec. 1, 1895, 95, 483.

WASHINGTON, D. C.—Cabin John Br. (st. br.) (Br. No. 4.) CONTRACTS.—1872. Lee Palmer & Co., coping (contract annulled). J. Muddaman, coping (contract annulled). R. A. Shinn & Co., 6,950 c. f. coping. 72, 1022, 1023. ENGINEERS.—In charge: Maj. G. H. Elliot, 1871. R., 71, 949. Maj. O. E. Babcock, 1872-76. Rs., 72, 1022; 73, 1166; (Col.) 76, ii, 693. Col. G. H. Elliot, 1892-94. Rs., 92, 3360; 93, 4290, 4298; 94, 3203. Maj. J. G. D. Knight, 1895. R., 95, 4105. Capt. D. D. Gaillard, 1896. R., 96, 3914. Assistant: T. B. Samo. R., 71, 955. OPERATIONS.—1873. Cutting and setting st. for

repairs to br., 73, 1167. 1875-76. Pavements repaired, 76, ii, 693. 1892-93. Roadway repaired, 93, 4290. 1894-95. Br. repaired with vitrified brick, 95, 4105. 1895-96. Parapet walls repaired, 96, 3914. PROJECTS.—Maj. Elliot submitted, 1871, plans for repairs, 71, 949.

WASHINGTON, D. C.—College Pond. (Iron.) (Br. No. 5.) In charge: Maj. N. Michler, 1867-69. Col. O. E. Babcock, 1873-76. **Rs.**, 73, 1166; 74, ii, 400; 75, ii, 815; 76, ii, 694. Lt. Col. T. L. Casey, 1880. **R.**, 80, 2345. Lt. Col. A. M. Miller, 1900. **R.**, 00, 5196. Assistant: T. B. Samo. **Rs.**, 67, 550; 69, 506. OPERATIONS.—1867. Br. is in a good condition, 67, 550. 1868-00. Br. painted, 69, 506; 80, 2345; 00, 5196.

WASHINGTON, D. C.—Griffith Park Br. (Br. No. 3.) CONTRACTS.—1872. **R. A.** Shinn & Co., 3,106 c. f. coping, 72, 1023. In charge: Maj. G. H. Elliot, 1871. **R.**, 71, 949. Maj. O. E. Babcock, 1872-76. **Rs.**, 72, 1023; (Col.) 76, ii, 690. Col. G. H. Elliot, 1892-94. **Rs.**, 92, 3361; 93, 4290, 4298; 94, 3203. Maj. J. G. D. Knight, 1894. **R.**, 95, 4105. Capt. D. D. Gaillard, 1896. **R.**, 96, 3914. Assistant: T. B. Samo. **R.**, 71, 955. OPERATIONS.—1876. Pavements repaired, 76, ii, 693. 1893-94. Br. repaired with vitrified bricks, 94, 4105. 1895-96. Parapet walls repaired, 96, 3914.

WASHINGTON, D. C.—Receiving reservoir (Delecarlia). (Wooden br. over waste chan.) In charge: Lt. Col. T. L. Casey, 1880-81. **Rs.**, 80, 2348; 81, 2703. Col. G. H. Elliot, 1892-94. **Rs.**, 92, 3360; 93, 4290, 4299; 94, 3203. Maj. J. G. D. Knight, 1895. **R.**, 95, 4105. Capt. D. D. Gaillard, 1896. **R.**, 96, 3914. Capt. T. A. Bingham, 1898. **R.**, 98, 3630. Lt. Col. A. M. Miller, 1899-1900. **Rs.**, 99, 3785; 00, 5196. OPERATIONS.—1880-81. Br. rebuilt, 81, 2704. 1892-95. Br. repaired, 93, 4290; 95, 4105. 1895-96. Extensive repairs made, 96, 3914. 1897-98. Floor repaired, 98, 3630. 1898-99. Minor repairs made, 99, 3785. 1899-00. Floor renewed, 00, 5196. PROJECTS.—Description of br. built in 1863. In a dangerous condition, 80, 2348. Erected in 1863, rebuilt in 1881, 81, 2704. Col. Elliot est., 1893, \$18,000 to replace this br. with a masonry br., 93, 4299.

WASHINGTON AQUEDUCT, brs. on. CONTRACTS.—1873. T. Harvey, cut st. parapets and coping for brs. Nos. 1, 2, and 3, 73, 1167. In charge: Maj. N. Michler, 1867-70. Maj. G. H. Elliot, 1871. Maj. O. E. Babcock, 1872-73. **Rs.**, 72, 1022; 73, 1167. Assistant: T. B. Samo. **Rs.**, 67, 549; 68, 908; 69, 505; 70, 524; 71, 955. OPERATIONS.—1866-67. Brs. Nos. 1, 2, 3, and 5 are unfinished, 67, 549; 68, 908; 69, 505; 70, 524. 1872-73. Brs. Nos. 1, 2, and 3 completed, 74, ii, 399. PROJECTS.—Importance of these brs. can not be overest. Rapidly deteriorating, and if winters continue as cold and as changeable, their usefulness for aqueduct purposes will become seriously impaired. 67, 549.

WATEREE R., S. C. (A.) (South Carolina R. R. and Wilmington. Columbia & Augusta R. R.)

LEGISLATION.—Use of South Carolina R. R. br. without draw au. by State acts of 1853 and 1858, 88, 2548. PLANS.—Capt. Bixby reported both brs. an obstr. to navigation, and recom. insertion of suitable draw spans 60' in the clear be required, 88, 2548.

WATEREE R., near Kingsville, S. C. (S.) (Southern Ry. Co.) PLANS.—Reconstr. approv. Oct. 16, 1902, 03, 646.

WATTUSKI R., Oreg. (Dr.) 02, 581.

WEAKFISH CREEK, near Corson Inlet, N. J. (O.) (West Jersey & Seashore R. R. Co.) PLANS.—Alterations to be completed within 7 months from July 23, 1909; subsequently extended to Apr. 10, 1910, 10, 1031.

WELSHMANS CREEK, Md. (See Jones Creek.)

WEST B., Galveston Isld. to Virginia Pt., Tex. (Sp., etc.) (Galveston County br.) LEGISLATION.—County au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Texas. PLANS.—Approv. July 20, 1892, 92, 407.

WEST FORK R., near Fairmont, W. Va. (S.) (Buckhannon & Northern R. R. Co.) PLANS.—Approv. Jan. 25, 1904, 04, 716.

WEST FORK R., at Lumberport, W. Va. (S.) (West Virginia Short Line R. R. Co.) PLANS.—Approv. Mar. 12, 1910, 10, 1028.

WEST FORK R., near mouth of Tavebaugh Creek, W. Va. (S.) (Monongahela River R. R. Co.) PLANS.—Br. to replace existing str. approv. May 23, 1910, 10, 1030.

WEST GALVESTON B., Galveston, Tex. (S.) (Galveston County br.) PLANS.—Approv. Sept. 30, 1907, 08, 870. Modified plans approv. June 23, 1909, 09, 918.

WEST PEARL R., Miss. (S.) (New Orleans & Northeastern R. R. Co.) PLANS.—Rebuilding approv. Mar. 16, 1906, 06, 805.

WEST R. (See Stony Creek, Conn.)

WEST R., Kimberly Avenue, New Haven, Conn. (O.) (New Haven and Orange br.) PLANS.—Specified alterations required on or before Oct. 14, 1900, 00, 702. Alterations to be completed within 1 year from Apr. 11, 1903, 03, 651.

WEST R., New Haven, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. approv. Nov. 5, 1906, 07, 823.

WEST R., NE. Branch, Kimberly Avenue, New Haven, Conn. (S.) (City br.) PLANS.—Reconstr. approv. July 25, 1905, 06, 801.

WEST THOROFARE, N. J. (S.) (Long Beach Turnpike Co.) PLANS.—Approv. Mar. 14, 1912, 12, 1306.

WEST TWIN R., at Two Rivers, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Approv. May 5, 1904, 04, 718.

WEST VALLEY (Skamokawa) CREEK, Skamokawa, Wash. (S.) (Wahkiakum County br.) PLANS.—Approv. Mar. 25, 1904, 04, 717.

- WESTHAMPTON BEACH**, Suffolk County, N. Y. (Across chan. separating ocean beach from mainland, Long Island, N. Y.) (S.) (West Bay Co.) PLANS.—Reconstr. approv. Jan. 12, 1912, 12, 1304.
- WESTPORT R.**, E. Branch, Westport Pt., Mass. (S.) (Bristol County br.) PLANS.—Approv. July 5, 1894, 94, 429.
- WEWEANITITT R.**, Wareham and Marion, Mass. (S.) (State brs.) PLANS.—Reconstr. approv. June 14, 1901, 01, 667.
- WEYMOUTH BACK R.**, at Lincoln Street, Hingham, Mass. (O.) (Brs. of Old Colony Street Ry. Co., the city of Quincy, and the towns of Weymouth and Hingham.) PLANS.—Alterations of the 2 brs. to be completed by June 30, 1911, 10, 1032.
- WEYMOUTH BACK R.**, between Weymouth and Hingham, Mass. (S.) (State br.) PLANS.—Reconstr. of existing br. approv. Jan. 17, 1912, 12, 1304.
- WEYMOUTH FORE R.**, between Quincy and Weymouth, Mass. (S.) (Norfolk County br.) PLANS.—Approv. Aug. 22, 1901; modified plans approv. Nov. 16, 1901, 02, 584. Reconstr. approv. June 20, 1911, 11, 1090.
- WHATCOM** (I and J Street Waterway), Wash. (S.) (Seattle & Montana R. R. Co.) PLANS.—Rebuilding approv. Aug. 21, 1902, 03, 645, 646.
- WHATCOM** (I and J Street Waterway), Wash. (S.) (Bellingham City br.) PLANS.—Approv. Feb. 13, 1904, 04, 716, 717.
- WHATCOM CREEK WATERWAY**, at New Whatcom, Wash. (S.) (Seattle & Montana R. R. Co.) PLANS.—Rebuilding approv. Nov. 27, 1900, 01, 663. Approv. Nov. 5, 1902, 03, 647.
- WHATCOM CREEK and SANALICUM CREEK WATERWAYS**, Bellingham B., Wash. (S.) (H. H. Taylor, trustee for Bellingham & British Columbia Ry. Co.) PLANS.—Approv. Feb. 6, 1909, 09, 917.
- WHEELING CREEK**, at Wheeling, W. Va. (S.) (Pennsylvania Lines west of Pittsburgh.) PLANS.—Br. to replace existing str. approv. Mar. 25, 1910, 10, 1028.
- WHITE OAK B.**, Houston, Tex. (S.) (Missouri, Kansas & Texas R. R. Co.) PLANS.—Approv. Nov. 28, 1892, 93, 466.
- WHITE R.** and tributaries. (Dr.) 07, 815.
- WHITE R.**, Ark. (Sp.) (White River Ry. Co.) Au. act May 3, 1902. PLANS.—Approv. Feb. 13, 1903, 03, 644.
- WHITE R.**, between Arkansas and Desha Counties, Ark. (Sp.) (Memphis, Helena & Louisiana Ry. Co.) Au. act Feb. 24, 1902. PLANS.—Approv. Aug. 14, 1902, 03, 643.
- WHITE R.**, near Augusta, Ark. (Sp.) (St. Louis, Iron Mountain & Southern Ry. Co.) Au. act Feb. 19, 1910. PLANS.—Reconstr. approv. Mar. 15, 1910, 10, 1021.
- WHITE R.**, near Negro Hill, Ark. (S. and Sp.) (Missouri & North Arkansas R. R. Co.) PLANS.—Approv. Mar. 13, 1908, 08, 872.
- WHITE R.**, Newport, Ark. (Sp.) (Newport Br., Belt & Terminal Ry. Co.) Au. act June 21, 1902. PLANS.—Approv. July 8, 1902, 03, 642.
- WHITE R.**, Ind. (See Wabash R.)
- WHITE R.**, near Deckers Station, and above the mouth of the W. Fork, Ind. (A.) (Evansville & Terre Haute R. R. Co. and the Evansville & Indianapolis R. R. Co.) PLANS.—Description of the brs. Draw should be placed in the Evansville & Indianapolis br., and the location of the draw in Evansville & Terre Haute br. changed. 88, 2558.
- WHITE R.**, Ind. (O.) (Evansville & Terre Haute R. R. Co. and Indianapolis R. R. Co.) PLANS.—Alterations for the 2 brs. required by Jan. 1, 1890, 89, 376.
- WHITE R.**, near mouth of Conger Creek, Ind. (S.) (Chicago, Indianapolis & Evansville R. R. Co.) PLANS.—Approv. Oct. 23, 1907, 08, 871.
- WHITE R.**, Indianapolis, Ind. (S.) (Cleveland, Cincinnati, Chicago & St. Louis Ry. Co.) PLANS.—Approv. Apr. 8, 1902, 02, 588.
- WHITE R.**, near Black R. Junction, Wash. (S.) (Seattle-Tacoma Interurban Ry.) PLANS.—Approv. Aug. 13, 1901, 02, 584.
- WHITE R.**, near Kent, Wash. (S.) (Seattle-Tacoma Interurban Ry.) PLANS.—Approv. Aug. 13, 1901, 02, 584.
- WHITE R.**, near town of Kent, King County, Wash. (S.) (King County br.) PLANS.—Approv. July 5, 1904, 05, 722.
- WHITE R.**, just s. of Kent, Wash. (S.) (King County br.) PLANS.—Approv. Apr. 26, 1911, 11, 1088.
- WHITE R.**, King County, Wash. (S.) (King County br.) PLANS.—Approv. Apr. 2, 1906, 06, 805.
- WHITE R.**, King County, Wash. (S.) (State br.) PLANS.—Approv. Sept. 8, 1910, 11, 1083.
- WHITE R.**, near Orillia, Wash. (S.) (King County br.) PLANS.—Approv. June 10, 1899, 99, 623.
- WHITE R.**, Orillia, Wash. (S.) (King County br.) PLANS.—Approv. Aug. 15, 1908, 09, 914.
- WHITE SALMON R.**, Wash. (S.) (Portland & Seattle Ry. Co.) PLANS.—Approv. Feb. 9, 1907, 07, 825.
- WILLAMETTE R.**, Albany, Oreg. (Sp., etc.) (City br.) LEGISLATION.—Company au. to constr. br. by act Dec. 26, 1890. PLANS.—Modified plans approv. Dec. 23, 1891, 92, 402.
- WILLAMETTE R.**, Albany, Oreg. (Sp.) (Oregon Central & Eastern R. R. Co.) LEGISLATION.—Company au. to constr. br. by act June 24, 1884. PLANS.—Alteration plans, reducing length of the fixed spans, approv. Sept. 30, 1895, 96, 422.
- WILLAMETTE R.**, at Corvallis, Oreg. (S.) (Benton County br.) PLANS.—Approv. Feb. 10, 1910, 10, 1027.
- WILLAMETTE R.**, Harrison Street, Corvallis, Oreg. (S.) (Benton County br.) PLANS.—

- Approv. Feb. 10, 1910, and modified plans changing location to Van Buren Street approv. Apr. 1, 1911, 11, 1088.
- WILLAMETTE R.**, Harrisburg, Oreg. (S.) (Southern Pacific Co.) PLANS.—Rebuilding approv. June 14, 1905, 05, 728.
- WILLAMETTE R.**, Oreg. (Dr.) 08, 865; 11, 1078.
- WILLAMETTE R.**, 1 m. above Harrisburg, Oreg. (S.) (Oregon Electric Ry. Co.) PLANS.—Approv. Feb. 14, 1912, 12, 1305.
- WILLAMETTE R.**, Oswego, Oreg. (S.) (Beaverton & Willsburg R. Co.) PLANS.—Approv. Apr. 5, 1907, 07, 826.
- WILLAMETTE R.**, Portland, Oreg. (Sp.) COMMERCE.—Requirements of, on Willamette R., 82, 2046, 2047, 2051, 2056, 2083, 2091. ENGINEERS.—Chief of Engineers. **RS.**, 73, 63, 592; 82, 263; 85, 292; 87, 339. Boards convened at Portland, Oreg., in Nov., 1872, and reported in favor of the plan, with certain requirements of location. **R.**, 73, 593. Approv. by Chief of Engineers and Sec. of War, Jan. 2, 1873, 73, 593. (Lt. Col. Alexander, Maj. Stewart, Mendell, and Robert, and Lt. Weedon.) **R.**, 87, 2663-2669. LEGISLATION.—Br. au. by act Feb. 2, 1870, 73, 592. State legislation, 1878, au. constr. of br., 82, 2043, 2044; 87, 2669. PLANS.—Described, 73, 594. Submitted by city of Portland, Oreg., referred to BE., 73, 592. General description of br. proposed, 82, 2052, 2080. Opposition to constr. of brs. at location proposed, 82, 2044, 2046, 2058, 2068. Constr. of br. commenced in 1880, 82, 2050. Width of spans considered inadequate and location of br. improper, 82, 2064. Action of Dept. of Justice toward protecting the rights of the U. S., 82, 2067, 2072. Injunction granted against constr. of br. by U. S. circuit court, 1881, 82, 2082, 2094. Petition in 1885 for constr. of br., 85, 1918.
- WILLAMETTE R.**, Burnside and Knight-Quinby Streets, Portland, Oreg. (Sp., etc.) (City br.) Chief of Engineers. **RS.**, 92, 409. Boards. (Maj. T. H. Handbury, Capt. T. W. Symons, and Lt. H. Taylor.) LEGISLATION.—City au. to constr. brs. under act Sept. 19, 1890, sec. 7, and act of Oregon, 92, 409. PLANS.—For 2 drawbrs.; reported adversely upon by BE. recom. for disapprov.; concurred in by Chief of Engineers; approv. Aug. 24, 1892, 92, 409.
- WILLAMETTE (Lower) R.**, Portland, Oreg. (A.) (North Pacific R. R. br. and wagon br.) PLANS.—Both str. a menace to navigation; should be wholly removed, 88, 2593.
- WILLAMETTE R.**, Portland, Oreg. (S.) (City br.) PLANS.—Rebuilding approv. June 28, 1909, 09, 919.
- WILLAMETTE R.**, near Portland, Oreg. (S.) (Portland & Seattle Ry. Co.) PLANS.—Approv. June 20, 1906, 06, 808.
- WILLAMETTE R.**, at Adams and Oregon existing str. at Holliday Avenue approv. Nov. 10, 1909, 10, 1025.
- WILLAMETTE R.**, at Broadway, Portland, Oreg. (S.) (City br.) PLANS.—Approv. Mar. 23, 1910, 10, 1028.
- WILLAMETTE R.**, between Morrison and E. Morrison Streets, Portland, Oreg. (S.) (City br.) PLANS.—Br. to replace existing str. approv. Dec. 11, 1903, 04, 716.
- WILLAMETTE R.**, Salem, Oreg. (Sp.) 87, 339, 2683. LEGISLATION.—Br. au. by act July 29, 1886. PLANS.—Br. already built when plans were submitted for approv. With slight modifications the br. not a serious obstr. to navigation. 87, 339, 2687.
- WILLAMETTE R.**, Union Street, Salem, Oreg. (S.) (Salem Falls City & Western Ry. Co.) PLANS.—Approv. Apr. 17, 1911, 11, 1088.
- WILLAMETTE R.**, near Wilsonville, Oreg. (S.) (Oregon Electric Ry. Co.) PLANS.—Approv. Aug. 8, 1906, 07, 821.
- WILLAMETTE (Upper) R.**, Oreg. (Ferry cables across.) (A.) PLANS.—List of localities at which such obstrs. exist, 88, 2590.
- WILLAPA R.**, at city of Raymond, Wash. (S.) (City br.) PLANS.—Approv. Aug. 11, 1909, 10, 1024.
- WILLAPA R.**, S. Arm, Wash. (Sp., etc.) (United Railroads of Washington.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Washington. PLANS.—Approv. July 7, 1892, 92, 407.
- WILLAPA R.** (S. Fork), at Raymond, Wash. (S.) (Northern Ry. Co.) PLANS.—Reconstr. approv. Dec. 2, 1909, 10, 1025.
- WILLAPA R.**, S. Fork, Pacific County, Wash. (S.) (Pacific County br.) PLANS.—Approv. Sept. 1, 1904, 05, 723.
- WILLAPA R.**, above Willapa, Wash. (S.) (Eastern & Pacific Ry. Co.) PLANS.—Approv. May 9, 1910, 10, 1029.
- WILMINGTON B.** (arm of), from Wilmington to San Pedro, Cal. (S.) (Los Angeles Interurban Ry. Co.) PLANS.—Trestle br. approv. May 7, 1904, 04, 718.
- WILMINGTON LAGOON SLOUGH**, inner H. of San Pedro, Cal. (S.) (Kerckhoff-Cuzner Mill & Lumber Co.) PLANS.—Approv. Mar. 29, 1898, 98, 535.
- WILSON CREEK**, Willapa, Wash. (S.) (Pacific County br.) PLANS.—Approv. June 28, 1907, 07, 828.
- WILTON WATERWAY**, at Tacoma, Wash.; **DAY ISLAND WATERWAY**, at Tacoma, Wash.; **STEILACOOM CREEK WATERWAY**, near Steilacoom, Wash.; **5TH STREET WATERWAY**, at Steilacoom, Wash.; and **CLIFF AVENUE WATERWAY**, at Steilacoom, Wash. (S.) (Northern Pacific Ry. Co.) PLANS.—Approv. Nov. 19, 1909, 10, 1025.

- WINTHROP COVE**, New London, Conn. (S.) (Central Vermont Ry. Co.) PLANS.—Reconstr. approv. Nov. 23, 1903, **04**, 715.
- WINTHROP COVE**, Crystal Avenue, New London, Conn. (S.) (City br.) PLANS.—Rebuilding approv. Nov. 14, 1906, **07**, 823.
- WINTHROP COVE**, New London, Conn. (S.) (New York, New Haven & Hartford R. R. Co.) PLANS.—Reconstr. approv. Jan. 2, 1907, **07**, 824.
- WISCONSIN R.**, Wis. (S.) (Union Br. Co.) PLANS.—Approv. Mar. 19, 1901, **01**, 665.
- WISCONSIN R.**, Kilbourn City, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Rebuilding approv. June 14, 1902, **02**, 589.
- WISCONSIN R.**, near Lone Rock, Wis. (S.) (Lone Rock Br. Co.) PLANS.—Approv. Feb. 21, 1895, **95**, 478.
- WISCONSIN R.**, Merrimac, Wis. (S.) (Chicago & North Western Ry. Co.) PLANS.—Reconstr. approv. Oct. 9, 1901, **02**, 585.
- WISCONSIN R.**, Portage, Wis. (S.) (Town br.) PLANS.—Temporary br. to replace one destroyed by storm approv. Sept. 18, 1905, **06**, 802.
- WISCONSIN R.**, Prairie du Chien, Wis. (S.) (Chicago, Burlington & Quincy Ry. Co.) PLANS.—Reconstr. approv. Feb. 3, 1903, **03**, 648.
- WISCONSIN R.**, near Sauk City, Wis. (S.) (Chicago, Milwaukee & St. Paul Ry. Co.) PLANS.—Rebuilding approv. Oct. 5, 1909, **10**, 1024.
- WISCONSIN R.**, Spring Green, Wis. (S.) (Spring Green, Wyoming & Wisconsin River Wagon Br. Co.) PLANS.—Approv. Dec. 7, 1903, **04**, 716.
- WISCONSIN R.**, Wyoming and Spring Green, Wis. (S.) (Town br.) PLANS.—Approv. May 23, 1906, **06**, 807.
- WISHKA R.**, Wash. (S.) (United Railroads of Washington.) PLANS.—Approv. Oct. 2, 1897, **98**, 533.
- WISHKA R.**, Heron Street, Aberdeen, Wash. (S.) (City br.) PLANS.—Approv. Nov. 29, 1905, **06**, 803.
- WISHKA R.**, at Young Street, North Aberdeen, Wash. (S.) (City br.) PLANS.—Approv. Jan. 22, 1910, **10**, 1026; and plans for new br. at Cleveland and Lafayette Streets, in lieu of first approv., approv. Feb. 2, 1911, **11**, 1086. Later instrument canceled May 25, 1911, and br. at Young Street approv., **11**, 1089.
- WISHKA R.**, Chehalis County, Wash., in sec. 15, T. 18 N., R. 9 W., Willamette meridian. (S.) (Chehalis County br.) PLANS.—Approv. Feb. 8, 1910, **10**, 1027.
- WISHKA R.** (See Hoquiam R.)
- WITHLACOOCHEE R.**, Dunnellon, Fla. (S. and A.) (Silver Spring, Ocala & Gulf Ry. Co.) **89**, 2797; **94**, 429; **95**, 478. PLANS.—No proper draw span; very little navigation, **89**, 2797. Plans for new br. approv. June 14, 1894, **94**, 429. Modified plans submitted Feb. 6, 1895; approv. Feb. 23, 1895, **95**, 478.
- WITHLACOOCHEE R.**, Dunnellon, Fla. (S.) (Br. of Marion and Citrus Counties.) PLANS.—Approv. Nov. 25, 1903, **04**, 715.
- WITHLACOOCHEE R.**, near S. Dunnellon, Fla. (S.) (Standard & Hernando R. R. Co.) PLANS.—Approv. June 3, 1904, **04**, 719.
- WITHLACOOCHEE R.**, Istachatta, Fla. (S.) (Hernando County br.) PLANS.—Approv. Oct. 8, 1909, **09**, 915.
- WITHLACOOCHEE R.**, in Marion and Citrus Counties, Fla. (S.) (Tampa Northern R. R. Co.) PLANS.—Approv. Mar. 15, 1910, **10**, 1028.
- WITHLACOOCHEE R.** and **BLUE RUN** (Wekiva R.), near Dunnellon, Fla. (S.) (Seaboard Air Line Ry. Co.) PLANS.—Approv. Mar. 15, 1910, **10**, 1028.
- WITHLACOOCHEE** and **PEACE RS.** (A.) (Florida Southern, the South Florida, and the Florida R. R. & Navigation Co.) **88**, 2630. PLANS.—Brs. would have to be provided with draws if imp. be undertaken, **88**, 2631.
- WOLF R.**, Gills Landing, Wis. (S.) (Wisconsin Central R. R. Co.) PLANS.—For new br. approv. Dec. 7, 1893, **94**, 427. Modified plans approv. Feb. 5, 1895, **95**, 477.
- WOLF R.**, at Hortonville, Wis. (S.) (Outagamie County br.) PLANS.—Reconstr. approv. Oct. 27, 1909, **10**, 1025.
- WOLF R.**, Matteson, Wis. (S.) (Town br.) PLANS.—Approv. Sept. 13, 1905, **06**, 802.
- WOLF R.**, near Memphis, Tenn. (S.) (Illinois Central R. R. Co.) PLANS.—Approv. Feb. 9, 1909, **09**, 917.
- WOLF R.**, New London, Wis. (Sp., etc.) (Milwaukee, Lake Shore & Western Ry. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Wisconsin. PLANS.—For new br. approv. Mar. 22, 1892, **92**, 404.
- WOLF R.**, between Shawano and Door Streets, New London, Wis. (S.) (City br.) PLANS.—Approv. May 23, 1912, **12**, 1307.
- WOLF R.**, Northport, Mukwa, Wis. (S.) (Mukwa town br.) PLANS.—Approv. Jan. 12, 1898, **98**, 534.
- WOLF R.**, at Rouses Ferry, Miss. (S.) (J. P. Rouse.) PLANS.—Approv. Sept. 21, 1909, **10**, 1024.
- WOODBIDGE CREEK**, Perth Amboy and Woodbridge, N. J. (S.) (Middlesex County br.) PLANS.—Approv. July 12, 1901, **02**, 583.
- WOODBURY CREEK.** (See Schuylkill R.)
- WOODBURY CREEK**, near National Park, N. J. (S.) (Gloucester County br.) PLANS.—Rebuilding approv. Oct. 27, 1909, **10**, 1025.
- WORTH LAKE**, Palm Beach, Fla. (S.) (Jacksonville, St. Augustine & Indian River R. R. Co.) PLANS.—Approv. July 19, 1895, **95**, 479.

Y.

- YALOBUSHA R.**, Leflore County, Miss. (Sp.) (Yazoo & Mississippi Valley R. R. Co.) LEGISLATION.—Company au. to constr. br. by act July 7, 1898. PLANS.—Approv. July 16, 1898, 98, 532.
- YALOBUSHA R.**, mouth of Martins Creek, Miss. (Sp.) (Grenada County br.) Au. act Feb. 12, 1901. PLANS.—Approv. Apr. 1, 1901, 01, 660.
- YAMHILL R.**, near Lafayette, Yamhill County, Oreg. (Sp., etc.) (Oregonian R. R. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Oregon. PLANS.—Reconstr. plan approv. Dec. 12, 1891, 92, 402.
- YAZOO R.** (See Sunflower R.)
- YAZOO R.**, Belzoni, Miss. (Sp.) (Washington County br.) Au. act Apr. 13, 1906. PLANS.—Approv. Aug. 23, 1906, 07, 817.
- YAZOO R.**, Greenwood, Miss. (Sp.) (Leflore County br.) LEGISLATION.—County au. to constr. br. by act Mar. 3, 1897; amending act Apr. 29, 1898. PLANS.—Approv. May 12, 1898, 98, 531.
- YAZOO R.**, at or near Roebuck Landing, Miss. (S.) (Leflore County br.) PLANS.—Approv. Apr. 8, 1911, 11, 1088.
- YAZOO R.**, Shell Bluff, Miss. (S.) (Leflore County br.) PLANS.—Approv. Oct. 20, 1910, 11, 1084. Plans for pile protection approv. Mar. 10, 1911, 11, 1087.
- YAZOO R.**, Yazoo City, Miss. (S.) (Yazoo & Mississippi Valley R. R. Co.) PLANS.—Approv. Jan. 29, 1902, 02, 586.
- YELLOW MILL POND**, Stratford Avenue, Bridgeport, Conn. (S.) (City br.) PLANS.—Reconstr. plan approv. Oct. 12, 1897, 98, 533.
- YELLOWSTONE R.**, Glendive, Mont. (Sp.) (Dawson County br.) LEGISLATION.—County au. to constr. br. by act Feb. 26, 1895, 95, 475, and June 6, 1900. PLANS.—Approv. July 9, 1895, 95, 475. Reconstr. approv. July 19, 1900, 01, 659.
- YELLOWSTONE R.**, Glendive, Mont. (Sp.) (Northern Pacific Ry. Co.) Au. act June 23, 1910. PLANS.—Approv. July 16, 1910, 11, 1079.
- YELLOWSTONE R.**, near Tusler, Terry, and Miles City, Mont. (Sp.) (Chicago, Milwaukee & St. Paul Ry. Co.) Au. act Apr. 2, 1906. PLANS.—Approv. Dec. 4, 1906, 07, 817.
- YORK R.**, Me. (Dr.) 08, 865.
- YORK R.**, York, Me. (Sewells Br.). (O. and A.) (Town br.) PLANS.—Alterations to be completed within 3 months from Oct. 19, 1900, 01, 667.
- YORK R.**, York, Me. (O.) (Town br.) PLANS.—Alterations to be completed on or before June 1, 1905, 04, 723. Approv. Apr. 11, 1907, and supple. plans July 25, 1907, 08, 868.
- YORK R.**, York, Me. (S.) (York County br.) PLANS.—Approv. Apr. 11, 1907, 07, 826.
- YOUGHIOGHENY R.**, Boston, Pa. (S. and Sp.) (Boston Br. Co.) LEGISLATION.—Company au. to constr. br. under act July 13, 1892, sec. 3, and act of Pennsylvania. PLANS.—Approv. Aug. 15, 1892, 92, 408.
- YOUGHIOGHENY R.**, Fayette County, Pa. (S.) (Youghiogheny Central Ry. Co.) PLANS.—Approv. Sept. 24, 1892, 93, 466.
- YOUGHIOGHENY R.**, 5th Avenue, McKeesport, Pa. (S.) (5th Avenue & High Street Br. Co.) PLANS.—Approv. July 31, 1895, 95, 479.
- YOUGHIOGHENY R.**, between McKeesport and Reynoldton, Pa. (S.) (Pittsburgh & Lake Erie R. R. Co.) PLANS.—Reconstr. plans approv. Apr. 29, 1898, 98, 535.
- YOUGHIOGHENY R.**, McKeesport, Pa. (S. and Sp.) (Port View Br. Co.) LEGISLATION.—Company au. to constr. br. under act Sept. 19, 1890, sec. 7, and act of Pennsylvania. PLANS.—Approv. Feb. 26, 1891, 91, 431.
- YOUGHIOGHENY R.**, McKeesport, Pa. (S.) (McKeesport & Port Vue Br. Co.) PLANS.—Approv. May 16, 1906, 06, 806.
- YOUGHIOGHENY R.**, Suterville, Pa. (S.) (Allegheny & Westmoreland Br. Co.) PLANS.—Approv. Dec. 30, 1895, for a suspension br., 96, 425. A truss br. was built, for which plans were approv. Apr. 13, 1897, 97, 533.
- YOUGHIOGHENY R.**, West Newton, Pa. (S.) (Westmoreland County br.) PLANS.—Rebuilding approv. May 18, 1905, 05, 727.
- YOUNGS B.**, Astoria, Oreg. (S.) (Clatsop County br.) PLANS.—Modified plans approv. Aug. 16, 1898, 98, 537.
- YOUNGS B.**, Oreg. (S.) (Astoria & Columbia River R. R. Co., successors to the Sea Shore Road Co.) PLANS.—Approv. Mar. 14, 1894, 94, 428. Sea Shore Road Co., having relinquished its right to constr. this br., plans submitted by the Astoria & Columbia River R. R. Co. were approv. Nov. 18, 1895, 96, 425.
- YOUNGS B.**, Oreg. (Dr.) 02, 581.

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

SECTION 2.—SUPERVISION OF STRUCTURES OTHER THAN BRIDGES IN CONNECTION WITH NAVIGABLE WATERS.

"Pursuant to the provisions of sections 9 and 10 of the river and harbor act of March 3, 1899, and of certain special acts of Congress, numerous applications for permission to build structures of various kinds, other than bridges (such as DAMS, WHARVES, DOLPHINS, BOOMS, WEIRS, etc.), in the navigable waters of the United States, have been examined with a view to the protection of navigation interests.

"Upon the recommendation of the Chief of Engineers, permits have been granted by the Secretary of War for the erection of a number of such structures, but specific reference is not deemed necessary except in the following cases:"

- ALVISO SLOUGH AND GUADALUPE R.**, Cal. (Sloughs emptying into.) (Dams—2—of A. C. Kuhn.) PLANS.—Approv. Sept. 22, 1909, 10, 1033.
- BARATARIA BAYOU**, near the entrance to Harvey Canal, La. (Dam of Jefferson and Plaquemine Drainage District.) PLANS.—Plans and map of location approv. June 7, 1912, 12, 1310.
- BEAR ISLAND LAKE**, Minn. (See Eve Lake.)
- BIRCH LAKE**, Minn. (See Eve Lake.)
- CASS LAKE** (outlet), Minn. (Dam of J. Neils Lumber Co.) PLANS.—Consent to constr. of temporary dam given May 6, 1911, 11, 1092.
- CHARLES R.**, Boston, Mass. (S.) (L. and d. of Mass.) ENGINEERS.—Chief of Engineers. R., 05, 730. PLANS.—General plans approv. May 18, 1904; detailed plans approv. Oct. 5, 1904, 05, 730.
- CHOCTAWHATCHEE R.**, near Newton, Ala. (Dam of Choctawhatchee Power Co.) Au. act Apr. 5, 1906. PLANS.—Approv. Apr. 2, 1907, 07, 830.
- CHOCTAWHATCHEE R.**, near Newton, Ala. (Sp.) (Dam of Choctawhatchee River Light & Power Co.) Au. act Mar. 10, 1908. PLANS.—Approv. Mar. 9, 1909, 09, 921.
- CLEARWATER R.** (N. Fork), at Bruce's Eddy, Idaho. (Dam of Clearwater Timber Co.) PLANS.—Approv. June 9, 1910, 10, 1033.
- CLEARWATER R.** (Middle Fork), at Kooskia, Idaho. (Dam of E. J. Hartman et al.) PLANS.—Approv. May 10, 1910, 10, 1033.
- CLINCH R.**, near Agee, Tenn. (S.) (Dam of Ruben Bollinger.) PLANS.—Approv. Jan. 19, 1909, 09, 921.
- COLORADO R.**, mouth of Pyramid Canyon, 22 m. n. of Fort Mohave, and at or near Black Pt., 20 m. n. of Ehrenberg, Ariz. (Dams of Chuacawalla Development Co.) PLANS.—Au. act Feb. 15, 1911, plans approv. May 10, 1911, 11, 1033.
- COOSA R.**, Ga. and Ala. (Sp.) (Dam of the Alabama Power Co., at site selected for L. and D. No. 12 under U. S. proj.) Au. act Mar. 4, 1907. PLANS.—Approv. Mar. 3, 1910, 10, 1033.
- CROW WING R.**, in Crow Wing County, Minn. (S.) (Dam of Cuyuna Range Power Co.) PLANS.—Approv. Apr. 12, 1912, 12, 1309.
- EVE, BIRCH, M'DOUGALL, and BEAR ISLD. LAKES**, Minn. (Dams—4—of the Fall Lake Boom Co.) PLANS.—Approv. Oct. 15, 1909, 10, 1033.
- FOX R.**, at Combined Locks, Wis. (Dam of Green Bay & Mississippi Canal Co.) PLANS.—Reconstr. plan approv. Apr. 19, 1911, 11, 1092.
- LAFOURCHE BAYOU**, La. (L. and d. of Atchafalaya and Lafourche Basin Levee Boards of La.) Au. act June 13, 1902. PLANS.—Approv. Dec. 17, 1902, and Nov. 20, 1903. Time for removal of temporary dam and constr. of locks extended to Jan. 1, 1910. 03, 641; 04, 709; 07, 830.
- M'DOUGALL LAKE**, Minn. (See Eve Lake, Minn.)
- MERMENTAU R.**, La. Act Jan. 10, 1903, au. Rice Irrigation & Imp. Association, State of Louisiana, to constr. l. and d. near mouth of R. Plans, specifications, maps approv. by Sec. of War, Mar. 12, 1903. 03, 641.
- MISSISSIPPI R.**, Augusta, Minn. (Dam of St. Cloud Electric Power Co.) Au. act June 28, 1906. PLANS.—Approv. Feb. 2, 1907, 07, 829.
- MISSISSIPPI R.**, Bemidji, Minn. (Dam of Beltrami Electric Light & Power Co., successor to Kirby Thomas, E. J. Swedback, and M. A. Spooner.) Au. act Mar. 3, 1905. PLANS.—General plans approv. Mar. 2, 1906; detailed plans approv. Apr. 29, 1907, 07, 830.
- MISSISSIPPI R.**, Des Moines Rapids, Iowa. (Sp.) (Dam of Keokuk & Hamilton Water Power Co.) PLANS.—Approv. May 9, 1908, 08, 875.

- port Water Power Co.) Au. act Apr. 5, 1904; amended act Feb. 5, 1907. PLANS.—Approv. June 11, 1907, **07**, 830.
- MISSISSIPPI R.**, at Sauk Rapids, Minn. (Dam of Sauk Rapids Water Power Co.) Au. act Feb. 26, 1904; amended act Mar. 2, 1907. PLANS.—Approv. Feb. 11, 1907, **07**, 830.
- MISSISSIPPI R.**, in Stearns and Benton Counties, Minn., above mouth of Watab R. (Sp.) (Dam of Watab Rapids Power Co.) Au. act Apr. 23, 1904. PLANS.—Approv. Apr. 6, 1905, **05**, 730.
- MISSISSIPPI R.**, at Coon Rapids, Minn. (Dam of Great Northern Development Co.) Au. act Jan. 12, 1911. PLANS.—Approv. Sept. 20, 1911, and amended Dec. 14, 1911, by eliminating "condition No. 3," **12**, 1309.
- MISSISSIPPI R.**, at or near the foot of Des Moines Rapids. (Dam of Keokuk & Hamilton Water Power Co.) PLANS.—Au. acts Feb. 8, 1901, and Feb. 9, 1905. Plans approv. Apr. 5, 1911. **11**, 1092.
- MISSISSIPPI R.**, in Madison County, near Royalton, Minn. (Dam of Pike Rapids Power Co.) Au. acts June 4, 1906; Mar. 7, 1907; and Mar. 4, 1911. PLANS.—Approv. July 1, 1912, **12**, 1310.
- MISSOURI R.**, near Canyon Ferry, Mont. (Sp.) (Dam of Helena Power Co., successor to Missouri River Power Co.) PLANS.—Approv. Oct. 19, 1905, **06**, 810.
- MISSOURI R.**, in vicinity of Buck Rapids, Mont. (Dam of Capital City Imp. Co.) Au. act Apr. 12, 1906. PLANS.—Approv. Aug. 17, 1906, **07**, 829.
- MISSOURI R.**, Ox Bow Bend, Mont. (Sp.) (Dam of the Ox Bow Power Co.) Au. act Apr. 28, 1904. PLANS.—Approv. Apr. 15, 1905, **05**, 730.
- MISSOURI R.**, Wolf Creek, Mont. (Sp.) (See above.) Dam of Capital City Power Co., successor to Capital City Imp. Co.) Au. act Apr. 15, 1906. PLANS.—Approv. Apr. 14, 1908, being in lieu of plans for dam at Buck (see above) Rapids which was approv. Aug. 17, 1906, **08**, 875.
- MYSTIC R.**, near Cradock Br., Medford, Mass. (Dam of Mass.) PLANS.—Approv. Sept. 6, 1906, **07**, 829.
- NORTH R.**, Wash. (Dam of Loggers Boom & Driving Co.) PLANS.—Approv. Mar. 17, 1910, **10**, 1033.
- RAINY LAKE R.**, Minn. (Sp.) (Dam of the Koochiching Co.—Rainy River Imp. Co.) Au. act May 4, 1898, and amendatory acts. PLANS.—Approv. Sept. 21, 1909, and instrument suppl. thereto dated Feb. 19, 1910, **10**, 1033.
- ROCK R.**, Carrs and Vandruffs Islds., Ill. (Dam of Samuel S. Davis.) Au. act May 1, 1906. PLANS.—Approv. Feb. 16, 1907, **07**, 830.
- ROCK R.**, Grand Detour, Ill. (Sp.) (Dam of Spencer B. Newberry.) Au. Feb. 16, 1906. PLANS.—Approv. Feb. 4, 1909, **09**, 921.
- ST. CROIX R.**, between Stillwater and Taylors Falls, Wis. and Minn. (A.) PLANS.—Booms, ps., and logs of the St. Croix Boom Co. form obstrs. to navigation for weeks, and sometimes months, of the season of navigation, **89**, 2798.
- ST. CROIX R.**, St. Croix, Wis. (Sp.) (Dam of St. Croix Falls (Wis.) Imp. Co., and the St. Croix Falls (Minn.) Imp. Co.) PLANS.—Constr. of a dam au. act Feb. 7, 1903; approv. Sept. 16, 1904, **05**, 730.
- ST. JOSEPH R.**, near Berrien Springs, Mich. (Dam of Berrien Springs Power & Electric Co.) Au. act Apr. 5, 1906. PLANS.—Approv. Apr. 19, 1907, **07**, 830.
- ST. JOSEPH R.**, Mich. (Dam of City of Sturgis, Mich.) PLANS.—Constr. au. act Jan. 12, 1911; plans approv. Apr. 14, 1911, **11**, 1092.
- ST. JOSEPH R.**, near Motville, Mich. (Dam of Herman L. Hartenstein.) Au. act Feb. 13, 1911. PLANS.—Approv. Feb. 13, 1912, **12**, 1309.
- ST. LAWRENCE R.**, between Adams and Les Galops Islds. (Sp.) (Dam of Dominion of Canada.) Au. act June 18, 1902. PLANS.—For constr. approv. Aug. 18, 1903; modified plans providing for an increase in height of dam approv. Oct. 10, 1904, **05**, 730.
- ST. LOUIS R.**, below Fond du Lac, Wis. (A.) PLANS.—St. Louis Boom Co. maintains a log boom which is an obstr. to navigation, **89**, 2798.
- SAVANNAH R.**, Gregg Shoals, S. C. (Sp.) (Dam of Savannah Power Co.) Au. act June 21, 1906, and Feb. 5, 1907. PLANS.—Approv. Aug. 8, 1907, **08**, 875.
- SAVANNAH R.**, near Prices Isld., S. C. (Sp.) (Twin City Power Co.) Au. act Feb. 28, 1908. PLANS.—Approv. Feb. 20, 1909, **09**, 921.
- SAVANNAH R.**, at or near mouth of Stevens Creek, between the counties of Edgefield, S. C., and Columbia, Ga. (Dam of Georgia-Carolina Power Co.) PLANS.—Approv. July 20, 1910, **11**, 1091.
- SNAKE R.**, Idaho, Oreg., and Wash. (Dam of Burbank Power & Water Co., in vicinity of Fivemile Rapids.) PLANS.—Approv. Sept. 10, 1906; modified plans approv. Nov. 2, 1909, **10**, 1033.
- SUSQUEHANNA R.**, near Conowingo, Md. (Susquehanna Power Co.) PLANS.—Approv. Apr. 9, 1907, **07**, 830.
- TENNESSEE R.**, at Hales Bar, below Chattanooga, Tenn. (Dam of Chattanooga & Tennessee River Power Co.) PLANS.—Approv. Aug. 26 and Oct. 14, 1910, **11**, 1092.
- WALLICUT R.** (N. and S. Forks), Wash. (Dam of commissioners of diking district No. 1, Pacific County, Wash.) PLANS.—Approv. Sept. 23, 1910, **11**, 1091.
- WHITE R.** (E. Fork), 4 m. below Shoals, Ind. (Dam of Shoals Power Co.) PLANS.—Approv. Apr. 20, 1911, **11**, 1092.
- WHITE R.**, near Forsyth, Taney County, Mo. (Dam of Ozark Power & Water Co.) Au. act

Feb. 4, 1911. PLANS.—Approv. Nov. 24, 1911, 12, 1309.

WHITE R., E. Fork, Williams, Ind. (S.) (Dam of Bedford Power Co.) PLANS.—Approv. Feb. 27, 1909, 09, 921.

WILLAMETTE SLOUGH, near Portland, Oreg. (S.) (Dam of Ruth Trust Co.) PLANS.—For str. to replace one built by the U. S. approv. May 12, 1909, 09, 921.

WISCONSIN R., Kilbourn, Wis. (Sp.) (Dam of P. L. Spooner.) PLANS.—Approv. Feb. 7, 1906, 06, 810.

WISCONSIN R., near Prairie du Sac, Wis. (Dam of Badger Hydro-Electric Co.) PLANS.—Approv. Aug. 4, 1909, 10, 1032.

WISCONSIN R., near Prairie du Sac, Wis. (Dam of Wisconsin River Power Co.) PLANS.—Approv. Feb. 3, 1911, 11, 1092; and May 11, 1912, 12, 1309.

WITHLACOOCHEE R., Dunnellon, Fla. (Sp.) (Dam of Camp Phosphate Co.) Au. act June 13, 1902. PLANS.—Approv. Apr. 16, 1904; modified plans approv. Sept. 23, 1905, 06, 810.

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

SECTION 3.—ESTABLISHMENT OF HARBOR LINES.

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|---|--------------------------------------|---|--------------------------------------|
| Aberdeen, Wash. (see Chehalis.) | 93, 462, 3472 | Astoria, Oreg. (see Columbia R.; Youngs Bay) | 04, 709, 3577 |
| Absecon Inlet, N. J. | 06, 797 | Astoria H., Oreg. | 91, 427, 3387 |
| Acushnet R., Mass. | 11, 1076 | Astoria H., Oreg., near | 96, 23, 3322 |
| Adams Isld., N. Y. | 09, 910 | Atlantic Basin, N. Y. | 02, 579, 983 |
| Adams Street, Troy, N. Y. | 03, 640, 820 | Atlantic City, N. J. | 09, 910 |
| Alameda H., Cal. (see San Francisco) | 02, 579, 961 | Atlantic City Br., Norfolk, Va. | 03, 640, 1089 |
| Alameda H., Cal. (see San Francisco) | 09, 910 | Back Cove, Portland, Me. | 01, 118, 1027 |
| Estab. of H. lines on e. shore of San Francisco B., from Pt. San Pablo southward, in front of Oakland and Alameda, Cal. | 93, 462, 3472 | Ballard, Wash. | 93, 462, 3472 |
| Albany, N. Y. (see Hudson R.) | 94, 424, 2505 | Puget Sound | 95, 21, 473, 3543 |
| Albina, Oreg. | 03, 640, 901 | Baltimore H., Md.: | |
| Willamette R. | 99, 39, 3251 | Curtis B. | 90, 40, 1697 |
| Alexandria B., N. Y. (see St. Lawrence) | 02, 579, 2338 | Sparrows Pt. (Patapsco R.) | 99, 39, 1410 |
| Alexandria, Va. (see Potomac) | 09, 910 | | 00, 40, 1693, 1697 |
| Alki Pt., Wash. (see Puget Sound) | 10, 1018 | Sparrows Pt., Md. | 03, 640, 1033 |
| Allegheny City, Pa. (see Ohio R.; Pittsburgh) | | Curtis B., s. side | 09, 910 |
| Ohio R. | 99, 39, 2449 | Baltimore H., Md., modification of lines in Curtis B. and Patapsco R. | 11, 1076 |
| Allegheny City, Pa. | 01, 119, 2709 | Bangor H., Me. | 01, 118, 1022 |
| Allegheny R., Pa. | 03, 640, 1708 | Bath, Me., Kennebec R. | 91, 424, 622 |
| | 03, 640, 1709 | Battery, New York, N. Y. | 04, 709, 1127 |
| | 09, 911 | Bayonne. (See New York) | |
| | 09, 911 | Belle H., Jamaica B., N. Y. | 06, 796 |
| Allegheny R., Lock No. 2, Pa. | 11, 1076 | Bellingham, Wash. (see Squa- lum) | 10, 1017 |
| Allegheny R., Pa. (third pool), Aspinwall to Natrona, Pa. | 11, 1076 | Bellingham B., Wash. | 92, 399, 2794 |
| Allouez Bay. (See Superior.) | | Bellingham B., Wash., modifica- tion. | 12, 1293 |
| Anacortes, Wash. | 93, 462, 3472 | Bellingham H., Wash., at I and J Streets | 07, 815 |
| Anacostia R., D. C. (see Potomac R.; Washington) | 04, 709, 1351 | Benicia. (See San Francisco.) | |
| Annapolis H., Md. | 11, 1077 | Bergen Neck. (See Jersey Flats; New York.) | |
| Aqueduct Br., D. C. | 01, 119, 1396 | Berrien Isld., N. Y. (see East R.; New York.) | 03, 640, 891 |
| Arthur Kill, N. Y. | 11, 1077 | Big Stony Islds., N. Y. (see Hud- son R.) | 07, 815 |
| Tottenville, N. Y. | 05, 718, 1062 | Black R. (See Port Huron.) | |
| Arthur Kill, N. J., near Tufts Pt., modification of pierhead line on w. side of Arthur Kill | 06, 797 | Black R., Mich. (see South Haven H.) | 10, 1018 |
| Arthur Kill or Staten Isld. Sound, N. Y. and N. J., revision through- out sound from Raritan B. to Newark B. | 06, 796 | Black Rock H., N. Y. (see Buf- falo.) | 01, 119, 3349 |
| Arthur Kill, N. Y. and N. J., st. monuments | 10, 1018 | Blaine, Wash. | 93, 462, 3472 |
| Arthur Kill, N. Y. and N. J.: | 12, 1293 | Bloomers. (See Hudson R., N. Y.) | |
| Around Buckwheat Isld. | 03, 141 | Borough of Brooklyn, N. Y. | 11, 1077 |
| | 04, 129 | Borough of Queens, N. Y. | 11, 1077 |
| Arthur Kill, N. J. | 08, 864 | | 89, 368, 601 |
| Smoking Pt. | 01, 118, 1279 | Boston, Mass. (see Cambridge; Chelsea; Jeffries Pt.) | 97, 23, 881 |
| Between Buckwheat Isld. and Morse Creek, N. J. | 05, 718, 1056, 1059 | | 02, 579, 887 |
| Ashland, Ky. | 05, 718, 1062 | | 04, 709, 899 |
| Ashland H., Wis. | 09, 910 | | 05, 718, 836 |
| Ashley R. (See Charleston.) | 10, 1018 | | 06, 796 |
| Ashtabula H., Ohio | 04, 709, 2487 | | 90, 332, 537 |
| Aspinwall, Pa. (see Allegheny R.) | 96, 23, 2455 | Charles R. | 91, 424, 638 |
| Astoria. (See East R. and Pot | 07, 815 | Extension of p. at Marine Park beyond estab. H. lines, Dor- chester Pt., e. end of South Boston. | 99, 39, 1098 |
| | 11, 1076 | Mystic R., with its tributaries. | 00, 40, 1225 |
| | | | 90, 332, 546 |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|
| Boston, Mass.—Continued. | | Charleston H., S. C..... | 97, 23, 1487 |
| N. side of the "reserved chan." | | Ashley R..... | 97, 23, 1487 |
| n. side of South Boston Flats, | | Cooper R..... | 97, 23, 1487 |
| and around Castle Isl. | 91, 424, 690 | Charleston, Wash. (see Port Or- | 10, 1017 |
| Extension of solid filling be- | | chard)..... | |
| yond the estab. bulkhead | | Cheesapeake Cr. (See New York.) | |
| lines at Simpson's Dry Dock | | Chehalis and Wishkah Rs., Aber- | |
| No. 1, Boston H..... | 90, 332, 547 | deen, Wash..... | 06, 797 |
| Jefferies Pt..... | 11, 1076, 1077 | Chehalis R., at Aberdeen, Wash., | |
| Bowery B., N. Y. (see East R., | 02, 579, 964 | modification..... | 11, 1076 |
| New York)..... | 06, 796 | Chelsea Creek (see Boston H.) | |
| Bremerton, Wash. (see Port Orch- | | Mass., modification of line in left | |
| ard)..... | 10, 1017 | bank..... | 11, 1076 |
| Bridgeport, Conn..... | 97, 23, 988 | Chesapeake Cr. (See New York.) | |
| Bridgeport H., Conn..... | 99, 39, 1193 | Chester, Pa. (see Delaware R.)..... | 06, 797 |
| Brilliant Pumping Station, Pa. | 93, 461, 998 | Chicago H., Ill..... | 91, 426, 2661 |
| Bristol, Pa. (see Delaware R.)..... | 07, 814 | Chicago R., N. Branch, Ill..... | 06, 797 |
| Brooklyn. (See Borough of; New | 11, 1077 | China Basin, Cal..... | 02, 579, 2110 |
| York; East R.; Newtown Cr.) | | Christiana R., Del., Wilmington, | 03, 640, 2202 |
| Brooklyn, N. Y. (see New York): | | Del. (see Delaware R.)..... | 10, 1018 |
| East R..... | 98, 34, 1028 | Cincinnati, Ohio..... | 03, 640, 981 |
| | 02, 579, 983 | City Pt. (See Richmond.) | 11, 1076 |
| Brooklyn, N. Y. (see Atlantic Basin) | 03, 640, 998 | | 96, 23, 2126 |
| | 07, 814 | | 95, 21, 472, |
| Red Hook Pt..... | 99, 910 | Cleveland H., Ohio..... | 3127 |
| Bronx Kills. (See New York.) | | | 96, 23, 3094 |
| Bronx R., N. Y. (see East R.)..... | 01, 118, 1266 | W. Basin..... | 99, 39, 3080 |
| Bronx R. (mouth), N. Y..... | 10, 1018 | College Pt., N. Y. (see East R.)..... | 11, 1076 |
| Bronx R., between New West- | | Columbia R., Astoria, Oreg..... | 01, 119, 1305 |
| chester br. and the New York, | | Commencement B., Wash..... | 04, 709, 3577 |
| New Haven & Hartford R. R. | | Communipaw. (See New York.) | 02, 579, 2432 |
| br., in front of property of P. J. | | Compton Cr. (See Sandy Hook.) | |
| Heany Co..... | 12, 1293 | Canonicut Cr. (See Jamestown.) | |
| Bronx R., N. Y., lower part..... | 12, 1293 | Coney Isl., N. Y. (see New York; | 04, 709, 1110 |
| Brother Island. (See East R.) | | Sheepshead Bay)..... | 11, 1077 |
| Brownsville, Pa. (see Monongahela | | Conners Pt., Minn. and Wis. (see | |
| R.)..... | 07, 815 | Duluth)..... | 11, 1076 |
| | 09, 911 | Constable Pt. (See Jersey Flats; | |
| Bruno Island. (See San Francisco.) | | New York.)..... | 11, 1077 |
| Brunot Isl., Pa. (see Ohio R.)..... | 07, 815 | Cooper Pt., N. J. (see Delaware R.) | |
| Brunswick, Ga..... | 89, 867, 1292 | Cooper R. (See Charleston.) | 01, 119, 3544 |
| Brunswick H., Ga..... | 06, 797 | Coos B., Oreg..... | 06, 797 |
| Bucksport, Cal. (see Humboldt Bay) | 06, 797 | Coos B. H., Oreg..... | 10, 1017 |
| Buckwheat Isl., N. J. (see Arthur | 08, 864 | Cordova B., Alaska..... | 11, 1076 |
| Kill)..... | 09, 910 | Coronado, Cal..... | 90, 334, 2904 |
| Buffalo H., N. Y.:..... | | Cosmopolis, Wash..... | 93, 462, 3472 |
| | 95, 21, 472, | Crisfield, Md.:..... | |
| Niagara R. (see Erie)..... | 3180 | Annesmessex R..... | 99, 39, 1399 |
| | 99, 39, 3123 | Curtis B., Md. (see Baltimore) | 09, 910 |
| Outer H., including West | 95, 21, 472, | | 11, 1076 |
| Seneca..... | 3176, 3180 | Dam No. 3, Ohio R., Pa..... | 04, 709, 2554 |
| | 00, 40, 4156 | Davenport H., Iowa..... | 98, 34, 1805 |
| Stony Pt..... | 04, 709, 3316 | Davis Isl. Dam, Pa. (see Pitts- | |
| Buffalo, N. Y., Erie Basin and | | burgh)..... | 04, 709, 2554 |
| Black Rock H..... | 01, 119, 3349 | Deadmans Isl., Cal..... | 11, 1077 |
| Burden Iron Works, Troy, N. Y. | 09, 910 | Delaware R., Del.:..... | |
| Bushwick Cr. (See New York.) | | Between Edgemoor and Chris- | |
| Buttermilk Chan., N. Y., Atlantic | | tiana Rs..... | 03, 640, 981 |
| Basin, Brooklyn..... | 02, 579, 983 | League Isl..... | 02, 579, 1041 |
| Byram R., N. Y..... | 01, 118, 1261 | Chester R..... | 06, 797 |
| Calumet H., Ill..... | 99, 39, 2891 | Delaware and Schuylkill Rs., | |
| | 97, 23, 881 | Philadelphia, Pa..... | 09, 910 |
| Cambridge, Mass. (see Boston)..... | 99, 39, 1100 | At Philadelphia, Pa. (see Phila- | |
| | 00, 40, 1225 | delphia)..... | 10, 1018 |
| | 06, 796 | Delaware R., Cooper Pt., near | |
| Charles R..... | 97, 23, 881 | Camden, N. J., extension of lines. | 11, 1077 |
| | 00, 40, 1225 | Delaware R., Philadelphia to Bris- | |
| | 04, 709, 899 | tol, lines on right bank from up- | |
| | 05, 718, 836 | stream end of lines at Philadelphia | 11, 1077 |
| | 06, 796 | Delaware R., at Trenton, N. J..... | 93, 462, 3039 |
| Camden, N. J. (see Philadelphia) | 11, 1077 | Detroit, Mich..... | 96, 23, 2900 |
| Canal Waterway, Wash..... | 10, 1018 | Detroit R., Mich..... | 05, 718, 2296 |
| Cape Fear R., N. C..... | 01, 119, 1572 | District of Columbia. (See Firth- | |
| Wilmington, N. C..... | 06, 797 | Sterling Co.)..... | |
| Carguinez Straits (see San Fran- | | Dog Isl., St. Georges Sound, Fla. | 00, 40, 2158 |
| cisco)..... | | Dorchester Pt. (See Boston.) | 97, 23, 2647 |
| Carters Creek, Va..... | 05, 718, 1182 | | 00, 40, 3642 |
| Castle Island (see Boston)..... | | | 03, 640, 1828 |
| Castro Rocks, Cal. (see San Fran- | | | 05, 718, 2011 |
| cisco)..... | 09, 911 | | |
| Charles R., Cambridge, Boston, | 04, 709, 899 | | |
| Mass. (see Boston; Cambridge)..... | 05, 718, 836 | | |
| | 06, 796 | | |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|--|---------------------------------------|---|--------------------------------------|
| Duluth, Minn., St. Louis B., Super- rior B., and adjacent waters, Minn. and Wis. | 91, 426, 2515 | Fairhaven H., Mass. | 03, 640, 820 |
| Duluth-Superior H., Minn. and Wis., front of Minnesota Pt. | 09, 911 | Fairport H., Ohio. | 95, 21, 472, 3130 |
| Duluth-Superior H. (Howards B.), vicinity of Conners Pt., Minn. and Wis. | 11, 1076 | Fall River H., Mass. | 00, 40, 1311 |
| Dutch Kills. (See New York.) | | Fernandina H., Fla. | 90, 334, 1545 |
| Duwamish Head, Wash. (see Puget Sound) | 10, 1018 | Fields Landing, Cal. | 10, 1017 |
| Eagle H., Wash. | 07, 815 | Fifty-fourth Street, New York, N. Y. | 04, 709, 1098 |
| East Chester and Givans Creek, N. Y., pierhead and bulkhead lines. | 12, 1293 | Fifty-ninth Street, New York, N. Y. | 89, 368 |
| East Liverpool, Ohio. (see Ohio R.) | 11, 1077 | First Street, San Francisco, Cal. | 04, 709, 1101 |
| East R., N. Y. (see Long Island City; New York; Pot Cove; Rikers Island; Westchester.) | | Firth-Sterling Steel Co., D. C. | 10, 1018 |
| Oak Pt. to Bronx R. | 00, 40 | Fivemile R. H., Conn. | 11, 1077 |
| College Pt., N. Y. | 01, 119, 1305 | Flavel. (See Youngs Bay.) | 92, 398, 730 |
| Bowery B., N. Y. | 02, 579, 964, 966 | Flushing R., Long Isl., N. Y. (see New York) | |
| Berrien Isld., N. Y., and N. Brother Isld. | 03, 640, 888, 891, 895 | Fore R., Portland, Me. | 11, 1077 |
| Lawrence Pt., and between E. 13th and E. 18th Streets. | 04, 709, 1096, 1098, 1101, 1105 | Ft. Hamilton. (See New York.) | 01, 118, 1027 |
| Bowery B. | 05, 718, 1006 | Fort Howard, Wis. | 95, 21, 472, 2887 |
| E. 26th and 29th Streets. | 06, 796 | Fort Lee, N. J., to Guttenberg | 03, 640, 905 |
| W. Shore, between 61st and 68th Streets, near mouth of Bronx R. and foot of Grand Street. | 07, 814 | Fort Norfolk. (See Norfolk.) | |
| Pot Cove, near Astoria, N. Y. | 10, 1017, 1018 | Fort Pulaski, Savannah, Ga.: in vicinity of quarantine station. | 93, 462, 1610 |
| About Great and Little Mill Rocks, Hell Gate, passage, abrogated. | 12, 1293 | Fort San Jacinto. (See Galveston.) | 03, 640, 1883, 1884 |
| East R., N. Y., at Randalls Isld., Wards Isld., and Sunken Meadow, modification. | 10, 1018 | Fox R., Wis. (see Oshkosh.) | 06, 797 |
| East R., Wis. (see Green Bay). | 06, 797 | Oshkosh, Wis. | 07, 815 |
| East Twin R., Wis. | 07, 815 | City of Green Bay. | 10, 1018 |
| Ecorse, Mich., at and near. | 96, 23, 2900, 2901, 2904 | Fox R., at Oshkosh, Wis., exten- sion and reestab. | 12, 1293 |
| Edenton, N. C. | 07, 815 | Galveston B., Texas City, Tex. | 04, 709, 2026 |
| Edenton B., N. C. | 07, 815 | Galveston H., Tex. | 96, 23, 1560 |
| Edgemoor, Del. (see Delaware R.) | 03, 640, 981 | Fort San Jacinto. | 00, 40, 2475 |
| Edmunds, Wash. | 93, 462, 3472 | Georgetown H., S. C. | 07, 815 |
| Eighteenmile Cr. (See Oleott H.) | | Givans Cr. (See E. Chester.) | |
| Eighteenth Street, New York, N. Y. | 03, 640, 895 | Glen Osborne, Pa. (see Ohio R.) | 09, 910 |
| Elizabeth, Pa. (See Monongahela R.) | 03, 640, 1698 | Gowanus B., N. Y. (see New York.) | 02, 579, 983 |
| Elizabeth City, N. C. | 07, 815 | Grand Rapids, Mich. | 05, 718, 2215 |
| Elizabeth Pt. (See New York.) | 02, 579, 1127 | Grand R., Mich. | 05, 718, 2215 |
| Elizabeth R., Va. | 00, 40, 1791 | Grand Street, New York, N. Y. | 10, 1018 |
| Elizabeth R., Va., modification of lines on right bank between Sewell Pt. and Tanners Pt., near Norfolk (see Norfolk) | 03, 640, 1089 | Grassy Pt., Minn. (see St. Louis Bay) | 95, 21, 472, 2588 |
| Elizabeth (S. Branch), opposite Norfolk Navy Yard, and Tan- ners Creek, Va., modification (see Southern Branch) | 11, 1076 | Gravesend B., N. Y. (see New York) | 04, 709, 1110 |
| Elizabethport, N. J. | 05, 718, 1056, 1059 | Grays H., Wash., at Hoquiam. | 07, 814 |
| Ellis Creek, Cal. (see San Francisco B.) | 06, 797 | Greatmill. (See New York.) | 12, 1293 |
| Ellis Isld., New York H. (q. v.), N. Y. | 96, 23, 874 | Green B., Wis. (see Fox R.) | 95, 21, 473, 3547 |
| Ellis Isld., N. Y. | 97, 23, 1075 | East R. | 06, 797 |
| Erie Basin, Buffalo, N. Y. (see Buffalo) | 02, 579, 988 | Green B. H., Wis. | 10, 1018 |
| Erie H., Pa. | 05, 718, 1025 | Greenport H., N. Y. | 95, 21, 472, 2887 |
| Eureka, Cal. (see Humboldt Bay) | 01, 119, 3349 | Greenville, N. J. | 94, 422, 716 |
| Everett H., Wash. (See Snohomish) | 97, 24, 3265 | Greenwich H., Conn. | 05, 718, 1003 |
| | 06, 797 | Grosse Isle, Detroit R., Mich. | 00, 40, 1475 |
| | 10, 1017 | Grossepoint, Mich.: Lake St. Clair. | 96, 23, 815 |
| | 94, 424, 2627 | Guttenberg, N. J. (see Ft. Lee; Howards Bay; New York) | 96, 23, 2909 |
| | 11, 1077 | Hackensack R., N. J. From Little Ferry to Hacken- sack. | 95, 21, 472, 3089 |
| | | Hackensack, N. J. | 01, 118, 1273 |
| | | Hague, The, Va. (see Norfolk H.) | 03, 640, 905 |
| | | Hampton (Jones and Herbert) Creek, Va. | 08, 865 |
| | | Hampton Roads, Va. (see James R.; Jones Cr.) | 10, 1018 |
| | | Hancock. (See Houghton.) | 10, 1018 |
| | | Hanging Rock, Ohio. | 04, 709, 1470 |
| | | Hannibal, Mo. (see Mississippi R.) | |
| | | Harlem R. (see Spuyten Duyvil; New York) | 07, 815 |
| | | Harriet Isld., Minn. | 06, 797 |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|--|--------------------------------------|---|--------------------------------------|
| Harrison, N. J. (see Passaic R.) | 07, 815 | Kahului H., Isld of Maui, Hawaii | 09, 911 |
| Hastings upon Hudson, N. Y. (see Hudson R.) | 07, 815 | Kaighn Pt. (See Philadelphia.) | 11, 1076 |
| Hawaii | 11, 1077 | Kansas City, Kans. (see Missouri R.) | 10, 1018 |
| Hazelwood, Pa. | 03, 640, 1702 | Kansas City, Mo. and Kans. | 09, 423, 3159 |
| Hell Gate, passage, East R., N. Y., about Great and Little Mill Rocks, pierhead and bulkhead lines abrogated. (see East R.) | 12, 1293 | Kansas R., Kansas City, Kans. | 02, 579, S. 213 |
| Herbert Creek, Va. | 07, 815 | Kansas R., Kansas City, Mo. and Kans. | 05, 718, 1708 |
| Hillsboro B., Fla. | 03, 885 | Kaw (see Kansas) R., Mo. and Kans. | 10, 1018 |
| Hillsboro R., Fla. (see Tampa, Fla.) | 12, 1293 | Kenosha H., Wis. | 05, 718, 1708 |
| Hilo H., Hawaii | 01, 119, 1763 | Kewaunee H., Wis. | 05, 718, 1708 |
| Hogans Creek, Fla. (see St. Johns) | 07, 815 | Key West, Fla. | 96, 23, 2568 |
| Homestead Br., Pa. (see Monongahela R.) | 11, 1077 | Kill van Kull, N. Y. (st. monuments). (See New York) | 00, 40, 3776 |
| Honolulu, Hawaiian Islds. | 07, 815 | La Conner, Wash. (see Swinowish Slough) | 12, 1293 |
| Honolulu B., Hawaii | 02, 579, 1912 | Lake Superior, Minn. | 97, 24, 2785 |
| Hoquiam, Wash. (see Grays H.) | 99, 39, 3769 | Lake Union, Wash. (see Seattle) | 06, 797 |
| Hoquiam R. | 00, 40, 5095 | Lake Washington. (See Seattle), Wash. | 03, 141 |
| Hospital Creek, Fla. (see St. Augustine H.) | 10, 1018 | Lamberts Pt. (See Norfolk.) | 04, 129 |
| Houghton and Hancock, Mich. | 93, 462, 3472 | Lavaca B., Tex. | 93, 462, 3472 |
| Howards B., Minn. and Wis. (see Duluth) | 95, 21, 473, 3547 | Lawrence Pt., N. Y. (see East R.) | 09, 911 |
| Hudson R., N. Y. (see New York H.; Yonkers): | 06, 797 | League Isld. Navy Yard, Pa. (see Delaware R.) | 03, 640, 1828 |
| Guttenberg, N. J., Troy, N. Y., Pleasant Valley Landing to Bloomers, N. J. | 92, 303, 2165 | Lermonds Cove, Me. | 08, 865 |
| New Baltimore, Troy | 99, 39, 2723 | Licking R., Ky., at its mouth. | 10, 1018 |
| Albany, N. Y. | 11, 1076 | Little Ferry, N. J. (see Hackensack) | 07, 815 |
| Yonkers | 01, 118, 1268, 1270 | Little Mill. (See New York) | 07, 815 |
| Hastings upon Hudson, N. Y., w. side near Van Wies Pt., below Albany; at Starbuck and Big Stony Isld., Troy | 02, 579, 961, 962 | Lock No. 1, Monongahela R., Pa. | 11, 1077 |
| Between Adams Street and Burden Iron Works, Troy, N. Y. | 03, 640, 901, 905 | Lock No. 4, Monongahela R., Pa. | 98, 34, 1025 |
| Humboldt B., Cal. | 04, 709, 1108 | Long Isld., N. Y. | 11, 1077 |
| Bucksport to Eureka, Cal. | 07, 814, 815 | Long Isld. City: | 91, 424, 621 |
| Fields Landing, Eureka, Cal. | 09, 910 | East R., N. Y. | 01, 118, 1018 |
| Humphreys Creek, Md. (see Sparrows Pt.) | 91, 427, 3138 | Lorain H., Ohio. | 02, 579, 1912 |
| Hunts Pt., N. Y. (see New York) | 06, 797 | Los Angeles H., Cal. | 04, 709, 2551 |
| Illinois R. and Peoria Lake, Peoria, Ill. | 10, 1017 | Lubec, Me. | 05, 718, 1865 |
| Iiwaco, Wash. | 10, 1018 | McKeesport, Pa. (see Monongahela) | 96, 23, 2565 |
| Irondale, Wash. (see Irondale) | 10, 1018 | Manitowoc, Wis. | 09, 911 |
| Ironton, Minn. | 07, 815 | Manitowoc R., Manitowoc, Wis. | 09, 911 |
| Jacksonville, Fla. (see St. Johns R.) | 93, 462, 3472 | Mare Isld. Strait (see San Francisco; Vallejo), Cal. | 04, 709, 3430 |
| Jamaica B., N. Y. (see Sheephead B.) | 95, 21, 472, 2588 | Marine City, Mich. | 10, 1018 |
| James R., Va. (see Richmond): | 03, 640, 1187 | Marine Park. (See Boston.) | 96, 23, 2747 |
| Hampton Roads, Newport News, Va. | 04, 709, 1757 | Marquette, Mich. | 89, 366, 2027 |
| Jamestown, R. I.: | 07, 815 | Martinez. (See San Francisco.) | 10, 1018 |
| Conanicut Isld. (Narragansett B.) | 06, 796 | Maryland Steel Co., Md. | 93, 462, 3475 |
| Jeffries Pt. (see Boston H.), Mass., modification. | 11, 1077 | Marysville, Wash. | 05, 718, 1516 |
| Jersey Flats, w. side of Upper B., New York H., extending from mouth of Hudson R. at Jersey City to Constable Pt., Bergen Neck, N. J. (see New York) | 00, 40, 1761 | Marthy Pt. (See Raritan Br.) | 03, 640, 2107 |
| Jones Creek, Va. | 06, 797 | Martinez. (See San Francisco.) | 10, 1017 |
| Jones Creek, near Hampton, Va., extension. | 12, 1293 | Matagorda B., Tex. | 95, 21, 471, 893 |
| | | Maumee R., Ohio (see Toledo) | 93, 462, 2788 |
| | | Between Oakdale Avenue and Ed. Ford Plate Glass Works | 95, 21, 472, 2686 |
| | | Milford H., Conn. | 04, 709, 2482 |
| | | Milwaukee, Wis.: | 09, 911 |
| | | Milwaukee R. | 03, 640, 2202 |
| | | Between Cherry and Walnut Streets | 07, 815 |
| | | Mingo, Ohio. | 07, 815 |
| | | Minnesota Pt., Minn. and Wis. (see Duluth) | |
| | | Mission Rock, Cal. (see San Francisco) | |
| | | Mississippi R., Moline, Ill. | |
| | | Mississippi R., Iowa | |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|---------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|
| Mississippi R., Minn. | 03, 640, 1513 | New York H., N. Y. (see Arthur | |
| St. Paul, Minn., Harriet Isld. | 06, 797 | Kill; Atlantic Basin; Battery; | |
| St. Louis, Mo. | 03, 640, 1455 | Bowery; Bronx; Brooklyn; 18th | |
| Mississippi R., Hannibal, Mo. | 05, 718, 1657 | Street; Ellis Isld.; 54th Street; | |
| Missouri R., St. Joseph, Mo. | 04, 709, 2334 | 59th Street; Grand Street; Kill | |
| Missouri R., Kansas City, Mo. and | 02, 579, S. 213 | Van Kull; Newtown Creek; 61st | |
| Kans. | 05, 718, 1708 | Street; 64th Street; 66th Street; | |
| Missouri R., Omaha, Nebr. | 09, 911 | 13th Street; 32d Street; 37th | |
| Mobile, Ala. | 06, 797 | Street; 29th Street; 26th Street; | |
| Mobile R., Mobile, Ala. | 06, 797 | 23d Street; Staten Isld.; | |
| At Pinto Isld. | 09, 910 | East R. | 97, 23, 1081 |
| Moline, Ill. | 07, 815 | Between Bungay and Cab- | 99, 39, 1256 |
| Monongahela R., Pa. (see Pitts- | | bot Streets, Oak Pt. | 00, 40, 1455, |
| burgh, Locks): | | | 1457 |
| | 02, 579, 1912 | West side of Rikers Isld. | 99, 39, 1254 |
| | 03, 640, 1698, | Between E. 23d and E. 24th | |
| | 1702, 1706 | Streets | 99, 39, 1258 |
| Homestead Branch to McKees- | 04, 709, 2551, | Harlem R. | 94, 422, 786 |
| port. | 2553 | At its entrance into | |
| | 05, 718, 1865, | East R. | 96, 23, 870 |
| | 1869 | Hudson R. | 97, 23, 1067, |
| | | | 1070 |
| Pittsburgh H., Locks Nos. 1 | 06, 797 | New York H. and adjacent waters | 89, 368, 807 |
| and 2. | | (see Brooklyn; Ellis Isld.; Har- | 00, 40, 1455, |
| Between Lock No. 4 and | | lem R.; Long Isld. City; Raritan | 1457 |
| Brownsville, Pa.; n. side | | Br.; Rikers Isld.; Spuyten Duy- | 97 723, 1070 |
| above Lock No. 1; between | | vil Creek): | |
| Elizabeth and Lock No. 4, | | Kill van Kull and Shooters | |
| Pa. | 07, 815 | Isld. | 90, 332, 786 |
| Brownsville, near Locks Nos. | 09, 911 | E. shore of East R., N. Y., | |
| 5 and 6, Rices Landing, Pa. | | from foot of Broadway, | |
| Monongahela R., Pa., modifica- | | Brooklyn, to Ravenswood, | 90, 332, 791 |
| tion from mouth to above Pitts- | | L. I. | |
| burgh, Cincinnati, Chicago & St. | | Shore of New Jersey from Com- | |
| Louis R. R. br. at Try Street, | | muni-paw, Jersey City, to | |
| and modification on left bank, | | Constable Pt., Bergen Neck. | 90, 332, 794 |
| between S. 6th Street and S. 9th | | S. and w. shores of Staten Isld. | |
| Street, and at Dam No. 1, Pitts- | | from Fort Wadsworth to | |
| burgh, Pa. | 12, 1293 | Elizabeth Pt., N. J., and w. | |
| Morse Creek, N. J. (see Arthur Kill). | 09, 910 | bank of Arthur Kill from | |
| Mount Hope B., Mass. | 00, 40, 1311 | Perth Amboy to Elizabeth | |
| Muscatine, Iowa. | 07, 815 | Pt., N. J. | 90, 332, 796 |
| Muskingum R., above and below | | E. shore of East R., N. Y., | |
| L. and D. 10, Zanesville, Ohio. | 09, 911 | Buttermilk Chan., and both | |
| Mystic R., Mass. (see Boston) | 02, 579, 887 | shores of Gowanus B. from | |
| Napa R., Napa, Cal. | 94, 424, 2522 | Lawrence Pt. to Fort Hamil- | |
| Natrona, Pa. (see Allegheny R.) | 11, 1076 | ton. | 90, 333, 810 |
| Navesink. (See New York.) | | W. bank of Hudson R. along | |
| Neuse R., N. C. | 00, 40, 1837 | Jersey City front from Wee- | |
| New Astoria, Oreg. | 96, 23, 3320 | hawken Cove to Communi- | |
| Newark B., N. J. | 01, 118, 1276 | paw Ferry | 90, 333, 816 |
| | 04, 709, 1177 | E., n., and w. shores of New- | |
| Staten Isld. | 05, 718, 1056 | ark B., N. J. | 90, 333, 818 |
| New Baltimore, N. Y. (see How- | | W. bank of North R. from Wee- | |
| ards Bay; Troy) | 02, 579, 962 | hawken Cove to Guttenberg, | |
| New Bedford H., Mass. | 03, 640, 820 | N. J.; e. bank of North R. | |
| Newbern, N. C. (see Trent R.) | 03, 640, 1114 | from W. 80th Street to the | |
| Newbern H., N. C. | 11, 1077 | Battery, New York City; the | |
| New Brunswick. (See New York.) | 00, 40, 1837 | Battery; and n. and w. shores | |
| New Castle, Del. | 91, 425, 1225 | of East R. from the Battery | |
| | 95, 21, 471, | to E. 81st Street, New York | |
| | 882 | City. | 90, 333, 820 |
| New Haven H., Conn. | 00, 40, 1366 | Raritan B. and R., N. J.; n. | |
| New Jersey, Staten Isld. Chan. | 01, 118, 1279 | shore from Perth Amboy to | |
| New London H., Conn. (see Shaws | 99, 39, 1189 | Crab Isld., and s. shore from | |
| Cove) | 00, 40, 1363 | Crab Isld. around South Am- | |
| | 08, 864 | boy to Cheesapeake Creek. | 90, 333, 826 |
| Newport H., R. I. | 02, 579, 912 | Ellis Isld., N. J. | 90, 333, 829 |
| Newport News, Va. (see James R.) | 06, 797 | Pierhead line for w. half of s. | |
| Newtown Creek (see New York | | shore of Staten Isld. from | |
| H.), Brooklyn, N. Y. | 03, 640, 898 | Sequins Pt. to Wards Pt. | 90, 333, 831 |
| Newtown Creek, Borough of | | Modification of pierhead line on | |
| Queens and Borough of Brook- | | e. shore of East R. from 1st | |
| lyn, N. Y., modification. | 11, 1077 | Street, Brooklyn, to br. | |
| Newtown Creek, at Metropolitan | | across Bushwick Creek at | |
| Avenue, Borough of Queens, | | Kent Avenue. | 90, 333, 833 |
| N. Y. | 12, 1293 | E. side of Manhattan Isld. from | |
| New Whatcom, Cal. (see Squa- | 10, 1017 | E. 81st Street n. to 3d Ave- | |
| lum Creek) | | nuce br. w. side of Manhattan | |
| New York B., N. Y., Red Hook, | 07, 814 | Isld. from W. 81st Street n. to | |
| Staten Isld., St. George Ferry | | Spuyten Duyvil Creek; w. | |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|--|--|---|--|
| NEW YORK H., ETC.—Continued. bank of North R. from Gut- tenberg, N. J., n. to Bloomer, N. J.; Spuyten Duyvil Creek through the Harlem R. to 3d Avenue Br.; n. shore of Bronx Kills from 3d Avenue Br. e. to Bungay Street (Port Morris); and Black- well, Ward, Randall, and Sunken Meadow Islds. | 91, 424, 958 | NEW YORK H., ETC.—Continued. Battery; Newark B., along Staten Isld. shore; Graves- end B., at Coney Isld. | 04, 129, 709, 1096, 1098, 1101, 1105, 1110, 1127, 1175, 1177 |
| Raritan R. from Crab Isld. to head of navigation at New Brunswick, N. J. | 91, 424, 960 | Arthur Kill, East R.; Eliza- bethport, N. J.; Ellis Isld.; Newark B.; Rossville; Smok- ing Pt.; Staten Isld. Sound.. | 05, 718, 1006, 1025, 1056, 1059, 1062 |
| Newtown Creek, N. Y., be- tween terminals at Whale Creek and Dutch Kills estab. by Sec. of War, Feb. 8, 1890, and Metropolitan Avenue (the present head of naviga- tion of the creek) | 91, 424, 961 | St. Georges, Staten Isld. | 04, 709, 1175 |
| East R., N. Y., along the n. shore from Port Morris e. to Throg Neck, including en- trance to Bronx R. and West- chester Creek; along the s. shore from Lawrence Pt. e. to Willetts Pt., including Bowery and Flushing B., and around North Brother, South Brother, Berrien, and Rikers Islds. | 91, 425, 963 | Gravesend B. | 06, 796 |
| Modification of p. and bulk- head line on the n. shore of Staten Isld. between John Street and Houseman Ave- nue, produced. | 91, 425, 973 | Niagara R., N. Y., at Tonawanda.. | 07, 814 |
| Great Mill and Little Mill Rocks, East R. | 92, 398, 849 | Niagara R., N. Y. (see Black Rock, Squaw Island): | 08, 865 |
| E. shore of Gravesend B. from Port Hamilton to Coney Isld. | 92, 398, 850 | Erie Basin and Black Rock H.. | 00, 40, 4156, 4159 |
| S. shore of Raritan and Sandy Hook Bs. from Chesapeake Creek to the highway br. across Shrewsbury R. at Navesink Highlands. | 92, 398, 851 | Norfolk, Va., Paradise Creek | 01, 119, 3349 |
| Modification of H. lines in Jer- sey flats, in front of Bayonne, N. J., to permit solid fitting and constr. by R. G. Packard outside the estab. H. lines.... | 92, 398, 854 | Norfolk (near), Va. | 07, 815 |
| Modification of H. lines estab. Jan. 9, 1891 (91, 963), on the n. shore of East R., between Oak Pt. and Hunts Pt. | 92, 398, 859 | Norfolk H., Va.: Smith Creek, Atlantic City br.. Smith Creek, The Hague. | 11, 1076 |
| Modification of pierhead line estab. Mar. 4, 1890 (90, 1892), on the Arthur Kill, in front of Perth Amboy, N. J. | 92, 398, 862 | Tanners Creek, Va. | 03, 640, 1089 |
| Modification of H. lines around Rikers Isld., East R., N. Y. | 93, 461, 1085 | Norfolk and Portsmouth Hs. (see Elizabeth R.) | 04, 709, 1470 |
| Modification of H. lines on e. shore of East R. at Ravens- wood, Long Isld., N. Y. | 93, 461, 1090 | Norfolk and Portsmouth Hs., Va., and adjacent waters: E., s., and w. branches of Eliza- beth R.; Elizabeth R. below w. branch, and bulkhead lines in Norfolk H. from Norfolk & Western R. R. br. and U. S. navy yard to Lamberts Pt. | 06, 797 |
| Harlem R. | 96, 23, 870 | S. branch of Elizabeth R. and Elizabeth R. below Fort Norfolk | 11, 1077 |
| Ellis Isld. (q. v.) | 96, 23, 874 | Norfolk Navy Yard, Va. | 90, 334, 1032 |
| Near foot E. 89th Street | 97, 23, 1081 | Normandie, N. J. (see Shrewsbury). | 90, 333, 1030 |
| W. 23d Street to W. 81st Street. | 97, 23, 1067 | North Brother Isld., N. Y. (see New York) | 92, 399, 1097 |
| Modification on Harlem R. and Spuyten Duyvil Creek | 97, 23, 1077 | North R. (See New York H.) | 11, 1077 |
| Modification on Ellis Isld. | 97, 23, 1075 | North Tonawanda, N. Y. | 03, 640, 888 |
| Arthur Kill, Bronx R.; College Pt.; Guttenberg, N. J. | 01, 118, 119, 1027, 1266, 1279, 1305 | Norwalk H., Conn. | 00, 40, 4159 |
| Shooters Isld.; Ellis Isld.; Go- wanus B.; Buttermilk Chan.. | 02, 579, 964, 966, 983, 986, 988 | Oakdale H., Ohio | 99, 39, 1202 |
| | 03, 640, 888, 891, 895, 905 | Oakland H., Cal. (see San Fran- cisco) | 10, 1017 |
| | | Oak Pt. (See New York.) | 94, 424, 2505, 2506 |
| | | Oconto H., Wis. | 93, 462, 2784 |
| | | Ocosta, Wash. | 94, 424, 2124 |
| | | Ohio R., Ky. and Ohio. | 93, 462, 3472 |
| | | Ohio R., Ohio. | 04, 709, 2487 |
| | | Ohio R., at East Liverpool, Ohio.. | 94, 423, 1384 |
| | | Allegheny City, Pa. | 04, 709, 2482 |
| | | Ohio R., Pa. (see Pittsburgh). | 11, 1077 |
| | | Brunot Isld., just below Pitts- burgh; right bank, just be- low mouth of Allegheny R., Pittsburgh H., Pa. | 01, 119, 2709 |
| | | Dam 3, Glen Osborne, Pa., to Dam 5, near Rochester, Pa.. | 04, 709, 2554 |
| | | Olcott H., Eighteenmile Creek, N. Y. | 07, 815 |
| | | Olympia, Wash. | 09, 911 |
| | | | 04, 709, 3378 |
| | | | 92, 399, 2794 |
| | | | 96, 23, 3391 |
| | | | 97, 24, 3484 |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|---|--------------------------------------|---|--------------------------------------|
| Omaha, Nebr. (see Missouri R.).... | 09, 911 | Port Morris, N. Y. (see New York.) | 04, 709, 1105 |
| Oshkosh: | | Port Orchard R., Wash. (Sinclair Inlet), Bremerton and Charles- ton | 10, 1017 |
| Fox R., Wis. | 99, 39, 2819 | Port Perry, Pa. | 04, 709, 2553 |
| Oshkosh, Wis. (see Fox R.)..... | 03, 640, 1883 | Port Townsend, Wash. | 05, 718, 1869 |
| | 06, 797 | Port Townsend, Wash., Irondale to Port Haddock. | 93, 462, 3472 |
| Oswego, N. Y. | 93, 462, 3178 | Port Townsend B., in front of Iron- dale, Wash. | 11, 1077 |
| Pamlico R., N. C. | 01, 119, 1570 | Portsmouth. (See Norfolk.) | 11, 1077 |
| Paradise Creek, Va. (see Norfolk) .. | 07, 815 | Pot Cove, left bank East R., near Astoria, N. Y., modification of pierhead and bulkhead lines (see East R.) .. | 12, 1293 |
| Pasquotank R., N. C. | 02, 579, 1127 | Potomac R., Washington, D. C. (see Anacostia R.; Washington) .. | 04, 709, 1351 |
| Passaic R., N. J.: | | Potomac R., Va., at Alexandria .. | 09, 910 |
| W. bank, near Harrison, N. J. | 07, 814, 815 | Potomac R., Aqueduct Br. to foot of 26th Street, D. C. | 11, 1077 |
| | 08, 866 | Potomac R., D. C., from mouth of Anacostia R. downstream in front of Firth-Sterling Steel Co., extension .. | 11, 1077 |
| Patapsco R., Md. (see Baltimore) .. | 03, 640, 1033 | Providence H. and R., R. I. | 03, 640, 825 |
| | 11, 1076 | Puget Sound, Wash., around Du- wamish Head and Alki Pt. | 95, 21, 473, 3543 |
| Patchogue R. | 94, 422, 719 | | 10, 1018 |
| Pawtucket (Seekonk) R., R. I. | 03, 640, 825 | Queens. (See Borough of; New- town Cr.; New York.) | 90, 334, 2010 |
| Pearl H., Hawaii. | 12, 1293 | Quincy B., Ill. | 01, 118, 1279 |
| Penobscot R., Me. | 01, 118, 1022 | Rahway R., N. J. | 10, 1018 |
| Pensacola H., Fla. | 01, 119, 1806 | Randalls Isld. (Sunken Meadow) (see East R.), New York, N. Y. | 11, 1077 |
| Peoria, Ill. | 07, 815 | Randalls Isld., East R., N. Y. | |
| Peoria Lake, Ill. (see Illinois R.) .. | 07, 815 | Raritan Bay. (See New York.) | |
| Perth Amboy. (See New York.) | | Raritan Br. and Marshy Pt.: Raritan R., N. J. | 96, 23, 819 |
| Philadelphia, Pa. (see Camden; Delaware R.; League Island) .. | 09, 910 | Ravenswood. (See New York.) | |
| | 10, 1018 | Raymond, Wash. | 10, 1017 |
| | 11, 1077 | Red Hook, N. Y. (see New York). Red Hook Pt., N. Y. (see Brook- lyn) .. | 07, 814 |
| E. shore of Delaware R., from Kaighn Pt. to Cooper Pt., along the water front of Cam- den, N. J. | 91, 425, 1121 | Rices Landing, Pa. (see Monon- gahela R.) .. | 09, 910 |
| W. shore of Delaware R., from Moore to Otis Streets, along the water front of Philadel- phia, Pa. | 91, 425, 1125 | Richmond to City Pt., Va.: James R. | 90, 333, 1012 |
| | 73, 887 | | 00, 40, 1761 |
| Delaware R. | 74, ii, 145, 146 | Rikers Isld., N. Y. (see New York City, etc.): East R. | 95, 21, 471, 1017 |
| | 77, 270 | | 09, 911 |
| | 78, 431, 443 | Rochester, Pa. (see Ohio R.) .. | |
| | 79, 462 | Rockaway Inlet (see Sheepshead B.), N. Y. | 11, 1077 |
| | 94, 423, 864 | Rockland H., Me. | 95, 21, 471, 595 |
| Pinto Isld., Ala. | 09, 910 | | 00, 40, 1138 |
| Pittsburgh and Davis Isld. Dam, Pa.: Ohio R. | 95, 21, 471, 2420 | Rossville, Staten Isld., N. Y. (see New York) .. | 05, 718, 1062 |
| Pittsburgh, Pa. (see Mononga- hela; Ohio; Smithfield; Tench st.) .. | 03, 640, 1702, 1706, 1709 | Rouge R., Mich. | 05, 718, 2296 |
| | 95, 21, 471, 2420 | Rude Waterway, Alaska .. | 11, 1076 |
| | 01, 119, 2709 | Sabine Pass, Tex.: H. | 96, 23, 1521 |
| Allegheny City .. | 02, 579, 1912 | Sabine Pass, Tex. | 04, 709, 1968 |
| | 05, 718, 1865, | Saginaw, Mich. | 05, 718, 2235 |
| | 1869 | Saginaw R., Mich. | 05, 718, 2235 |
| Allegheny R. | 07, 815 | Sailors Encampment Isld., Mich.: St. Marys R. | 96, 23, 2897 |
| Monongahela R. | 96, 23, 2219 | St. Augustine H., Fla. | 91, 425, 1635 |
| | 95, 21, 471, 2420 | Hospital Creek .. | 06, 797 |
| | 96, 23, 2215 | St. Clair Lake, Mich. | 95, 21, 472, 3069 |
| Pittsburgh H., Lock No. 1, Pa. | 06, 797 | Port Huron .. | 98, 34, 2607 |
| Pittsburgh, Pa., Lock No. 2. | 05, 718, 1869 | St. George Ferry Terminal, N. Y. (see New York) .. | 07, 814 |
| Pittsburgh H., Lock No. 2, Pa. | 06, 797 | St. George, Staten Isld., N. Y. | 04, 709, 1175 |
| Pleasant Valley Landing. (See Howards Bay.) | | St. Georges Sound, Fla. | 06, 796 |
| Pocomoke R. (See Snow Hill.) | | St. Johns R., Fla. | 00, 40, 2158 |
| Pt. San Pablo. (See San Francisco.) | | Near Jacksonville .. | 03, 640, 1187 |
| | 89, 274, 2027 | Hogan Creek, Jacksonville .. | 04, 709, 1757 |
| Portage Lake, Mich. | 90, 246, 2323 | | 07, 815 |
| | 91, 316, 317 | St. Joseph, Mo. (see Missouri R.) .. | 04, 709, 2334 |
| | 426, 2519 | | |
| Port Angeles, Wash. | 93, 462, 2472 | | |
| Port Costa. (See San Francisco.) | | | |
| Port Chester H., N. Y. | 01, 118, 1261 | | |
| Port Haddock, Wash. (see Port Townsend) | 11, 1077 | | |
| Port Huron, Mich. (see St. Clair): Black R. | 93, 462, 2958 | | |
| Portland H., Me. (see Back Cove; Fore R.) .. | 01, 118, 1027 | | |
| Portland, Oreg. (see Willamette R.) .. | 92, 399, 2869 | | |
| Portland H., Oreg. | 00, 40, 4456 | | |
| | 06, 797 | | |
| Port Lavaca, Tex. | 02, 579, 1402 | | |
| | 05, 718, 1516 | | |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|---|---|---|--|
| St. Joseph H., Mich..... | (94, 424, 2258 98, 34 | Shelton, Wash..... | 93, 462, 3475 |
| St. Lawrence R., N. Y.: | | Shooters Isld., N. Y. (see New York)..... | 02, 579, 986 |
| Alexandria B..... | 02, 579, 2338 | Shrewsbury R., N. J. (see New York; Seabright)..... | (01, 118, 1282 08, 865 |
| St. Louis, Mo. (see Mississippi R.).. | 03, 640, 1455 | Between Seabright and Nor- mandie, N. J..... | 10, 1018 |
| St. Louis B. and around Grassy Pt., Minn. and Wis. (see Duluth)..... | 95, 21, 472, 2588 | Sidney, Wash..... | 93, 462, 3472 |
| St. Marys R. (See Sailors Encamp- ment; Sault Ste. Marie.) | | Sinclair Inlet, Wash. (see Port Or- chard)..... | 10, 1017 |
| St. Paul, Minn. (see Mississippi R.).. | (03, 640, 1513 06, 797 | Sixty-first Street, New York, N. Y. | 10, 1017 |
| San Bruno Canal, Cal..... | 10, 1018 | Sixty-fourth Street, New York, N. Y..... | 10, 1017 |
| San Diego, Cal..... | 12, 1293 | Sixty-sixth Street, New York,, N. Y..... | (89, 368 |
| San Diego H. and adjacent waters, Cal..... | (90, 334, 2904 92, 399, 2640 98, 34, 2733 | Smith Creek, Va. (see Norfolk)..... | 04, 709, 1101 |
| Sandusky H., Ohio..... | | Smithfield Street, Pittsburgh, Pa. | 03, 640, 1089 |
| Sandy Hook B., N. J. opposite mouth of Compton Creek (see New York)..... | 10, 1018 | Smoking Pt., Staten Isld., N. Y. (see Arthur Kill, New York)..... | 03, 640, 1706 |
| San Francisco, Cal. (see Alameda; First Street; Stuart Street)..... | 10, 1018 | Snohomish, Wash..... | 05, 718, 1062 |
| Mouth of Ellis Creek..... | 06, 797 | Snohomish R., near Everett H., Wash..... | 93, 462, 3475 |
| San Francisco B., Cal.: | | Snow Hill, Md.:..... | 11, 1077 |
| Between Pt. San Pablo and Castro Rocks..... | 09, 911 | Pocomoke R..... | 96, 23, 994 |
| Between 1st and Stuart Streets. E. shore of San Francisco B., from Pt. San Pablo s. in front of Oakland and Alameda..... | 10, 1018 | Somerville, Mass..... | 02, 579, 887 |
| | | South Amboy. (See New York.) | |
| Between San Pablo and Oak- land..... | 94, 424, 2505, 2506 | South Bend, Wash..... | (93, 462, 3472 08, 865 |
| San Francisco H., Cal..... | 99, 39, 3194 | South Brother Island. (See New York.)..... | |
| Mission Rock, n. of; n. of China Basin..... | 01, 119, 3460 | South Haven H., Mich..... | 10, 1018 |
| To Bruno Canal..... | (03, 640, 2202 10, 1018 | Southern Branch, Va.:..... | |
| San Francisco H. and adjacent waters..... | | Elizabeth R..... | 96, 23, 1094 |
| Water front of the city of San Francisco and at Mission Rock, bay of San Francisco.. | 91, 426, 2948 | Southport, N. C..... | 01, 119, 1572 |
| Port Costa and Martinez on the s. shore of Carquinez Strait, and Benicia on the n. shore and e. shore of Mare Isld. Strait..... | 90, 334, 2890 | Sparrows Pt. (see Baltimore H.), Md..... | 03, 640, 1033 |
| San Jacinto B., Tex..... | 90, 334, 2893 | Or Humphreys Creek, n. side of Maryland Steel Co.'s prop- erty..... | 10, 1018 |
| San Pablo, Cal. (see San Fran- cisco)..... | 00, 40, 2476 | Spuyten Duyvil Creek (see Harlem R.; New York), N. Y..... | 97, 23, 1077 |
| San Pedro, Cal..... | 09, 911 | Squalicum Creek waterway, Wash. | 10, 1017 |
| San Pedro, Wilmington H. (q. v.), Cal..... | 06, 797 | Squaw Isld., N. Y.:..... | |
| San Pedro (inner) H., Cal..... | (91, 426, 2976 92, 399, 2638 09, 911 | Niagara R..... | 94, 424, 2452 |
| Sault Ste. Marie, Mich.:..... | | Stamford H., Conn..... | 90, 332, 682 |
| St. Marys R..... | 93, 462, 3037 | Starbuck, N. Y. (see Hudson R.).. | 00, 40, 1368 |
| Savannah, Ga. (see Fort Pulaski)... | (98, 34 89, 367, 1285 01, 119, 1730 | | 06, 796 |
| Schuylkill R. (see Delaware R.), Pa..... | 09, 910 | | 97, 815 |
| Seabright, N. J.: (See Shrews- bury R.)..... | | Staten Isld. (see New York H.), N. Y..... | (89, 368 03, 141 04, 129, 709, 1175, 1177 06, 796 07, 814 |
| Shrewsbury R..... | 94, 423, 823 | Staten Isld. Sound (see Arthur Kill; Newark Bay; New Jersey; New York; Smoking Pt.), N. Y. and N. J..... | 05, 718, 1056, 1059, 1062 |
| Seabright, N. J..... | (01, 118, 1282 10, 1018 93, 462, 3472 95, 21, 473, 3543 99, 39 07, 815 08, 865 10, 1018 | Steilacoom, Wash..... | 93, 462, 3472 |
| Seattle, Wash. (see Puget Sound; Lake Washington)..... | | Steinway, N. Y..... | 02, 579, 964 |
| Lake Union..... | | Steubenville, Ohio..... | 04, 709, 2482 |
| Canal waterway..... | | Stony Pt., N. Y. (see Buffalo)..... | 04, 709, 3316 |
| Seekonk (Pawtucket, q. v.) R., R. I..... | 03, 640, 825 | Stuart Street, San Francisco, Cal. | 10, 1018 |
| Sequines Pt. (See New York.)..... | | Sunken Meadow, East R., N. Y. (see Randalls Island; East R.)..... | 11, 1077 |
| Seyvern R., Md..... | 01, 119, 1396 | Superior B., Minn. and Wis. (see Duluth)..... | (94, 423, 2039 97, 23, 2647 |
| Sewell Pt., Va. (see Elizabeth R.).. | 11, 1076 | Superior, Wis.:..... | |
| Shaws Cove, New London H. (q. v.), Conn..... | 93, 461, 997 | Allouez B..... | 93, 462, 2695 |
| Shaws Cove, Conn..... | 08, 864 | Superior H., Wis..... | 00, 40, 3642 |
| Sheepshead B. and Atlantic Ocean at e. end of Coney Isld., N. Y., and Jamaica B., and through Rockaway Inlet, N. Y..... | 11, 1077 | Swinomish Slough, Wash., at La Conner..... | 09, 911 |
| | | Tacoma, Wash..... | (93, 462, 3472 99, 39 |
| | | Tacoma H., Wash..... | 02, 579, 2432 |
| | | Tampa, Fla..... | 01, 119, 1763 |
| | | Hillsboro R..... | (99, 39, 1643 00, 40, 2084 06, 797 08, 865 11, 1077 |
| | | Tanners Creek, Va. (see Norfolk)... | 11, 1077 |
| | | Tanners Pt., Va. (see Elizabeth).... | 11, 1076 |
| | | Tenth Street, Pittsburgh, Pa..... | 03, 640, 1706 |

| Place. | Reports of Chief of Engineers. | Place. | Reports of Chief of Engineers. |
|--|--------------------------------------|--|--------------------------------------|
| Texas City, Tex. (see Galveston Bay)..... | 04, 709, 2026 | Wands Pt., Oreg..... | 06797, |
| Thames R., Conn..... | 00, 40, 1363 | Wards Isld. (see East R.), N. Y..... | 11, 1077 |
| Thirteenth Street, New York, N. Y..... | 03, 640, 895 | Wards Pt. (See New York.) | |
| Thirty-second Street, New York, N. Y..... | 04, 709, 1098 | Washington, D. C. (see Potomac R.)..... | 04, 709, 1351 |
| Thirty-seventh Street, New York, N. Y..... | 05, 718, 1006 | Anacostia R..... | 92, 398, 1079 |
| Throg Neck. (See New York.) | | Potomac R..... | 99, 39, 1463 |
| Toledo, Ohio: | | Washington, N. C..... | 01, 119, 1570 |
| Maumee R..... | 96, 23, 3091 | Waterway (canal), Wash..... | 10, 1018 |
| | 99, 39, 3078 | Waukegan H., Ill..... | 97, 24, 2786 |
| Toledo H., Ohio..... | 03, 640, 2107 | Weehawken Cove. (See New York.) | |
| | 10, 1017, 1018 | Weems, Va..... | 05, 718, 1182 |
| Tonawanda, N. Y. (see New York)..... | 08, 865 | Westchester, N. Y. (see New York.): | |
| Tottenville, N. Y..... | 06, 797 | From estuary at East R..... | 94, 423, 790 |
| Trent R., at Newbern, N. C..... | 11, 1077 | West Seneca. (See Buffalo.) | |
| Trent R., N. C..... | 00, 40, 1837 | Whale Cr. (See New York.) | |
| Trenton, N. J. (see Delaware R.)..... | 03, 649, 1114 | Willamette R., Oreg..... | 00, 40, 4456 |
| Troy, N. Y. (see Adams St.; Burden Iron Works; Hudson R.)..... | 01, 118, 1268 | Willets Pt. (See New York.) | 06, 797 |
| | 02, 579, 961 | Willapa R., Wash..... | 08, 865 |
| | 07, 815 | | 10, 1017 |
| Troyto New Baltimore: | | Wilmington, N. C. (see Cape Fear)..... | 96, 23, 1147 |
| Hudson R..... | 90, 332, 770 | | 06, 797 |
| Tufts Pt., N. J. (see Arthur Kill)..... | 10, 1018 | Wilmington H., Cal. (see San Pedro)..... | 95, 21, 473, |
| Twenty-ninth Street, New York, N. Y..... | 04, 709, 1096 | | 3287 |
| | 07, 814 | Wilmington H., Del. (see Christiana)..... | 06, 797 |
| Twenty-sixth Street, New York, N. Y..... | 04, 709, 1096 | | 11, 1076 |
| | 07, 814 | Wilson, Pa..... | 03, 640, 1698 |
| Twenty-third Street, New York, N. Y..... | 07, 814 | Wishkah R. (see Chehalis), Wash..... | 05, 718, 1865 |
| Twin Rs. (see Two Rivers H.), Wis..... | 06, 797 | Yellow Mill Chan. (see Hudson R.), Conn..... | 06, 797 |
| Two Rivers H., Wis..... | 06, 797 | Yonkers, N. Y. (see Hudson R.)..... | 07, 814 |
| Urbana Creek, Va..... | 07, 815 | Hudson R..... | 04, 709, 1108 |
| Vallejo, Cal..... | 04, 709, 1359 | Youngs B., Oreg., near Astoria..... | 98, 34, 1072 |
| | 04, 709, 3430 | Youngs B., Flavel, Oreg.:..... | 96, 23, 3322 |
| Vancouver, Wash..... | 10, 1018 | Columbia R..... | 93, 463, 3537 |
| Van Wies Pt., N. Y. (see Hudson R.)..... | 92, 399, 2794 | Zanesville, Ohio (see Muskingum R.)..... | 09, 911 |
| | 07, 814 | | |

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

SECTION 4.—WRECK REMOVALS FROM NAVIGABLE WATERS.

NOTE.—The following table consists of the names of navigable waterways, the names arranged alphabetically, from which wrecks have been removed from time to time under the direction of the Chief of Engineers, U. S. Army. (See also p. 2116 of this Index.)

ABBREVIATIONS: Brg.=barge, Bk.=bark, Br.=brig, C. b.=canal boat, F. b.=ferryboat, L.=lighter; P. b.=pilot boat, P.=pungy, Sch.=schooner, Sc.=scow, Sh.=ship, Sl.=sloop, Str.=steamer, T.=tug.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|---------------------------------------|--------------------------------------|--|--------------------------------------|
| Absecon Inlet, N. J.: | | Ashley R., S. C.: | |
| Sh. Geestemunde..... | 93, 128, 1182 | Sl. Ella ⁴ | 93, 189, 1531 |
| Sch. A. T. Coleman (parts of) .. | 01, 262, 1351, 1352 | Sl. ———..... | 94, 174, 1128 |
| Sch. Rival..... | 05, 186, 1123 | Wreckage..... | 95, 198, 1447 |
| Sch. A. L. Lee..... | | T. Douglass..... | 99, 254, 1550 |
| Str. (yacht) Viva..... | | Brg. Phosphate (Agostine C. ⁵) .. | 03, 257, 1140 |
| Str. Brazoria..... | 09, 224, 1184 | | 04, 261, 1565 |
| Str. Brazoria..... | 11, 278, 1401 | | 05, 270, 1258 |
| Albemarle Sound, N. C.: | | Ashtabula H., Ohio: | |
| Str. I. D. Coleman..... | 93, 183, 1449 | Sch. Joy..... | 89, 328, 2334 |
| Sch. Marion A. Greene..... | 03, 228, 1088 | Sch. Pelican..... | 90, 296, 2787 |
| Str. Tourist..... | 08, 280, 1275 | Wreck reported ¹ | 94, 378, 2426 |
| Alexandria H., Va.: | | Wreck reported ¹ | 02, 506, 2293 |
| Brg. ———..... | 09, 272, 1249 | Brg. Ynkon..... | 06, 693 |
| Algers, La.: | | T. Knapp..... | 07, 716, 2096 |
| Sh. Ile Marthe..... | 89, 201, 1500 | | 11, 933, 2508 |
| Alpena H., Mich.: | | Assateague Entrance, Va.: | |
| Str. Shamrock..... | 06, 663 | Sch. Rose..... | 12, 328, 1620 |
| Sch. Harvey Bissell..... | 09, 780, 2119 | Atlantic City, N. J., near: | |
| | 10, 859, 2280 | Str. Florida..... | 93, 128, 1182 |
| Ambrose Chan. (8 m. e. of), N. Y.: | | | 01, 263, 1353 |
| Sch. Garfield White..... | 12, 253, 1228 | | 02, 190, 1062 |
| Anacostia R., D. C.: | | Str. Ranald ⁶ | 05, 186, 1123 |
| 7 coal barges, canal boats, etc. | 08, 263, 1253 | | 07, 207, 1134, 1135 |
| | 09, 272, 1249 | Brg. Baker..... | 07, 207, 1135 |
| Anclote Anchorage, Fla.: | | Atlantic Ocean: | |
| Sch. Addie F. Cole..... | 09, 384 | Sch. ———..... | 95, 1356 |
| Apalachicola B., Fla.: | | Sch. Marion F. Sprague ⁶ | 95, 1079 |
| Str. C. Emlin ³ | 03, 306, 1236 | Atlantic Ocean, off Corsons Inlet, N. J.: | |
| Apalachicola R., Fla.: | 04, 321, 1792 | Brg. Maryland..... | 12, 328, 1620 |
| L. ———..... | 07, 369 | Atlantic Ocean, off Atlantic City, N. J.: | |
| L. Georgia..... | 08, 392, 1420 | Str. Ranald..... | 12, 328, 1620 |
| Appomattox R., Va.: | | Atlantic Ocean, abreast of Sheep Pen Hill, Va.: | |
| Sch. J. B. Taylor..... | 05, 235, 1200 | Str. Oakdene..... | 11, 277, 1400 |
| | 06, 250, 1140 | Back Creek, Md.: | |
| Appoquinimink R., Del.: | | Sunken logs..... | 01, 272, 1390 |
| Sch. Samuel Applegate..... | 01, 263, 1352 | Sunken piles and logs..... | 04, 1274 |
| Arkansas R.: | | | 05, 202, 1147 |
| Str. John Matthews..... | 93, 279, 2121 | Back Creek, Va.: | |
| Str. Eli..... | 95, 286, 2037 | Str. Norfolk-on-the-Roads..... | 06, 250, 1141 |
| | 96, 248, 1696 | | 07, 262, 1219 |
| Arthur Kill, N. Y. and N. J.: | | Baltimore H., Md.: | |
| C. b. ———..... | 98, 144, 1072 | Sch. W. M. French..... | 89, 115, 942 |
| C. b. John Hebron..... | 02, 177, 1038 | Sch. Pinalore ⁶ | 93, 147, 1262 |
| Brg. Will Sherman..... | 03, 158, 955 | Sch. Margaret Kennedy..... | 97, 174, 1307 |
| C. b. ———..... | 03, 159, 956 | Sch. Three Brothers..... | 98, 177, 1181 |
| Sch. Hattie E. King..... | 12, 278, 1558 | Sch. Fleming..... | |
| Arthur Kill, N. J.: | | Sch. Sarah J. Elizabeth..... | 06, 214, 1090 |
| C. b. C. C. Morton..... | 04, 148, 1157 | Sl. Potter..... | 08, 239 |
| C. b. ———..... | 04, 148, 1158 | | |
| Ashepoo R., S. C.: | | | |
| 3 lighters..... | 99, 255, 1550 | | |

¹ Not found.

² Removed by U. S. snag boat *Roanoke*.

³ Removed by U. S. plant and hired labor.

⁴ Removed by owners.

⁵ Removed by U. S. plant.

⁶ Removed by storms.

⁷ Removed by gunboat *Vesuvius*.

⁸ Removed by ice and waves.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|---|--------------------------------------|---|--------------------------------------|
| Barnegat Inlet, N. J.: Str. Mediator..... | 91, 118, 1090 | Bridgeport H., Conn.: C. b. City of Utica..... | 07, 117, 982 |
| Str. Guadaloup..... | 03, 128, 1182 | L..... | 09, 124, 1054 |
| T. Starlight..... | 94, 117, 861 | Towboat Stephen E. Babcock.. | 12, 177, 1463 |
| Wreckage..... | 10, 255, 1309 | Sch. Clara Waples..... | 12, 177, 1463 |
| Bk. (part of) Charles Loring.. | 11, 278, 1402 | Brigantine Shoal, N. J.: Sch. Booth Brothers..... | 93, 1183 |
| Str. Alert..... | 00, 1588 | Str. Cassandra..... | 94, 117, 861 |
| Barnegat Light, N. J., near: Sch. George A. Howes ¹ | 95, 69, 710 | Str. Cassandra..... | 82, 126, 798 |
| Bass R., Mass., near: Sch. O. D. Witherell ² | 95, 70, 710 | Broadkill R., Del.: Str. J. I. Van Dorn..... | 83, 130, 660 |
| Sch. Light of the East..... | 95, 70, 710 | Str. J. I. Van Dorn..... | 87, 96, 847 |
| Bayou La Batre, La.: Schrs. P. J. Lyons, M. Fleckas, and J. A. Sprinkler ³ | 12, 644, 1949 | Sch. William D. Rambo..... | 88, 95, 758 |
| Bearse Shoal, Mass.: Wreckage..... | 95, 71, 720 | Wreck..... | 10, 255, 1309 |
| Beaufort, N. C.: Bk. Anna..... | 04, 244, 1505 | Part of wreck..... | 10, 255, 1310 |
| Beaufort H., N. C.: Str. Wave..... | 87, 139, 1098 | Str. Marie Thomas..... | 11, 277, 1400 |
| Beaufort R., S. C.: Wreckage ⁴ | 93, 1530 | Broad Sound, Boston, Mass.: Sch. Davis Palmer..... | 12, 328, 1619 |
| P. b. Sprite..... | 99, 255, 1550 | Bronx R., N. Y.: C. b. | 93, 105, 1076 |
| Sch. Leonora..... | 09, 332, 1317 | C. b. Fox..... | 99, 147, 1278 |
| Belle R., Mich.: Sch. Albany..... | 08, 742, 2139 | Brg. B. L. Collar..... | 02, 178, 1039 |
| Hiddeford Pool, Ma.: Sch. Index..... | 02, 95, 865 | Brg. B. L. Collar..... | 03, 138, 139, 887 |
| Big Pigeon Bayou, La.: Str. E. H. Barmore ⁵ | 94, 232, 1383 | Brg. Bertha Miner..... | 03, 139, 887 |
| Black R., Ark.: Str. W. J. Bryan ⁶ | 00, 424, 2613 | C. b. Schroeder & Horstmann.. | 04, 125, 1052 |
| Black R., Mich.: Str. Clark..... | 12, 1091, 2676 | C. b. Louise..... | 04, 125, 1053 |
| Black R., N. C.: Str. Delta ⁷ | 96, 171, 1144 | C. b. Thomas Mathews..... | 04, 126, 1053, 1054 |
| Black R., Ohio: Se. (dump) ⁸ | 08, 760, 2168 | Brg. Kate..... | 09, 157, 1089 |
| Block Isld. Sound, R. I.: Sch. Harry White..... | 94, 82, 711 | Brooklyn, N. Y.: T. William Horre..... | 97, 138, 1158 |
| Wreckage..... | 98, 84, 931 | Br. Narcissus..... | 99, 147, 1278 |
| Sch. Merrill C. Hart..... | 10, 112, 1147, 1148 | Brownays Isld., Me., off: Sch. Huntress..... | 93, 37, 722 |
| Block Isld., R. I.: Sch. Jennie R. DuBois..... | 04, 86, 930 | Browns Ledge, Mass., near: Wreckage ⁹ | 94, 63, 619 |
| Brg. Nora..... | 07, 94, 954 | Sch. Harry L. Whiton ¹⁰ | 95, 70, 718 |
| Brg. Montana..... | 12, 135, 1431 | Wreckage ¹¹ | 95, 701 |
| Sch. Mary A. Randall..... | 12, 135, 1431 | Brunswick H., Ga.: Wreckage..... | 98, 231, 1321 |
| Boca Grande Chan., 20 m. w. of Key West, Fla.: Sch. Medford ¹² | 11, 463 | Buffalo Bayou, Tex.: Brg. No. 3..... | 02, 342, 1391 |
| Bogue Sound, N. C.: Sch. Laura J..... | 89, 147, 1116 | Dr. boat..... | 03, 361, 1347 |
| Boothbay H., Me.: Sch. Harriet W. Babson ¹³ | 03, 53, 727 | Flatboat Daisy..... | 03, 361, 1347 |
| Boston H., Mass.: Sch. Goldsmith Maid..... | 89, 43, 592 | Buffalo H., N. Y.: Brg. Massasoit ¹⁴ | 05, 627 |
| Sch. Mary..... | 96, 54, 616 | Bulkhead Bar, Delaware R.: Wreckage..... | 96, 122, 938 |
| Sch. Lillie No. 140120..... | 03, 88, 785 | Buzzards B., Mass.: Sch. Annie E. Hayes..... | 89, 55, 641 |
| So. ¹⁵ | 05, 74, 835, 836 | White Foam ¹⁶ | 95, 69, 704 |
| Str. Kiowa..... | 06, 72 | Sch. Golden Rule ¹⁷ | 95, 69, 707 |
| Sch. Chromo..... | 08, 76, 969 | Sch. Maria Adelaide..... | 95, 70, 712 |
| Sch. Phineas H. Gay..... | 08, 77, 970 | Sch. S. S. Scranton..... | 95, 70, 713 |
| Str. City of Birmingham..... | 09, 77, 1002 | Brg. Baden..... | 07, 94, 953 |
| Sch. Nat. Ayer..... | 11, 91, 1193 | Calumet R., Ill.: T. Macatawa..... | 08, 681, 2002 |
| Sch. Davis Palmer..... | 11, 91, 1193, 1194 | 6 wrecks..... | 08, 718, 2002 |
| Brandywine R., Del.: C. b. Loring Monroe..... | 94, 132, 907 | Sch. Maryette..... | 10, 795, 2161 |
| Stone brg. | 08, 217, 1177 | Cambridge H., Md.: Sch. Two Brothers..... | 89, 111, 905 |
| Branford, Conn.: Sch. Lizzie D. Saunders..... | 96, 102, 802 | Eldridge ¹⁸ | 90, 101, 942 |
| | 97, 138, 1156 | Sch. Corador ¹⁹ | 95, 150, 1147 |

¹ Removed by storms.² Removed by owners.³ Removed by U. S. snag boat *Demopolis*.⁴ Not yet removed.⁵ Removed by U. S. and owner.⁶ Removed by U. S. snag boat *H. G. Wright*.⁷ Removed by U. S. dr. *Maumee*.⁸ Believed to be.⁹ Removed by local wreckers.¹⁰ Drifted away.¹¹ Removed by gunboat *Vesuvius*.¹² Supposed to be.¹³ Removed by city of Buffalo.¹⁴ Supposed to be.¹⁵ Removed by Maryland oyster police.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|--------------------------------------|--|--------------------------------------|
| Cape Cod, Mass.: | | Chatham H., Mass.—Continued. | |
| Sch. Perkiomen..... | 86, 80, 618 | Bk. Albertina..... | 05, 93, 868, 869 |
| Sch. J. B. Woodbury..... | 92, 66, 641 | Sch. Frauline..... | 05, 93, 869 |
| Sch. Bertha J. Fellows..... | 97, 63, 859 | Chatham Roads (Old), Mass.: | |
| Sch. Annie E. Rudolph, No. 106315..... | 98, 69, 883 | Sch. G. M. Farnsworth..... | 94, 63, 613 |
| Cape Fear R., N. C.: | | Wreckage..... | 95, 71, 724 |
| U. S. gunboat..... | 93, 183, 1450 | Chesaw R., S. C.: | |
| Brg. Clio..... | 86, 175, 1080 | Sch..... | 88, 138, 990 |
| Sch. North Heath..... | 87, 139, 1098 | Chesapeake B.: | |
| Sch. George G. Green ¹ | 94, 168, 1065 | Clara S..... | 83, 148, 725 |
| | 94, 168, 1065 | Cascarella..... | 83, 148, 725 |
| Sch. Enchantress..... | 95, 1356 | | 84, 151, 948 |
| | 96, 171, 1143 | Sch. Olephant..... | 86, 135, 878 |
| 2 wrecks..... | 08, 305 | | 87, 101, 879 |
| Sch. Frye..... | 09, 315 | Brg..... | 85, 137, 890 |
| Sch. Georgiana..... | 10, 359 | Brg. Harry..... | 88, 104, 775 |
| Cape Hatteras, N. C.: | | Str. Express..... | 88, 104, 775 |
| Sch..... | 94, 168, 1065 | Sch. J. W. Knight..... | 90, 101, 942 |
| Cape Henry Light, Va.: | | Sch. Lulu..... | 93, 166, 1344 |
| Sch. A. D. Lawson..... | 98, 201, 1235- | Wreckage..... | 94, 152, 987 |
| Cape Lookout, near: | | Brg. Rose Helen ² | 97, 171, 1289 |
| 3 wrecks ² | 94, 168, 1065 | Sch. Del May..... | 98, 175, 1172 |
| Cape May, N. J., near: | | Sch. Walker Armington..... | 98, 201, 1235 |
| Brg. Puritan..... | 04, 156 | Brg. C. C. Chapman..... | 99, 232, 1484 |
| Capes of Delaware, near: | | Brg. Washington..... | 00, 234, 1693 |
| Sch. Adeline Townsend ³ | 09, 224, 1183 | C. b. Hero..... | 00, 264, 1783 |
| Cape Porpoise H., Me.: | | Brg. Caravan..... | 01, 272, 1391 |
| Sch. J. H. G. Perkins..... | 09, 47, 979 | Sch. Augustus Palmer..... | 01, 298, 1462 |
| Carrabelle R., Fla.: | | Brg. Frank Thompson ⁴ | 02, 203, 1080 |
| Sch. Grace Andrews..... | 04, 321, 1792 | Dr..... | 04, 227, 1380 |
| T. Bishop..... | 05, 329, 1351 | Sch. E. H. Weaver..... | 06, 214, 1090 |
| Carters Creek, Va.: | | Sch. Mary V. Duncan..... | 06, 236, 237, |
| Bugeye Daisy..... | 02, 218 | Raft of piles..... | 1124 |
| | 03, 218, 1071 | Sch. Amelia M. Price ¹¹ | 06, 250, 1140 |
| Cedar Creek, N. J.: | | Sch. Samuel L. Russell ¹² | 06, 250, 1141 |
| Sch. I. W. Norris..... | 01, 263, 1352 | Brg. Oak..... | 06, 250, 1141 |
| Sch. Pearsall..... | 04, 177, 1249 | Sch. W. H. Van Name..... | 07, 228 |
| Charleston Bar, S. C.: | | Sch. Edward Wright..... | 08, 239 |
| Wreckage..... | 90, 141, 1233 | Sch. Samuel D. Lankford..... | 08, 280, 1275 |
| Charleston H., S. C.: | | Str. Emma K..... | 09, 247 |
| | 93, 189, 1531 | Sch. J. E. Watkins..... | 10, 281, 1334 |
| Sch. Kate V. Aitken..... | 94, 174, 1128 | Sc..... | 11, 306, 1431 |
| | 95, 198, 1447 | Sch. Sunny South..... | 12, 362, 1654 |
| U. S. S. Housatonic..... | 05, 270, 1258 | Sch. J. Dallas Marvil..... | 12, 420, 1731 |
| Bk. Cambusdoon ⁴ | 06, 292, 1185 | Sch. Herbert D. Maxwell..... | 12, 420, 1732 |
| T. Buck..... | 08, 323 | Sch. Stella B. Kaplan..... | |
| Anchor ⁵ | 09, 332, 1315 | Sch. Joseph G. Ray ¹³ | |
| Charleston to Beaufort, inland pas- sage: | 10, 378, 1457 | | |
| Raft of logs..... | 12, 483, 1809 | Chester Creek, Pa.: | |
| Charlevoix H., Mich.: | | C. b. Frank Dodson..... | 00, 206, 1589 |
| Sch. B. Parsons..... | 00, 291, 1876 | | 01, 262, 1350 |
| Chatham, Mass., near: | | | 02, 190, 1063 |
| Sch. Acacia..... | 84, 300, 1995 | Chicago R., Ill.: | |
| Wreckage ⁶ | 94, 62, 611 | C. b. China..... | 97, 420, 2881 |
| Sch. Emily G. Sawyer..... | 97, 928 | Sch. John Raber..... | 99, 485, 283, |
| Chatham, New H., Mass.: | | | 390 |
| Wreckage..... | 03, 103, 820 | Brg. Robert Howlett..... | 06, 608 |
| Chatham, Old H., Mass.: | | Brg. H. A. Richmond..... | 07, 635, 1934 |
| Wreckage..... | 99, 81, 1095 | Brg. Atlas..... | 08, 681, 2002 |
| Chatham Bar, Mass.: | | Chicago R., N. Branch, Ill.: | |
| Str. Perit..... | 00, 93, 1218 | St. Peri..... | 07, 635, 1934 |
| Chatham B., Mass.: | | C. b. Fallas..... | 08, 681, 2002 |
| Sch. Charles E. Sears..... | 98, 69, 883 | Str. Eagle..... | 09, 718, 2003 |
| Chatham Beach, Mass., near: | | Sch. S. A. Wood..... | 11, 855, 2372 |
| Sch. Mary J. Castner..... | 06, 92, 919 | L. Hanberg..... | |
| Chatham H., Mass.: | | Chicago R., N. Branch Canal, Ill.: | |
| Sch..... | 95, 70, 709 | Gospel ship A. G. Morey..... | 10, 795, 2161 |
| Wreckage..... | 94, 49, 568 | L. O. J. Hale..... | |
| | 98, 69, 883 | Chicago R., S. Branch, Ill.: | |
| Sch. Electa Bailey ⁷ | 01, 175, 1147 | L. York State..... | 10, 795, 2162 |
| | 02, 122, 911 | Chincoteague, Va.: | |
| | | Sch. Florence I. Lockwood..... | 09, 223, 1182 |

¹ Sunk during the Civil War.

² Removed by gunboat *Vesuvius*.

³ Reported not an obstr.

⁴ Removed by dr. *Wingah Bay*.

⁵ Ex. made, but no wreck found.

⁶ Could not be located.

⁷ Removed by hired labor.

⁸ Removed by wrecking company.

⁹ Removed by U. S. tender *Sentinel*.

¹⁰ Removed by owner.

¹¹ Not an obstr.

¹² Removed by U. S. naval destroyer *Lebanon*.

¹³ Destroyed by revenue cutter *Onondaga*.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|---|---|--|
| Chincoteague B.: Bk. Wolverton..... | (83, 148, 725 84, 151, 948 | Cumberland R., Tenn.: Str. W. K. Phillips..... | (01, 463, 2417 02, 302, 1706 03, 417, 1589 06, 496, 1512 07, 525, 1620 08, 560, 1696 07, 525, 1620 08, 560, 1696 |
| Chincoteague Lighthouse, Va., near: Str. Oakdene ¹ | 03, 194, 1025 | Str. Bart E. Linehan..... | |
| Choctank R., Md.: Sl. John Thomas..... | 95, 150, 1147 89, 111, 905 | Wharf boat Mayflower..... | |
| Sl. Eva Hemingway..... | (90, 101, 942 | Cumberland Sound, Ga. and Fla.: City of Austin..... | 03, 271, 1171 04, 279, 1668 05, 288, 1290 |
| Choctank (Little) R., off Hills Pt., Md.: Sch. Virginia S. Lawson..... | 11, 306, 1432 | Franconia..... | |
| Christiana R., Del.: C. b. J. D. Hilton..... | 94, 132, 906 96, 973 | Puntalones..... | |
| 6 wrecks..... | 97, 170, 1288 | Cuttyhunk Isl., Mass.: Sch. Dora M. French..... | 95, 69, 708 |
| Str. Alice Clark..... | 88, 138, 991 | Cuttyhunk Pond, Mass.: Sch. Quilp..... | 90, 50, 584 |
| S. b. Delaware..... | 98, 175, 1172 | Cypress Creek, Va.: Sch. Kate Johnson..... | 08, 280, 1276 |
| Car float..... | 04, 177, 1249 | Darien H., Ga.: Str. Molton..... | (92, 180, 1292, 1293 |
| Sailing vessel..... | 08, 217, 1176 | Str. St. Matthews..... | 97, 237, 538 98, 231, 1320 12, 523, 1846 |
| Brg..... | 08, 217, 1176, 1177 | Wreckage..... | |
| Brg. Elsie..... | 12, 328, 1621 | Dredge No. 14..... | |
| Church Flats: Str. Alice Clark..... | 88, 138, 991 | Davis Strait, Me.: Sch. Nevada..... | 98, 52, 838 |
| Clear Creek, Tex.: Brg..... ² | 08, 473, 1538 | Deals Isld., Md.: Sch. Columbia..... | 00, 229, 1661 |
| Clearwater H. and Tampa B., Fla., chan. between: Dr. Hester ³ | 12, 569 | Deals Isld. H., Md.: Sch. Addie Thatcher ¹⁰ | (03, 194, 1024 |
| Cleveland H., Ohio: Sch..... ⁴ | 01, 584, 3270 | Sch. Little Myro ¹⁰ | |
| Sch. Horace H. Badger ⁵ | 03, 556, 2105 | Deer Isld. Thoroughfare, Me.: Sch. Matilda..... | (98, 52, 838 99, 62, 1049 |
| Str. C. H. Davis ⁶ | 04, 608, 3207 | Delaware B.: Sch. Addie Walton..... | |
| Sch. Algeria..... | 07, 716, 2096 | Sch. B. H. Irons..... | |
| Sch. Lillie..... | 09, 797, 2141 | Sch. E. B. Wheaton..... | |
| Sch. Shawnee..... | 12, 1110, 2710 | Sch. Helen Pommell..... | 80, 607 |
| Clinton R., Mich.: L..... | 07, 685 | Sch. Jessie Wilson..... | 81, 822 |
| Cobbs Isld., Va.: Sch. Ann R. Rogers..... | 92, 131, 980 | Sch. J. B. Austin..... | 82, 797 |
| Cohansey R., N. J.: Brg. Henry C..... | 03, 194, 1024 | Sch. W. A. McGahan..... | |
| Sch. Ann Virginia..... | 05, 186, 1123, 1124 | Sch. M. E. Smith..... | |
| Cold Spring Inlet, N. J.: Str. Major W. Allen..... | (11, 278, 1403 12, 328, 1618 | Sch. W. G. Dearborn..... | |
| Colgate Creek, Md.: Sc..... | 99, 205, 1410 | Sh. Adolphus..... | 87, 85, 814 87, 85, 813 |
| Columbia R., Oreg.: (91, 420, 3373 96, 401, 3256 97, 502, 3406 98, 507, 3039 99, 594, 3245 00, 670, 4360 | | Sch. Eureka..... | |
| Sh. Sylvia de Grasse..... | | Sch. Annie S. Gaskell..... | 93, 128, 1183 |
| Common Flats, Mass.: Wreckage..... | 95, 71, 724 | Brg. McClellan..... | 94, 862 |
| Conneaut H., Ohio: Car ferry Chenango No. 1..... | (04, 608, 3209 05, 619, 2368 06, 693, 1921 07, 716, 2096 | Sch. Mount Vernon..... | 95, 132, 1078 97, 1227 98, 156, 1104 99, 182, 1367 00, 206, 1587 01, 263, 1350 02, 178, 1039 03, 165, 972 04, 157, 1201 05, 163, 1086 06, 176, 1042 00, 206, 1588 |
| Connecticut R., Conn.: Sl. G. C. Bloomer..... | 87, 55, 636 | Sch. Allegheny ¹¹ | |
| Sch. R. H. Daly..... | 88, 57, 588 | Sch. Lottie K. Friend..... | |
| Str. Walontha ⁷ | 06, 114, 940 | Sch. Addie Ludington..... | |
| Sc..... | 12, 177, 1464 | Sch. Lavinia Campbell..... | |
| Cooper Creek, N. J.: C. b. Francis J. Henry ⁸ | 93, 1183 | Sch. Lida Fowler..... | |
| Sc..... | 03, 194, 1024 | Sl. Mary W. Meerwald..... | |
| Cooper Creek, S. C.: T. b. F. Huger..... | 93, 189, 1530 | Sch. Mary E. Insley..... | 03, 165, 971 |
| Crisfield H., Md.: P. Cornelia Ann..... | 99, 202, 1398 | Sch. Milton R. Studhams..... | 04, 156, 1200 |
| Cross Rip Lightship, Mass.: Sch. Richard S. Leaming..... | 05, 93, 869 | Sch. Reynolds Postles..... | 04, 156, 1201 |
| | | Brg. Gilberton..... | 05, 163, 1086 06, 176, 1041 05, 163, 1086 06, 176, 1042 07, 185, 1104 11, 242, 1365 |
| | | Brg. Santiago..... | |
| | | Philadelphia City Iceboat No. 3..... | |
| | | Brg. Elmwood..... | |
| | | Brg. Kalmia..... | |
| | | Sch. Hampton..... | |
| | | Sl. Roda and Florence..... | |

¹ Not found.² Removed by snag boat Capt. C. W. Howell.³ Formerly U. S. dr. *Suwanee*.⁴ Removed by owners.⁵ Removed by storms.⁶ Not an obstr.⁷ Removed by U. S. L. *Panuco*.⁸ Removed by Camden County.⁹ Not yet removed.¹⁰ Removal not recom.¹¹ Removed by owners.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|
| Delaware B. and R.: | | Detroit R., Mich.—Continued. | |
| Sch. Gen. W. T. Sherman..... | 91, 118, 1090 | Brg. Richard Martini..... | 05, 601, 2288 |
| C. b. Agatha Brady..... | 92, 119, 940 | Sch. City of Toledo..... | 06, 676, 1921 |
| Str. Blanche Henderson..... | | Sch. Montpelier..... | 07, 698, 2057 |
| Brg. Casilda..... | | Sch. John Schuette..... | 08, 742, 2139 |
| Sch. David Lee..... | | T. Louise..... | 10, 859, 2281 |
| Sch. G. H. Bent..... | 88, 85, 716 | Sch. Maria Martin..... | 10, 2282 |
| Bk. II Salvatore..... | 89, 101, 875 | | 11, 914, 2476 |
| Bk. Patriot..... | 90, 92, 905 | Dividing Creek, N. J.: | |
| Brg. St. Cloud..... | | Sl. Lydia..... | 11, 278, 1402 |
| Sch. S. C. Morton..... | | Dorchester B., Boston H., Mass.: | |
| Brg. Tonawanda..... | | Sch. Sceneby..... | 12, 102, 1404 |
| Brg. Wallace..... | | Duluth H., Minn.: | |
| Brg. Our Little Henry..... | 97, 153, 1227 | Str. Winnipeg..... | 98, 385, 2287 |
| Delaware Breakwater H., Del.: | | T. E. P. Ferry..... | 01, 514, 2883 |
| Dr. Potomac..... | 01, 263, 1351 | | 02, 438, 2042 |
| Sch. Sea Bird..... | 02, 178, 1039 | Str. Thomas Wilson..... | 02, 2042 |
| Delaware R.: | 04, 156, 1200 | | 03, 1828 |
| Sl. Ann..... | 86, 123, 848 | Dutch Isld. H., R. I.: | |
| C. b. T. Carroll..... | 82, 126, 798 | Sch. Davis Brothers..... | 93, 69, 851 |
| Sch. J. E. Hurst..... | 84, 138, 850 | Duwamish R., Wash.: | |
| Sch. J. S. Detwiler..... | 85, 126, 855 | Br. Atlas..... | 08, 849 |
| | 93, 1183 | Eagle H., Wis.: | |
| C. b. General Grant..... | 94, 117, 861 | Str. Cecelia Hill..... | 09, 706, 1986 |
| Sch. Kent..... | 94, 117, 861 | East Chester B., N. Y.: | |
| Sch. Enterprise..... | | Se..... | 09, 156, 1089 |
| Wreckage..... | 96, 122, 938 | East R., N. Y.: | |
| C. b. Resolute..... | 99, 182, 1367 | U. S. engineer dr. Flood Rock..... | 94, 95, 785 |
| Sch. Joseph R. Ellis..... | 99, 182, 1367 | | 95, 120, 998 |
| Sl. John W. Elliot..... | 00, 206, 1588 | Brg. Milton..... | 96, 109, 869 |
| Sch. Clara..... | 00, 206, 1589 | C. b. | 94, 95, 786 |
| C. b. Victory..... | 00, 206, 1589 | Sl. Pell..... | 95, 120, 998 |
| C. b. James McNeal..... | 01, 263, 1352 | C. b. | 00, 1422 |
| Sch. Mary Baxter..... | 01, 263, 1352 | Sl. Pell..... | 03, 139, 887 |
| Brg. Iron State..... | 01, 262, 1351 | C. b. | 04, 126, 1053 |
| 2 wrecks..... | | Pile driver..... | 07, 145, 146, |
| C. b. H. C. Webster..... | 02, 178, 1040 | | 1019, 1020 |
| C. b. Beaver..... | 03, 165, 971 | Str. Malvina St. Clair..... | 07, 146, 1020 |
| Brg. Harry E. Bird..... | 04, 156, 1200 | Sch. H. T. Hedges..... | 09, 157, 1089 |
| Sch. Annie Cooney..... | 04, 156, 1201 | Sch. Long Island..... | 11, 183, 1283 |
| Se. — (pile driver)..... | 05, 163, 1085, | C. b. Jamaica..... | 11, 184, 1285 |
| | 1086 | C. b. | 12, 223, 1501 |
| Brg. Alice..... | 06, 176, 1041 | Brg. Frank Miller..... | 11, 184, 1285 |
| | 07, 185, 1103 | Eatons Neck Lighthouse, Long | |
| | 08, 193, 1142 | Isld. Sound: | |
| | 06, 176, 1042, | Sch. Clara E. Simpson..... | 95, 93, 850 |
| | 1043 | Edgartown H., Mass.: | |
| Pontoon..... | 07, 185, 1103, | Sch. | 93, 70, 857 |
| | 1104 | Edgartown, Marthas Vineyard, | |
| Coal sc..... | 06, 177, 1043 | Mass.: | |
| C. b. | 07, 185, 1104 | Yacht Senta..... | 11, 117, 1218 |
| C. b. | 08, 193, 1142 | Elizabethport, N. J.: | |
| Houseboat..... | 09, 198, 1152 | Brg. Nellie..... | 91, 107, 1013 |
| Brg. Alfred..... | 08, 193, 1142 | Elizabeth R., N. J.: | |
| Sch. Eden..... | 08, 193, 1142 | 3 C. b. | 94, 108, 823 |
| Sch. John A. Lingo..... | 09, 198, 1152 | Brg. Antoinette Fisher..... | 03, 159, 955 |
| Brg. Admiral Clark..... | 09, 198, 1153 | Elizabeth R., Va.: | |
| T. James Herron..... | | Str. Helen Smith..... | 97, 198, 1380 |
| Se. Joe Herron..... | 11, 242, 1365 | | 98, 201, 1234 |
| Sch. Howard W. H. Taylor..... | | Sch. Henry Lippitt..... | 95, 1295 |
| Brg. Estella..... | 12, 289, 1579 | | 96, 159, 1084 |
| Brg. Tragic..... | 12, 289, 1579 | Sch. John C. Haynes..... | 97, 198, 1379 |
| Sch. Eugene H. Cathrall..... | 12, 289, 1577 | | 98, 159, 1084 |
| Dennis Creek, N. J.: | | | 96, 159, 1084 |
| Sch. Druzilla B. Lee..... | 00, 206, 1589 | Sch. Maggie..... | 98, 159, 1084 |
| Sch. Irene A. B. Crawford..... | 01, 262, 1350 | F. b. Manhasset..... | 00, 264, 1783 |
| Detroit R., Mich.: | 02, 190, 1063 | Wrecked cars..... | 00, 264, 1784 |
| Sch. Sweetheart..... | 82, 298, 2375 | Brg. East New Market..... | 02, 226, 1126 |
| Str. Nile..... | 83, 306, 1886 | Brg. Centennial..... | 11, 350, 1511 |
| Sch. Leader..... | 01, 570, 3198 | Brg. | |
| | | Elk R., Md.: | |
| | | Brg. J. E. Gillingham..... | 98, 175 |
| | | Brg. William E. Weller..... | 99, 182, 1367 |
| | | Sunken piles and logs..... | 04, 1274 |
| | | | 05, 202, 1147 |

¹ Removed by owners.
² Removed from chan. by U. S. plant and raised
by owners.
³ Removed by private parties.

⁴ Not found.
⁵ Removed by owners.
⁶ Disappeared in the mud.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|---|--|--------------------------------------|
| Elk R., Md.—Continued. | | Grand R., Ohio: | |
| Sch. Sallie Ann..... | 11, 306, 1432 | T. McCormick..... | 07, 716, 2096 |
| Str. Lizzie Hunt..... | 12, 362, 1654 | Grassy Sound, N. J.: | 08, 760, 2168 |
| Erie H., Pa.: | | Dr. Townsend..... | 12, 328, 1619 |
| Sc. Pacific..... | 96, 376, 3127 | Great Chazy R., N. Y.: | |
| T. Annie Laurie..... | 97, 472 | C. b. F. W. Avery..... | 08, 76, 970 |
| T. Sheldon Bros..... | 11, 2510 | Great Egg H. Inlet, N. J.: | |
| Fairhaven H., Mass.: | | Sch. Marcia S. Lewis..... | 93, 128, 1182 |
| Sch. Francis Edwards..... | 93, 69, 851 | Sch. Palestine..... | 97, 153, 1227 |
| Fairport H., Ohio: | | Sch. Alice Bell..... | |
| Sch. J. J. Hill..... | 86, 339, 1876 | Great Pedee R., S. C.: | |
| Part of timber crib..... | 04, 608, 3207, 3208 | Confederate gunboat..... | 09, 333, 1317 |
| Brg. L. L. Lamb ¹ | 03, 556, 2106 04, 607, 3206, 3207 | Great Pt. Rip, Mass.: | 10, 377, 1457 |
| Yacht Idler ¹ | 05, 618, 2367 04, 608, 3208, 3209 | Wreckage..... | 11, 995, 1589 |
| Fenwicks Isld. Light, Del., near: | 05, 618, 2367 | Sch. Julia E. Pratt..... | 95, 712 |
| Str. Sutton..... | 03, 194, 1025 | Great Salt Pond H., R. I.: | 95, 70, 715 |
| Flint R., Ga.: | 04, 193, 1274 | Brg. Montana..... | 07, 94, 954 |
| Str. Mascot..... | 01, 363, 1793 | Great South B., N. Y.: | |
| Flushing Creek, N. Y.: | 02, 293, 1280 | Sch. | 05, 134, 980 |
| Brg. Helen R..... | | Sl. | 07, 145, 1019 |
| Flynns Knoll, N. Y.: | 10, 179, 1213 | Wreck..... | 10, 180, 1214 |
| Brg. David Crockett ² | 99, 147, 1278 | Green B., Wis.: | |
| Fort Hamilton, N. Y.: | | T. J. W. Bennett..... | 07, 624, 1915 |
| Str. Ailsa..... | 97, 114, 1039 | Str. Cecelia Hill..... | 09, 706, 1986 |
| Fort McHenry, Md.: | | Green B. H., Wis.: | |
| Sch. Margaret Kennedy..... | 97, 174, 1307 | Str. City of Glasgow..... | 08, 669, 1983 |
| Frankford Creek, Pa.: | | Greenport H., N. Y.: | |
| C. b. Daisy..... | 04, 156, 1200 | Sch. Doretta Kahn..... | |
| Brg..... | 12, 289, 1577 | Sch. Saucy Maid..... | |
| Frankford, Me.: | | Sch. Chief Justice Dailey..... | |
| Sch. Swan ³ | 97, 43, 801 | Sch. S. P. Bogart..... | 04, 125, 1052 |
| Galveston B., Tex.: | | Sch. Arabella..... | |
| Str. Cumberland..... | | Sch. Jennie..... | |
| Brg. Jules..... | 01, 411, 1859 | Green Run Lightship Station, Md., near: | |
| Brg. Alice..... | 02, 342, 1390 | 2 wrecks..... | 02, 190, 1063 |
| T. Kate..... | 05, 399, 1516 | Green Run Inlet, Md., near: | |
| Boats, beacons, and bridges ⁴ | 06, 429, 1351 07, 450 | Sch. Elsie M. Harris..... | 03, 194, 1023 |
| Ophelia (vessel) ⁴ | 06, 1351 | Gulf of Mexico, entrance to With- lacoochee R., Fla.: | |
| Lady Dora ⁴ | 08, 473, 1538 | Br. Zoradia..... | 12, 568 |
| Brg. No. 3 (oil)..... | | Habana H., Cuba: | 10, 5 |
| Galveston H., Tex.: | | U. S. battleship Maine..... | 11, 1119, 3039 |
| Str. City of Waco..... | 99, 345, 1972 | Hackensack R., N. J.: | 12, 1344, 3585 |
| Dr. No. 3..... | 00, 394, 2341 | C. b..... | 11, 233, 1347 |
| Brg. Swearingen ⁵ | 02, 342, 1391 03, 361, 1347 | Hampton Creek, Va.: | |
| Gay Head, Mass.: | 10, 558, 1659 | Sch. R. L. Loper..... | 00, 264, 1784 |
| Sch. Josiah R. Smith..... | 95, 71, 725 | Sch. Three Sisters..... | 07, 263, 1219 |
| Sch. Josiah Whitehouse..... | 91, 61, 732 | 5 wrecks..... | 12, 420, 1732 |
| Gedney Chan., N. Y.: | | Hampton Roads, Va.: | |
| T. Talsiman..... | 94, 95, 785 | Bk. E. L. Pettingill..... | 89, 120, 963 |
| Brg. Andrew Jackson..... | 96, 109, 869 97, 114, 1039 | Sch. Willie Lee Hall..... | 90, 108, 1029 |
| Glen Cove H., N. Y.: | | Brg. John R. Zimmerman..... | 03, 228, 1088 |
| Sch. Superior..... | 11, 209, 1314 | Sch. Bismarck..... | 04, 227, 1380 |
| Gowanus Canal, N. Y.: | | Sch. Wm. Henry..... | 07, 282, 1219 |
| T. William Horre (see Brook- lyn, N. Y.)..... | 97, 138, 1158 | Handkerchief Lightship, Mass.: | 09, 288, 1271 |
| Grand Lake, La.: | | Sch. Benjamin Gartside..... | 10, 328, 1398 |
| Str. Queen of the West..... | 95, 259, 1782 96, 225, 1520 | Handkerchief Shoal, Mass.: | |
| Grand Marais H., Mich.: | | Sch. Sarah Potter..... | 90, 50, 585 |
| Str. A. A. Parker ⁶ | 04, 517, 2781, 2782 | Sch. M. C. Haskell..... | 91, 61, 731 |
| Grand R., La.: | | Hardings Beach, Mass.: | |
| Str. G. W. Anderson..... | 94, 232, 1383 | Sch. Anna Laura..... | 03, 103, 820 |

¹ Removed by U. S. dr. *Maumee*.² Not yet removed.³ Supposed to be.⁴ Removed by U. S. dr. *Gen. S. M. Mansfield*.⁵ Removed by U. S. derrick brg. No. 1.⁶ Not an obstr.⁷ Could not be located.⁸ Removed by U. S. str. *Sentinel*.⁹ Removed by hired labor.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|---|--------------------------------------|--|---|
| Harlem R., N. Y.—Continued. | | Hudson R.—Continued. | |
| T. Sea Wall..... | 07, 146, 1021 | C. b. Bertha..... | 11, 183, 1282 |
| Sch. Deborah T. Hill..... | 08, 154, 1071 | C. b. George Chambers..... | 11, 183, 1286 |
| C. b. General..... | 11, 184, 1284 | C. b. ———— | 11, 183, 1284, 1284 |
| Hempstead H., N. Y.: | | C. b. Elsie..... | 11, 184, 1286 |
| Str. Bay Ridge..... | 89, 70, 733 | C. b. ———— | |
| C. b. Thomas Tryon ¹ | 90, 62, 667 | C. b. ———— | |
| Hen and Chicken Lightship, Mass.: | 07, 146, 1020 | C. b. Calcutta..... | 12, 223, 1499 |
| Brg. Fidelia..... | 04, 86, 929 | Landing float ———— | |
| Henderson H., N. Y.: | | C. b. ———— | 12, 223, 1500 |
| C. b. ———— | 97, 482, 3304 | C. b. Perty..... | |
| Hereford Inlet, N. J.: | | C. b. Annie Big..... | 12, 223, 1502 |
| Str. Gulf Stream..... | 09, 224, 1183 | Sc. ———— | |
| Sch. ———— | 12, 328, 1621 | Huron H., Ohio: | |
| Hereford Lighthouse, N. J.: | | T. Osceola ⁷ | 10, 878, 2301 |
| Sch. Marion F. Sprague..... | 96, 122, 938 | Hyannis H., Mass.: | |
| Hillsboro B., Fla.: | | Sch. S. S. Bickmore..... | 91, 62, 732 |
| Str. Kissimmee (boilers of)..... | 02, 281, 1225 | Sch. Annie W. Akers..... | 94, 63, 614 |
| Sch. Eugene Barty..... | 08, 368 | Sch. Stephen Raymond..... | 94, 63, 615 |
| Hillsboro R., Fla.: | | Sch. Katie Mitchell..... | 94, 63, 616 |
| L. ———— | 97, 251, 1566 | Sch. Robert Mowe..... | 96, 69, 665 |
| Brgs. and sunken timber..... | 06, 331, 1240 | Sch. Melinda Wood..... | 99, 96, 1145 |
| Sc. ———— | 07, 347 | Sch. Thomas Borden..... | 03, 103, 819 |
| Logs ² | | Sch. Alice T. Boardman..... | 08, 96, 995 |
| Piles..... | 08, 369 | Illinois R. (see Removal of snags): | |
| Phosphate dr..... | 09, 384 | Wreck..... | 09, 553, 1617 |
| Logs, etc..... | 09, 385 | Inland passage, Charleston to | |
| Sch. Lily White..... | 11, 462 | Beaufort, S. C.: | |
| Hilo H., Hawaii: | | Sunken logs..... | 01, 324, 1607 |
| Bk. Martha Davis..... | 06, 790, 2052 | | 02, 251, 1173 |
| Hog Isld., Va.: | | | 03, 257, 1140 |
| Sch. Harvey W. Anderson..... | 92, 131, 980 | Inland waterway of New Jersey: | |
| Hoopers Strait, Md.: | | Brg. Saratoga..... | 12, 328, 1620 |
| Sch. Mary Liz Thomas..... | 12, 362, 1653 | Jackson Creek, Md.: | |
| Horn Isld. H., Miss.: | | Sch. Maria Green..... | 91, 131, 1201 |
| Bk. Hilja ³ | 04, 342, 1839 | Wreckage ⁴ | 96, 972 |
| | 05, 353, 1428 | Sch. Harry Moore ⁵ | 01, 272, 1391 |
| Hudson R.: | | James R., Va.: | |
| C. b. ———— | 83, 100, 556 | Str. Wyanoke..... | 98, 200, 1234 |
| Sl. Locomotive..... | 88, 67, 637 | Bk. J. D. Bischoff..... | 06, 250, 1140 |
| F. b. New Brunswick..... | 97, 114, 1039 | | 07, 249, 1199 |
| C. b. Hager Johnson..... | | Dr. City of Richmond. | 08, 263, 1261, 1252 |
| T. W. R. Sheffield..... | 99, 163, 1315 | Sch. Curtis W. Wright..... | 08, 280, 1276 |
| C. b. McDonald..... | | Sch. ———— | |
| Deck load of stone..... | 00, 187, 1517 | Sl. Haze ¹⁰ | 09, 288, 1271 |
| Sl. Pacific..... | | Sl. ———— ¹¹ | 10, 307, 1374 |
| C. b. R. G. Fairbanks..... | 00, 187, 1516 | Sch. W. S. Rodgers..... | 11, 330, 1482 |
| Str. W. M. Whitney..... | 99, 163, 1316 | Sl. ———— | |
| L. Union..... | 01, 223, 1248 | T. Col. J. C. Hill..... | 12, 420, 1730 |
| C. b. Alert..... | 03, 139, 887 | Brg. ———— | |
| Wreck..... | 03, 139, 888 | Judith Pt., R. I.: | |
| Brg. Jas. Cogswell..... | | Brg. ———— | 95, 71, 723 |
| C. b. ———— | 04, 125, 1052 | Kennebec R., Me.: | |
| Brg. H. L. Higgins..... | 04, 125, 1053 | Lavina Bell..... | 99, 62, 1049 |
| C. b. Andrew Grant..... | 04, 126, 1054 | Sch. Henry L. Peekham..... | 00, 62, 1100 |
| C. b. ———— ⁴ | | Sch. Young Brothers..... | 11, 61, 1163 |
| C. b. ———— | 05, 140, 1024 | Kewaunee H., Wis.: | |
| Brg. Percie and Bertha..... | 05, 134, 989 | T. James N. Brooks..... | 07, 624, 1916 |
| Sch. Eaglet..... | 07, 145, 1019 | Sch. Edith H. Koyen..... | |
| T. Sharp..... | | Sch. Exchange..... | |
| Brg. Coggeswell..... | 07, 146, 1021 | Brg. Liberty..... | |
| Brg. Charles G. Hill..... | 07, 146, 147, 1022 | Unknown vessel..... | |
| F. b. Paterson..... | 08, 153, 1069, 1070 | Keyport H., N. J.: | |
| | 07, 147, 1022 | Sch. G. W. Van Cleaf..... | 00, 187, 1517 |
| C. b. Mamie Doherty..... | 08, 153, 1070 | Key West H., Fla.: | |
| C. b. D. & H. No. 3079 ⁵ | 08, 154, 1071 | Bk. Marcello..... | 96, 198, 1338 97, 251, 1566 98, 245, 1343 |
| Brg. ———— | 09, 157, 1090 | Bk. Brandon..... | |
| Sch. Winslow Morse ⁶ | 10, 179, 1212 | Bk. Auto..... | |
| Brg. Bessie..... | 10, 179, 1213 | Bk. Almora..... | |
| Sc. ———— | 10, 180, 1213 | Sch. Adelaide Baker..... | |
| Wreck..... | | Sch. Rosalie..... | |
| Wreckage..... | 11, 183, 1282 | Sh. Marie Frederika..... | |
| float..... | | Str. Cochran..... | |
| | | Old dry dock..... | |
| | | Str. Governor Marvin..... | |

¹ Removed by hired labor.

² Removed by U. S. dr. and snag boat *Suwanee*.

³ Removed by U. S. and owners.

⁴ Floated away.

⁵ Owner remitted cost of removal.

⁶ Assumed. Locality not stated.

⁷ Removed by U. S. dr. *Maumee*.

⁸ Removed by Chester R. Steamboat Co.

⁹ Removed by U. S. tender *Sentinel*.

¹⁰ Removed by private parties.

¹¹ Not an obstr.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|---|--------------------------------------|--|--------------------------------------|
| Key West H., Fla.—Continued. | | Lake Michigan, Wis.: | |
| Bk. Ceres..... | 02, 273, 1216 | Sch. Kate Kelly..... | 95, 367, 2681 |
| Str. O. C. Williams..... | | | 96, 323, 2560 |
| Sch. Cottrell..... | 03, 281, 1187 | Lake Michigan, Ill.: | |
| Sc. (3)..... | | Brg. No. 2 (car ferry)..... | 08, 681, 2002 |
| Propeller ¹ | 06, 331, 1240 | Sch. David Dows..... | 09, 718, 2032 |
| Sch. Frederick W. Alton..... | 10, 434 | Hydraulic dr..... | 09, 718, 2003 |
| T. G. W. Childs..... | 12, 586 | Lake Monroe, Fla.: | |
| Sch. Heartsease..... | | Str. Starlight ² | 05, 309, 1320 |
| Kill Pond Bar, Mass.: | | | 06, 331 |
| Sch. Asia..... | 99, 96, 1144 | Lake Ontario: | |
| Brg. Excelsior..... | 98, 84, 932 | Anchored spar ³ | 03, 575, 2169 |
| | 99, 96, 1144 | Lake Pontchartrain, La.: | |
| Kill Van Kull, N. Y. and N. J.: | | Sch. A. J. Ramsay..... | 10, 528, 1627 |
| Str. Canonicus..... | 95, 120, 998 | Lake Superior, Mich.: | |
| C. b. Geo. H. Notter..... | 07, 174, 1077 | Str. Hutchinson..... | 04, 517, 518, |
| Kill Van Kull, N. J.: | | | 2782 |
| Sch. Chrystal..... | 08, 183, 1118, | | 08, 647, 1938 |
| | 1119 | | 09, 683, 1939 |
| Lake St. Clair, Mich.: | | Str. Alex Nimick..... | 10, 757, 2094 |
| Lighthouse cribs..... | 04, 3139 | | 11, 813, 2298, |
| T. Fannie Tuthill..... | 06, 676, 1891 | | 2299 |
| U. S. str. Hancock..... | 07, 698, 2057 | Str. Sevona ¹⁰ | 09, 683, 1940 |
| Lake Champlain: | 06, 676, 1891 | | 10, 756, 2094 |
| C. b. (8) or parts of..... | 03, 73, 753 | Str. Chauncey Hurlbut..... | 10, 757, 2095 |
| C. b. Anna Weightman..... | | Str. Manhattan..... | 11, 813, 2299, |
| C. b. Russell Wright..... | 05, 74, 836 | | 2300 |
| C. b. Julius Fulton, jr..... | 06, 72 | Leipsic R., Del.: | |
| C. b. E. M. Wright & Co. ² | 09, 77, 1003 | Sch. Mint..... | 95, 150, 1146 |
| C. b. (8)..... | 10, 88, 1121 | Sch. Jas. K. Burnite ⁹ | 03, 194, 1025 |
| C. b. Geo. D. Cull..... | | | 04, 178, 1248 |
| C. b. John R. Myers..... | | Lewes Creek, Del.: | |
| C. b. North Star..... | 10, 88, 1121 | Sl. Glide..... | 12, 328, 1619 |
| C. b. E. D. Case..... | | Lexington, Mich., near: | |
| C. b. Richmond..... | | Str. Eliza H. Strong ¹¹ | 06, 663, 664 |
| C. b. William Parker..... | | | 07, 698, 2057 |
| C. b. F. J. Bailey..... | | Little Creek, Del.: | |
| C. b. Governor Roosevelt..... | | Sch. Mary L. Bird..... | 00, 229, 1660 |
| C. b. George T..... | 10, 88, 1121 | Sch. Van Seiver..... | 03, 194, 1023 |
| C. b. Armenia Allore..... | | Sl. Nettle..... | 12, 328, 1621 |
| Str. Germania..... | | Sch. Carrie..... | |
| Str. Reindeer..... | | Little Egg H. Inlet, N. J.: | |
| C. b. Folsom..... | | Sh. Parkfield..... | 84, 138, 850 |
| C. b. A. Gravel..... | | Sh. Francis..... | 85, 126, 856 |
| C. b. Thompson..... | 10, 88, 1121 | Sch. Rebecca M. Smith..... | 98, 156, 1104 |
| C. b. Thos. F. Quinn..... | 11, 183, 1280 | | 05, 186, 1122, |
| C. b. R. A. Bullis..... | | | 1123 |
| C. b. Damon..... | | Little Egg H. B., N. J.: | |
| C. b. Alec Black..... | 10, 88, 1121 | Brg. Carrie..... | 04, 178, 1249 |
| C. b. Saunders..... | 11, 183, 1281 | | 05, 186, 1122 |
| C. b..... | | Little H., Woods Hole, Mass.: | |
| C. b. Jamson..... | 11, 183, 1281, | Sch. Ellen R..... | 90, 50, 584 |
| C. b. Clara..... | 1282 | Little Red R., Ark.: | |
| C. b. Una..... | | Coal brg. —..... | 00, 424, 2613 |
| Lake Erie: | | Little Rock, Ark.: | |
| Sch. Benson..... | 00, 603, 4094 | Str. Eli..... | 95, 286, 2037 |
| Sch. Laura Miller..... | 00, 603, 4095 | | 96, 248, 1696 |
| Sch. H. G. Cleveland..... | 00, 603, 4096 | Locklies Creek, Va.: | |
| Sch. Dundee..... | 01, 584, 3269 | Bugeye ⁹ | 10, 307, 1373 |
| Str. George Dunbar..... | 03, 556, 2103 | Logstown, Pa.: | |
| Str. Lockwood ³ | 04, 607, 608, | 4 coal boats..... | 94, 289, 1889 |
| | 3207 | Long Isl. Sound: | |
| Str. Queen of the West ⁴ | 04, 608, 3208 | Sch. E. J. Higgins..... | 88, 57, 584 |
| Spar..... | 05, 627 | Sch. Louisa Bliss..... | 94, 82, 714 |
| Str. Iron Age..... | 09, 780, 2120 | Sch. Lizzie Raymond..... | 94, 82, 712 |
| Sch. Spademan..... | 10, 859, 2281 | Sch. Eliza Anderson..... | 95, 731 |
| Str. W. C. Richardson..... | 10, 878, 2301 | Wreckage ¹² | 95, 93, 850 |
| | 12, 1125, 2733 | Sch. Clara E. Simpson..... | 99, 141, 1251 |
| Lake Huron: | | Sch. Richard Hall ¹³ | 00, 159, 1421 |
| — D. M. Wilson ⁶ | 95, 395, 2841 | Sch. Buena Ventura ¹⁴ | 07, 117, 982 |
| Brg. Checotah ⁶ | 07, 698, 2057, | Sch..... | 09, 157, 1090 |
| | 2058 | Longport, N. J., point of beach: | |
| Sch. or brg. —..... | 08, 742, 2139 | Piling..... | 11, 278, 1403 |
| | 08, 742, 2139 | Lorain H., Ohio: | |
| Str. Eliza H. Strong..... | 09, 780, 2119 | Str. Quito ⁷ | 03, 556, 2104 |
| | 10, 859, 2280 | Lower New York B., N. Y.: | |
| | | Brg. Andrew Jackson..... | 96, 109, 869 |

¹ Not found.² Removed at private expense.³ Not an obstr.⁴ Removed by U. S. t. *Quest*.⁵ Removed by ice and waves.⁶ Spar of, removed by U. S. t. *Johnson*.⁷ Removed by U. S. str. *Hancock*.⁸ Removed by U. S. snag boat *Florida*.⁹ No obstr.¹⁰ Part removed by owners and part by U. S. str. *Vidette*.¹¹ Removed by underwriters.¹² Removed by strong tide or currents.¹³ Removal incomplete.¹⁴ Destroyed by revenue cutter *Mohawk*.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|--|--|---|
| Lynn H., Mass.: Sch. Ellen Maria..... | 00, 77, 1169 | Milwaukee B., Wis.: Brg. Sumatra..... | 97, 407, 2751 |
| Lynn Haven H.: Sch. Anthea Godfrey..... | 86, 159, 970 | Sch. Hiram R. Bond..... | 05, 543, 2063 |
| Mackey Creek, N. C.: Logs ² | 09, 288, 1271 | Milwaukee R.: Sch. Contest..... | 99, 473, 2812 |
| Mackinac Straits, Mich.: Brg. Richard Winslow..... | 02, 494, 2244 03, 542, 2046 | Misham Pt., Mass.: Sch. S. S. Scranton..... | 95, 70, 713 |
| Mahon R., Del.: Sch. Malvina..... | 02, 190, 1063 | Mispillion R., Del.: T. Charles Lea..... | 93, 143, 1228 94, 132, 906 04, 178, 1249 05, 186, 1121 |
| Manhasset B., N. Y.: Bk. Hoppet..... | 95, 93, 852 | Sc. ———..... | |
| C. b. 2..... | 96, 102, 801 | Mississippi R. (see Removal of snags): Str. Albert S. Willis..... | 95, 287, 2043 |
| Manitou (South) H., Mich.: Sch. Margaret Dall..... | 11, 885, 2414 | Br. 2—coal..... | 96, 23, 249, 1707 |
| Manitowoc H., Wis.: Str. (ferry) Ann Arbor No. 1..... | 12, 1004, 2534, 2535 | Str. Hudson..... | 97, 23, 317, 2001 |
| Man of War H., Fla.: Wrecks (designated as) Nos. 9, 10, 11, 12, 13 (Florida), 14, 15 (Cora's boiler) Old stern dock..... | 97, 251, 1566 98, 245, 1343 09, 385 | Brg. ———..... | |
| Manokin R., Md.: Sch. Wm. H. Roach..... | 00, 229, 1661 01, 272, 1390 | Str. Golden City..... | 98, 309, 1687 |
| Mantua Creek, N. J.: Brg. Homeward Bound..... | 09, 224, 1183 | Str. Dolphin No. 2..... | |
| Marblehead Light, Ohio, near: Str. City of Concord..... | 07, 716, 2096 | Brg. ———..... | |
| Sch. Wm. Crosthwaite..... | | Mississippi R., above Missouri R. (see Removal of snags): 3 wrecks..... | 02, 370, 1609 03, 393, 1467 08, 1628 09, 553, 1617 |
| Marcus Hook Ice H., Pa.: C. b. M. P. Howlett..... | 04, 156, 1200 | Boilers of str. Ravenna..... | |
| Mare Isld. Straits, Cal.: Sch. Witch of the Bay..... | 07, 749, 2151 | Brg. ———..... | |
| Marine City, Mich.: Float..... | 03, 2047 | Wreck..... | |
| Marsh R., Me.: Sch. Old Swan..... | 97, 43, 801 00, 62, 1100 | Mississippi R., below Missouri R. (see Removal of snags): Dr. New Era..... | 01, 434, 2167 |
| Marthas Vineyard, Mass.: Sch. Mary B. Smith..... | 98, 84, 931 | Brg. ———..... | |
| Mattaponi R., Va.: Sl. ———..... | | Str. Howard..... | |
| Sc. ———..... | 88, 116, 845 | Yacht Signia..... | |
| Sch. ———..... | | 2 brgs..... | |
| L. Exertion..... | 04, 217, 1342 | 7 wrecks..... | 02, 366, 1593 |
| Mattituck Creek, N. Y.: Sc. ———..... | 12, 253, 1528 | Str. Eagle..... | 03, 389, 390, 1442 |
| Maumee B., Ohio: Sch. Ferrett..... | 96, 368, 2972 | C. b. ———..... | |
| Floating crib..... | 03, 557, 2106 | Str. Jim Lee..... | |
| Maurice R., N. J.: Brg. ———..... | | Str. Robert E. Lee..... | |
| Sch. Trade Wind..... | 83, 130, 660 | 2 derrick boats..... | 05, 423, 1584 |
| Sch. Anna Maria..... | 98, 156, 1104 | 4 brgs..... | |
| C. b. May..... | 99, 182, 1367 | Old wreck..... | |
| Sl. Gertrude..... | 00, 206, 1589 | Brg. ———..... | |
| Sl. Constitution..... | 04, 177, 1249 04, 178, 1249 05, 186, 1121, 1122 | Str. Emma Etheridge..... | 06, 461, 1399 |
| Sch. Baltimore..... | 11, 277, 1401 | Traction engine..... | |
| Mayaguez H., P. R.: Sch. Frank T. Stinson..... | 11, 1062, 2656 | Str. Fred Nellis..... | 06, 461, 1399 |
| Sch. Mary B. Pierce..... | 12, 1275, 2878 | Sand dr. Colorado..... | 08, 519, 1610 |
| L. Indie..... | | Str. City of St. Louis..... | 08, 519, 1610 |
| Michigan City H.: Str. Horace A. Tuttle..... | 99, 504, 2951 00, 568, 3933 | Str. Frank..... | 06, 461, 1399 |
| Millbridge, Me.: Sch. L. Holoway..... | 97, 42, 798 98, 52, 838 | Str. Iona..... | 08, 519, 1610 |
| | | 7 wrecks..... | 07, 486, 1535 |
| | | 4 brgs..... | |
| | | Machinery of str. Currin..... | |
| | | Boilers and machinery of str. Moran..... | 08, 519, 1610 |
| | | 3 brgs..... | |
| | | Machinery of str. Frank..... | |
| | | Machinery of U. S. pile driver..... | |
| | | 23 wrecks..... | 09, 549, 1594 |
| | | Missouri R. (see Removal of snags): 2 launches..... | 08, 546, 1665 |
| | | Boilers of str. Susan..... | 08, 546, 1667 |
| | | 59 miscellaneous obstrs..... | 08, 546, 1669 |
| | | Str. Uncle Sam..... | 11, 705, 2022 |
| | | Mobile B., Ala.: Brg. Goodwin..... | 05, 353, 1428 06, 380 |
| | | Old dry dock..... | 06, 380 |
| | | Mobile H., Ala.: Dr. Jumbo..... | 04, 342, 1839 |

¹ Removed by snag boat *Roanoke*.
² Removed by hired labor and leased plant.
³ Removed by U. S. str. *Visitor*.
⁴ Removed by U. S. dr. *Maumee*.
⁵ Removed by U. S. str. *Hancock*.
⁶ Removed by hired labor and U. S. snag boat.
⁷ Owners paid for removal.
⁸ Removed by U. S. dr. *Phoenix*.
⁹ Removed by U. S. snag boat *Col. A. Mackenzie*.
¹⁰ Removed by U. S. snag boat.
¹¹ Removed by U. S. snag boat *Horatio G. Wright*.

¹² Removed by U. S. snag boats.
¹³ Removed by U. S. snag boats *H. G. Wright* and *J. N. Macomb*.
¹⁴ Removed by snag boat *H. G. Wright*.
¹⁵ Aground; pulled off by snag boat *H. G. Wright*.
¹⁶ Removed by U. S. snag boat *Macomb*.
¹⁷ Passengers rescued by snag boat *H. G. Wright*.
¹⁸ Removed by snag boats *Missouri*, *James B. McPherson*, and *Mandan*.
¹⁹ Removed by U. S. plant.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|---|--------------------------------------|---|--------------------------------------|
| Mobile R., Ala.: | | Nantucket Sound, Mass.—Contd. | |
| Brg. New York..... | | Sch. Mary Farrow..... | 11, 117, 1218 |
| Br. Uncle Sam..... | 84, 206, 1217 | Sch. Lois V. Chaples..... | 12, 135, 1431 |
| Str. Gertrude..... | 93, 237, 1782 | Sch. Hannah F. Carleton..... | |
| | 94, 219, 1332 | Napa R., Cal.: | |
| | 95, 243, 1712 | L. No. 1..... | 08, 797, 2229 |
| Dry dock..... | 07, 394, 1397 | Narragansett B., R. I.: | |
| | 08, 420, 1454 | Sch. Mott Haven..... | 86, 81, 619 |
| | 09, 438, 1437 | Sch. Willie De Wolf..... | 99, 96, 1145 |
| Sc. ——— | 99, 317, 1784 | Narraguagus B., Me.: | |
| Brg. ——— ¹ | 00, 359, 2223 | Sch. L. Holway..... | 97, 42, 798 |
| Sch. Fleet Wing..... | 01, 378, 1853 | | 98, 52, 838 |
| Several pontoons ² | 03, 324, 1272 | Nauset H., Mass.: | |
| Brg. Black Diamond..... | 10, 488, 1588 | Wreckage..... | 01, 159, 1091 |
| Mobjack B., Va.: | | Sch. Ira Laffrinier ³ | 02, 108, 886 |
| Brg. ———..... | 12, 390, 1696 | Sch. Mondego..... | 03, 88, 785 |
| Monomoy, Mass.: | | Sch. Maud Briggs ⁴ | 02, 108, 886 |
| Sch. ———..... | 93, 70, 859 | Sch. Life-Saving Station, Mass.: | 03, 88, 785 |
| Sch. Charlotte Fish..... | 93, 69, 855 | Sch. Mary A. Heaton..... | 96, 70, 666 |
| Sch. J. B. Woodbury..... | 93, 69, 849 | Naushon Isld., Mass.: | |
| Sch. Bertha J. Fellows..... | 93, 69, 850 | Sch. Golden Rule ⁵ | 95, 69, 707 |
| Bk. R. A. Allen..... | 93, 69, 854 | Sch. E. K. Hart..... | 95, 70, 714 |
| Sch. Royal Arch..... | 95, 70, 719 | Nebish (west) Chan., Mich.: | |
| Sch. Ellen Morrison..... | 95, 70, 716 | Str. John B. Ketcham ⁶ | 10, 859, 2282 |
| Brg. Oneonta..... | 95, 71, 726 | Newark B., N. J.: | |
| Monomoy Beach, Mass.: | | C. b. Harwick..... | 98, 144, 1072 |
| Sch. Asa H. Pervere..... | 94, 63, 618 | C. b. Katie Watson..... | 00, 187, 1516 |
| Bk. Harriet S. Jackson ³ | 99, 1094 | C. b. W. B. Hurd..... | 00, 187, 1516 |
| Monomoy Isld. (w. side), Mass.: | | C. b. ———..... | 02, 177, 1038 |
| Sch. A. G. Cole..... | 12, 135, 1430 | C. b. ———..... | 03, 158, 954 |
| Monomoy Life-Saving Station: | | C. b. F. D. Tower..... | 03, 159, 955 |
| Sch. Nellie V. Rokes..... | 93, 70, 859 | C. b. (2)..... | 04, 188, 1187 |
| | 94, 62, 607 | C. b. ———..... | 06, 167, 1019 |
| Monomoy Pt., Mass.: | | C. b. ———..... | 10, 211, 1254 |
| Sch. Rogers..... | 93, 70, 859 | Newburyport H., Mass.: | |
| Sch. Ocean Traveler..... | 94, 62, 608 | Sch. J. E. Sanford..... | 90, 37, 516 |
| Sch. Wm. Wilson..... | 94, 62, 606 | Sch. Ocean Eagle..... | 95, 63, 642 |
| Sch. James G. Blaine..... | 03, 103, 820 | Sch. Julia A. Dicker..... | 08, 76, 969 |
| Sch. Connecticut..... | 04, 86, 930 | New Haven H., Conn.: | |
| Monomoy Pt. Lighthouse: | | Sch. June..... | 85, 95, 700 |
| Sch. Franklin..... | 94, 63, 616 | Sch. Eliza Anderson ¹ | 94, 82, 712 |
| Sch. Laura E. Messer..... | 94, 63, 617 | Sch. Geo. Hotchkiss..... | 95, 93, 851 |
| Monroe B., Va.: | | Sch. Eclipse..... | 08, 121, 1020 |
| Brg. Laurel..... | 07, 249, 1199 | Sch. Menawa..... | 09, 124, 1054 |
| Monroe H., Mich.: | | Newport H., R. I.: | |
| Dr. ———..... | 98, 452, 2687 | Sch. Charles W. Morse..... | 99, 96, 1145 |
| | 99, 536, 3075 | Newport News, Va.: | |
| Wrecks ——— ⁴ | 02, 506, 2294 | Str. Wyanoke..... | 97, 198, 1379 |
| Moosabeach, Me.: | | | 98, 200, 1234 |
| Sch. Huntress..... | 92, 89, 533 | New Orleans H., La.: | |
| Muskeget Chan., Mass.: | | Str. Gresham..... | 85, 225, 1427 |
| Sch. St. Thomas..... | 03, 103, 819 | Str. Ailsa..... | 86, 223, 1290 |
| Nansemond R., Va.: | | Str. General Grant..... | |
| Sch. Terry Not..... | 86, 159, 970 | Sh. Isle Marthe..... | 91, 231, 1869 |
| Nantucket H., Mass.: | | Str. E. J. Gay..... | |
| Sch. ———..... | 93, 70, 856 | Newton Creek, N. Y.: | |
| Sch. Julia E. Pratt..... | 95, 70, 715 | Wreckage..... | 98, 124, 1025 |
| Sch. Frank Palmer ⁴ | 05, 93, 869 | C. b. Col. Grubb..... | 99, 147, 1277 |
| Nantucket Isld., Mass.: | | C. b. ———..... | 04, 126, 1053 |
| Sch. Nettie B. Dobbin..... | 10, 112, 1148 | L. ——— (car float)..... | 06, 140, 988 |
| Nantucket Light, Mass.: | | | 07, 147, 1022 |
| Sch. Andrew J. York..... | 92, 65, 638 | L. Hero..... | 1023 |
| Nantucket Shoals, Mass.: | | | 08, 154, 1070 |
| Sch. Dora Mathews..... | 03, 104, 820 | Brg. Kaaterskill No. 1..... | 10, 179, 1213 |
| Sch. Agnes E. Manson..... | | Sc. ———..... | 12, 253, 1528 |
| Nantucket Sound, Mass.: | | New York H., N. Y.: | |
| Sch. John P. Kelsey..... | 94, 62, 612 | Bk. Samarang..... | 81, 115, 729 |
| Sch. Lucy Jones..... | 92, 65, 638 | | 82, 116, 714 |
| Sch. Allie Oakes..... | 92, 66, 640 | | 83, 111, 590 |
| Sch. Edith T. Gandy..... | 94, 62, 604 | Str. Nankin..... | 84, 121, 762 |
| Steam yacht Alva..... | 95, 71, 724 | | 85, 114, 787 |
| Wreckage..... | 95, 712 | C. b. ———..... | 92, 97, 838 |
| Wreckage ⁵ | 95, 70, 710 | Sch. F. E. Hallock..... | 91, 93, 937 |
| Sch. Light of the East..... | 99, 96, 1145 | Str. Atlas..... | 88, 67, 637 |
| Sch. Fannie Flint..... | 07, 94, 953 | Bk. Quickstep..... | 89, 82, 799 |
| Bk. Bonnie Doon..... | 09, 99, 1024 | C. b. Atlas..... | |
| Sch. Harry Messer..... | 09, 100, 1024 | C. b. ———..... | |
| | 10, 111, 112, | | |
| Sch. Jennie French Potter..... | 1146, 1147 | | |

¹ Removed by owners.² Removed by U. S. snag boat *Tombigbee*.³ No obstr. to navigation.⁴ Not found.⁵ Removed by strong tide or currents.⁶ Not dangerous obstrs. to navigation.⁷ Supposed to be.⁸ Removed by private parties.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|-------------------------------------|--------------------------------------|---|--------------------------------------|
| New York H., N. Y.—Continued. | | Nomini Creek, Va.: | |
| Str. Scotland..... | 69, 56, 405 | Sch. | 12, 390, 1696 |
| Sch. Wild Pigeon..... | 70, 74 | Norfolk H., Va.: | |
| Brg. Marion..... | 93, 105, 1076 | Brg. Marion..... | 88, 104, 774 |
| Brg. Milner..... | 94, 95, 786 | Sch. Maggie..... | 96, 159, 1084 |
| T. Talisman..... | 95, 120, 998 | Str. Helen Smith..... | 97, 198, 1380 |
| Brg. Andrew Jackson..... | 94, 95, 785 | Sch. John Howard..... | 98, 201, 1234 |
| T. William Horre..... | 96, 109, 869 | Sch. Georgia F. Golden..... | 06, 250, 1140 |
| Wreckage..... | 97, 138, 1158 | Sch. Dauntless..... | 07, 262, 1219 |
| C. b. | 98, 124, 1025 | Brg. John J. McNally..... | 08, 279, 1275 |
| Str. Ailsa..... | 98, 144, 1072 | Northeast R., N. C.: | 10, 328, 1398 |
| Br. Samuel E. Spring..... | 97, 114, 1039 | Str. St. Peter..... | 02, 237 |
| C. b. Donnell..... | 98, 128, 1041 | North R. Bar, N. C.: | |
| Sc. dump ¹ | 99, 147, 1277 | Raft ² | 03, 228, 1088 |
| Str. Alvena..... | 99, 147, 1277 | Norton Shoal, Mass.: | |
| Brg. David Crockett..... | 99, 147, 1278 | Sch. Enterprise..... | 96, 70, 667 |
| T. B. Farrell..... | 97, 114, 1040 | Oakland H., Cal.: | 97, 89, 927 |
| Sch. Penokee..... | 98, 128, 1042 | Bk. Agate..... | 12, 1165, 2773 |
| C. b. Daisy..... | 99, 147, 1276 | Occoquan Creek, Va.: | |
| Wreckage..... | 00, 166, 1471 | Sc. No. 1..... | 08, 263, 1251 |
| Brg. Jamima Leonard..... | 00, 166, 1472 | Sc. | 08, 263, 1252 |
| C. b. A. S. Hatch..... | 00, 167, 1475 | Ocean City, N. J., near: | |
| C. b. B. P. Ransom..... | 00, 167, 1474 | Brg. | 09, 224, 1184 |
| Wreckage..... | 00, 166, 1473 | Ocmulgee R., Ga.: | |
| Brg. Jamima Leonard..... | 01, 223, 1247 | Str. Allen..... | 98, 232, 1321 |
| C. b. A. S. Hatch..... | | Ogdensburg H., N. Y.: | |
| C. b. B. P. Ransom..... | 01, 223, 1248 | Str. Massena..... | 06, 711 |
| Brg. | | Ogeechee R., Ga.: | 07, 733, 2129 |
| C. b. | 01, 229, 1299 | T. Columbus..... | |
| Sch. Grover Cleveland..... | | Str. Nashville..... | 91, 1605 |
| L. | 02, 151, 982 | Ohio R. (see Removal of snags): | |
| Sch. Jacob Rivell..... | | 2 brgs. coal..... | 95, 322, 2384 |
| Brg. Lichtenfels Bros..... | 02, 151, 982 | Wrecks..... | 96, 278, 2120 |
| Brg. Ringleader..... | 03, 145, 924 | 11 coal brgs..... | 94, 289, 1889 |
| Brg. P. J. Carleton..... | | Str. Percy Kelsy ⁷ | |
| C. b. | 03, 145, 924 | Str. Comer B. ⁷ | |
| Sch. John Comstock..... | 03, 145, 925 | Str. City of New Orleans ⁷ | |
| Minor obstrs. ² | 04, 134, 1126 | Str. Potomac ⁷ | |
| C. b. Flannery ² | | Str. Storm ⁷ | |
| C. b. ² | 04, 134, 1127 | Str. Homer B. ⁷ | 01, 473, 2646 |
| Sc. ² | | Str. W. F. Nisbet ⁷ | |
| Float ² | | Str. Dick Brown ⁷ | |
| Sch. Eva R..... | 05, 140, 1024 | Str. John Fowler ⁷ | |
| Sch. Hattie V. Kelsey..... | | Str. Charley McDonald ⁷ | |
| Raft..... | 05, 140, 1024, 1025 | 76 wrecks (not named) ⁷ | |
| C. b. | 06, 146, 991 | Coal brg. ⁸ | 01, 505, 2816 |
| Dumped stones..... | 08, 161, 1086 | Str. Junius S. Morgan ⁹ | 05, 423, 1584 |
| Brg. Addie B. Bacon..... | 09, 164, 1099 | 43 coal brgs. ¹⁰ | |
| Str. Daghestan..... | 10, 187, 1223 | 39 coal boats ¹⁰ | |
| Brg. Wm. H. Connor..... | 09, 164, 1100 | 3 flatboats ¹⁰ | |
| Str. Finance..... | 10, 187, 1223 | 2 fuel boats ¹⁰ | 05, 465, 466, |
| Sch. Daylight..... | 11, 209, 1313 | 2 wharf boats ¹⁰ | 1819, 1820, |
| Sch. J. Henry Edmunds..... | 10, 187, 1223 | 1 sand boat ¹⁰ | 1821, 1822 |
| C. b. M. P. DeLong..... | 10, 187, 1224 | 3 steamboats ¹⁰ | |
| C. b. Mary O'Donnell..... | 11, 209, 1313 | 1 covered brg. ¹⁰ | |
| C. b. Daniel B. Fish (or Fisk)..... | 11, 209, 1314 | Str. | |
| Brg. Hopatcong..... | 12, 253, 1527 | Str. Hudson..... | 06, 1563 |
| C. b. Martha A. Bigelow..... | 12, 1528 | Brg. Several..... | |
| C. b. | | Str. Fred Wilson..... | 06, 1568, 1569 |
| C. b. Curtis & Blaisdell..... | | 43 coal brgs. ¹¹ | |
| Niagara R., N. Y.: | | 13 coal boats ¹¹ | |
| Brg. Massasoit ⁴ | 06, 703 | 4 coal floats ¹¹ | |
| Str. Embury..... | 07, 725, 2112 | 3 wharf boats ¹¹ | |
| Sc. Trader..... | 08, 769, 2186 | 3 cinder brgs. ¹¹ | 06, 1569 |
| | 09, 806, 2161 | 1 sand boat ¹¹ | |
| | | 1 flatboat ¹¹ | |
| | | 5 wrecks (not named) ¹¹ | |
| | | Strs. (remains of 5) ¹¹ | |
| | | 3 coal boats ¹² | |
| | | 3 fuel boats ¹² | |
| | | Anchor ¹² | 06, 1607 |

¹ Removed by owners.

² Removed by U. S. S. *Manisees*.

³ Removed by U. S. S. *Manisees* and owners.

⁴ Not found.

⁵ Removed by U. S. snag boat *Roanoke*.

⁶ Removed by U. S. S. *General Warren*.

⁷ Removed by U. S. snag boat *E. A. Woodruff* and hired vessels.

⁸ Removed by drs. Louisville and No. 1 and *Wabash*.

⁹ Removed by U. S. snag boat *J. N. Macomb*.

¹⁰ Removed by U. S. snag boat *E. A. Woodruff* and U. S. launch *Wenonah*.

¹¹ Removed by U. S. snag boat *E. A. Woodruff*.

¹² Removed by U. S. snag boats.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|--------------------------------------|---|--------------------------------------|
| Ohio R., etc.—Continued. | | Penobscot R., Me.: | |
| 30 coal brgs. ¹ | | Sch. Olive Branch | 05, 42, 800 |
| 12 coal boats ¹ | | Sch. Annie L. Henderson | 09, 47, 979 |
| 4 brgs. ¹ | 07, 540, 1677 | | 10, 58, 1098 |
| 1 flatboat ¹ | | Pensacola H., Fla.: | |
| 3 steamboats (remains of) ¹ | | Sh. Bride of Lorne | 88, 158, 1189 |
| 4 fuel flats ¹ | | Bk. Laigia | 89, 184, 1402 |
| 2 coal brgs. ¹ | | Wreckage | |
| 2 coal boats ² | 07, 553, 1726 | T. Florence Witherbee | 08, 392, 1420 |
| 1 boiler ² | | Petaluma Creek, Cal.: | |
| Str. U. S. S. Slackwater ¹ | | Sch. Rainbow | 99, 561, 3188 |
| 17 coal brgs. ¹ | | Philadelphia, Pa.: | |
| 13 coal boats ¹ | | Yacht David B. Sellers ¹ | 98, 156, 1104 |
| 3 fuel boats ¹ | | Philadelphia H., Pa.: | |
| 2 gravel brgs. ¹ | 08, 577, 1757 | Str. Shearwater | 10, 223, 1274 |
| 2 scows ¹ | | L. Benedict ¹¹ | 12, 289, 1578 |
| Wharf boat ¹ | | Brg. Belle Russell | 12, 289, 1578 |
| Boiler ¹ | | Piankaskan R., Va.: | |
| Str. (remains of) ¹ | | Sunken raft | 02, 218, 1108 |
| Coal flat ² | | Pigeon Cove H., Mass.: | |
| 2 coal brgs. ² | 08, 589, 1795 | Sch. J. M. Eaton | 99, 81, 1094 |
| Flat ² | | Sch. Albert H. Harding | 05, 74, 836 |
| Oldmans Creek, N. J.: | | Pleasant R., Me.: | |
| Brg. Sally | 09, 224, 1183 | Sch. Golden Eagle | 91, 32, 610 |
| Brg. Bennie | | Sch. Cerulius | |
| Old Warwick Cove, Oakland | | Plum Gut, Long Isl. Sound, | |
| Beach, R. I.: | | N. Y.: | |
| St. Tina B. | 12, 135, 1431 | Sch. Edith E. Denis | 12, 177, 1404 |
| Ontonagon H., Mich.: | | Plymouth H., Mass.: | |
| T. Quail | 10, 756, 2094 | Brg. City of Montreal | 10, 89, 1122 |
| Pagan R., Va.: | | Brg. Harberson Hickman | 11, 91, 1192, |
| Sch. George W. Childs | 06, 250, 1141 | | 1193 |
| St. Lucy | 10, 328, 1398 | Sch. Howard A. Hunt | 12, 102, 1403 |
| Pamlico R., N. C.: | | Point Breeze: | |
| Brg. Albemarle | 86, 159, 970 | Str. Maryland | 94, 118, 862 |
| Str. Concord | 87, 123, 990 | Point Celeste, La. (Miss. R.): | |
| Sch. | 92, 169, 1194 | Dry dock | 92, 224, 1521 |
| Sch. | 91, 169, 1417 | Point Judith, R. I.: | |
| Str. Concord | 93, 183, 1450 | Wreckage | 95, 71, 723 |
| Sc. | 99, 244, 1516 | Wreckage (spars) ¹² | 99, 1145 |
| Pamlico Sound (inland waterway): | | Sch. J. G. Fell | 02, 122, 912 |
| Sc. | 10, 359 | Sc. ——— or float ¹² | 04, 86, 930 |
| Pamunkey R., Va.: | | | 05, 93, 869 |
| Brg. Amicus | 89, 134, 1025 | Brg. Moonbeam ¹² | 06, 92, 918 |
| | 90, 121, 1084 | Pollock Rip, Mass.: | |
| Pile driver ⁴ | 08, 263, 1253 | Brg. Shamokin | 95, 69, 705 |
| | 09, 272, 1249 | Sch. Mary J. Castner | 95, 70, 709 |
| Parkers R., Mass.: | | Sch. Royal Arch | 95, 70, 719 |
| Wreckage ³ | 94, 63, 620 | Brg. Oneonta | 95, 71, 726 |
| Sch. White Foam | 95, 69, 704 | | 96, 69, 665 |
| Pascagoula H., Miss.: | | Str. Williamsport | 03, 108, 819 |
| Sch. Robert H. Rathburn ⁵ | 99, 317, 1783 | Pollock Rip Chan., Mass.: | |
| Pasquotank R., N. C.: | | Brg. Sooloo | 93, 69, 852 |
| Sch. Dorcas and Eliza | 88, 104, 775 | Brg. Storm King | 93, 69, 853 |
| Raft ⁶ | 03, 228, 1088 | Steam yacht Alva | 93, 70, 857 |
| Brg. John J. Ward | 04, 227, 1380 | | 94, 62, 604 |
| Passaic R., N. J.: | | Str. Addie G. Bryant | 96, 70, 665 |
| Brg. Eldorado ⁷ | 03, 158, 954 | Str. Aransas | 05, 93, 869 |
| Brg. Leon Fisher ⁷ | 03, 159, 955 | Brg. Shenandoah | 10, 112, 1147 |
| Sc. N. D. Shultz | 09, 187, 1130 | Pollock Rip Lightship, Mass.: | |
| Sch. | 12, 278, 1558 | Brg. Tivoli | 96, 70, 666 |
| Pass Marianne, Miss.: | | Sch. ——— ¹² | 01, 174, 1147 |
| Bk. | 82, 193, 1388 | Sch. David Siner | 08, 98, 995 |
| | 83, 212, 1130 | Sch. Jesse Barlow | 11, 117, 1218 |
| Patapsco R., Md.: | | Sch. Belle Halladay | |
| Brg. | 87, 101, 879 | Pollock Rip Shoal, Mass.: | |
| St. Mary Jane | 00, 234, 1693 | Sch. S. L. Simmons | 90, 50, 583 |
| Sch. Cecil | 01, 272, 1391 | Sch. Weybosset | 91, 61, 731 |
| Sch. Sarah E. Vetra ⁸ | 01, 272, 1390 | | 92, 65, 637 |
| Sch. Maggie ⁹ | 10, 281, 1334 | Sch. Python | 92, 68, 640 |
| Brg. Gertrude | 12, 362, 1653 | Sch. Florence Nowell | 92, 68, 641 |
| Brg. Elizabeth E. Vane | | Sch. Geo. V. Jordan | 07, 94, 953 |
| Pawtucket R., R. I.: | | Sch. Rebecca Shepard | 08, 98, 995 |
| Sch. L. H. Hopkins ¹⁰ | 94, 63, 620 | Brg. West Virginia | 10, 112, 1147 |
| | 95, 702 | Pollock Rip Slue, Mass.: | |
| Penobscot R., Me.: | | Sch. Frank A. Magee | 96, 70, 666 |
| Sch. | 11, 61, 1163 | Sch. Levi Hart | 04, 86, 930 |
| | 12, 64, 1372 | Wreck | 05, 93, 868 |

¹ Removed by U. S. snag boat *E. A. Woodruff*.² Removed by U. S. snag boats.³ Removed by U. S. launches *Wenonah* and *Luzon*.⁴ Floated out of way.⁵ Not yet removed.⁶ Removed by U. S. snag boat *Rossmoke*.⁷ Removed by owners.⁸ Raised and beached.⁹ Removed by U. S. steam tender *Sentinel*.¹⁰ Removed by the State.¹¹ Removed by U. S. plant.¹² Could not be located.¹³ Removed by strong tide or currents.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|--------------------------------------|--|--------------------------------------|
| Pollock Rip Slue, Mass.—Contd. | | Providence R., R. I.: | |
| Sch. Nimrod..... | 06, 92, 919 | Brg. N. & W., No. 4, coal ^a | 94, 62, 612 |
| Str. Horatio Hall..... | 09, 99, 1024 | Provincetown H., Mass.: | |
| Ponce H., Porto Rico: | | Sch. A. A. Holton..... | 00, 37, 516 |
| T. Mayaguez..... | 07, 807, 2240 | Sch. Wildfire..... | 94, 49, 568 |
| | 08, 557 | Sch. Lydia Jane..... | 99, 81, 1095 |
| Pontchartrain Lake, La.: | | Sch. Hellen F. Ward..... | 00, 93, 1219 |
| Dr. boat W. H. Moore..... | 94, 232, 1383 | Sch. Louise C. Cabral..... | 08, 77, 970 |
| Brg. ———..... | 97, 291, 1776 | Pugsleys Creek, N. Y.: | 10, 89, 1121 |
| | 98, 281, 1489 | C. b. ———..... | 07, 147, 1023 |
| Pores Isld., Va., n ar. | | C. b. ———..... | 08, 154, 1070, |
| Brg. Anderson..... | 94, 907 | | 1071 |
| Str. Uriarte..... | 03, 124, 1023 | Pultneyville, N. Y.: | |
| | 04, 193, 1274 | Sch. St. Peter..... | 00, 619, 4180 |
| Portage Lake Ship Canals, Mich.: | | Pungoteague Creek, Va.: | |
| Str. Toledo..... | 99, 456, 2722 | Sch. Joel F. Sheppard..... | 12, 420, 1731 |
| Str. Toledo..... | 03, 475, 1827 | Put in Bay, Ohio: | |
| Port Chester H., N. Y.: | | Sch. M. P. Barkalow..... | 02, 506, 2293 |
| Sch. Richard Hall..... | 01, 223, 1246 | Fuyallup R., Wash.: | |
| Port Clinton H., Ohio: | | Str. Messenger..... | 96, 417, 3391 |
| T. Wilcox and sl. Rescue..... | 92, 352, 2510 | Quimby Creek, S. C.: | |
| Sch. Onward..... | 93, 404, 3093 | Wreckage..... | 93, 189, 1530 |
| Port Henry, N. Y.: | | Quonochontang, R. I.: | |
| C. b. (4) unknown..... | 10, 88, 1121 | Wreckage ^a | 98, ^a 4, 931 |
| C. b. Little Frank..... | 11, 183, 1281 | | 99, 1144 |
| C. b. Jersey Lily..... | | Racine, Wis.: | |
| Port Huron, Mich., near: | | Sch. Kate Kelly..... | 95, 367, 2681 |
| Anchor ² (of 1919)..... | 04, 3139 | Raisin R., Mich.: | 96, 323, 2560 |
| Portland H., Me.: | | Dr. ¹⁰ | 98, 452, 2687 |
| Sch. Annie J. Russel..... | 91, 32, 609 | Rams Horn Creek, S. C.: | |
| Sch. Sarah C. Smith..... | 06, 40 | Wreckage, torpedo boat ¹¹ | 95, 207 |
| Portland Head Light, Me., near: | | | 96, 186, 1302 |
| Sch. Steven Bennett..... | 04, 34, 792 | Ranocas R., N. J.: | |
| Port Royal R.: | | Sc. Paddy Ryan..... | 92, 119, 940 |
| P. b. Sprite ³ | 00, 290, 1875 | C. b. Daisy..... | 01, 262, 1351 |
| Port Royal H., S. C.: | | C. b. Ida May..... | 02, 190, 1063 |
| Caisson..... | 09, 333, 1317 | C. b. Ella..... | 03, 194, 1023 |
| | 10, 377, 1457 | | 06, 194, 1069, |
| Port Royal Sound, S. C.: | | | 1070 |
| Sch. Firrh ⁴ | 10, 377, 378, | T. America..... | 11, 278, 1402 |
| | 1457 | Rappahannock R., Va.: | |
| Portsmouth H., Me.: | | Sch. Spray..... | 88, 116, 845 |
| Sch. Samuel J. Goucher..... | 12, 64, 1373 | Sch. Lizzie Bell..... | 12, 389, 1695 |
| Potomac R., D. C.: | | Raritan B., N. J.: | |
| Str. W. W. Coit..... | 94, 145, 971 | C. b. ———..... | 92, 97, 839 |
| Str. Lady of the Lake..... | 96, 152, 1064 | Sch. Salamander..... | 91, 93, 937 |
| Sc. ———..... | 04, 217, 1341 | Brg. Mist..... | 96, 102, 801 |
| Sc. ———..... | 05, 224, 1182 | | 97, 138, 1157 |
| Sc. ———..... | 06, 236, 1123 | Brg. Satanella..... | 00, 187, 1517 |
| T. A. P. Gorman..... | 06, 236, 1123, | Sl. Imogene H. Terry..... | 01, 223, 1247 |
| Brg. Great Wardrobe..... | 06, 236, 1123, | | 06, 146, 991 |
| | 1124 | Hulk ———..... | 07, 174, 1076 |
| 8 wrecks..... | 08, 1208 | | 08, 183, 1117, |
| 19 logs..... | 08, 263, 1250 | | 1118 |
| Str. W. W. Corcoran..... | 12, 389, 1694 | Wreck ———..... | 10, 211, 1253, |
| Str. Plumie B. Smith..... | | | 1254 |
| Potomac R., Md.: | | Se. Osceola..... | 10, 211, 1254 |
| Vessel (unknown)..... | 03, 218, 1071 | Raritan R., N. J.: | |
| Sch. American Patriot..... | 04, 217, 1341 | Sch. Anna Augusta..... | 97, 138, 1157 |
| Reft (piles)..... | 05, 224, 1181 | C. b. Hazelton..... | 99, 163, 1315 |
| Wreck ⁵ | 10, 307, 1373 | Wreck..... | 02, 177, 1038 |
| Potomac R., Va.: | | C. b. Laura E. Plantz..... | 03, 159, 955, |
| Sch. Leading Breeze..... | 99, 222, 1443 | | 956 |
| Sl. Thomas H. Ruark..... | 00, 254, 1739 | C. b. Clarence M. Curtis..... | 06, 167, 1018 |
| Brg. ———..... | 08, 263, 1252 | C. b. B. G. Clark..... | 08, 183, 1118 |
| Sch. E. G. Irwin..... | 09, 272, 1250 | C. b. Thomas Walker..... | 11, 233, 1347 |
| Sch. Emily Washington ⁶ | 10, 307, 1372 | C. b. W. F. O'Rourke, jr..... | |
| Sch. ———..... | 12, 389, 1694 | Richmond H., Va.: | |
| Powder Hole H., Mass.: | | Brg. John Hagan ¹² | 99, 254, 1738 |
| Sch. Ellen Morrison..... | 95, 70, 716 | Roads H., Md.: | |
| Presque Isle H., Mich.: | | Brg. Charles Gring..... | 05, 202, 1147 |
| Wreckage..... | 94, 361, 2257 | Roanoke R., N. C.: | |
| | 95, 395, 2840 | Str. City of Long Branch..... | 93, 183, 1450 |
| Providence H., R. I.: | | Rockaway Inlet, N. Y.: | |
| Br. D. A. Small..... | 04, 86, 930 | Str. Governor..... | 07, 146, 1020 |
| Brg. Expounder..... | 08, 96, 994 | | |

¹ Removed by gunboat *Vermion*.

² Removed by U. S. S. *Hancock*.

³ Sold at auction.

⁴ Removed by U. S. dr. *Winyah Bay*.

⁵ Not found.

⁶ Removed by U. S. launch *General Warren*.

⁷ Removal not au.

⁸ Removed by owners.

⁹ Could not be located.

¹⁰ Not yet removed.

¹¹ Supposed to be.

¹² Removed by the city.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|---|---|---|
| Rockaway, N. Y., near: Wreck..... | 10, 180, 1214 | St. Johns R., Fla.—Continued. | |
| Rock Creek, Md.: Sch. Alethea..... | 09, 247 | Str. Magic City..... | 11, 462 |
| Rockland H., Me.: Sch. Isabel Alberto..... | (92, 39, 533 93, 37, 722 | Str. Chatham..... | 11, 463 |
| Sch. Eleazer Boynton..... | 12, 64, 1372 | Str. Zeeburg..... | 12, 567 |
| Rockport H., Me.: Sch. Silas McLoon ¹ | 05, 800 | St. Jones R., Del.: Str. Mary U. Githens..... | (04, 178, 1249 05, 186, 1122 |
| Sch. Onward..... | 06, 40 | Sch. Mary..... | (05, 186, 1124 06, 194, 1069 |
| Rogers Shoal, Mass.: Sch. Albert F. Stearns..... | 04, 86, 929 | St. Josephs H., Mich.: Str. City of Duluth..... | (99, 505, 2951 00, 568, 3933 |
| Rondout H., N. Y.: C. b. | 96, 109, 869 | T. Payne..... | 12, 1057, 2613 |
| Root R., Wis.: Sch. Mount Vernon..... | 94, 330, 2124 | St. Lawrence R., N. Y.: Str. Reid..... | 97, 434, 2947 |
| Rouge R., Mich.: T. T. L. Higbie..... | 09, 780, 2119 | Str. Islander..... | 10, 899, 2338 |
| Sabine Pass, Tex.: Bk. Alice..... | 00, 383, 2282 | St. Marys R., Mich.: Sch. Bruce..... | 97, 451, 3033 |
| Sag H., N. Y.: Sch. Miller..... | 96, 102, 802 | T. Martin Swain..... | 02, 494, 2244 |
| Saginaw R., Mich.: Sch. Ellen..... | (05, 590 06, 663 | Timber crib..... | 04, 3139 |
| Str. Garden City..... | 06, 663 | Dump sc..... | 06, 676, 1891 |
| Wreck..... | 10, 859, 2281 | Str. John B. Ketcham 2d..... | (11, 914, 2476 12, 1091, 2676 |
| St. Clair Flats, Mich.: Str. T. D. Stimson..... | 04, 591, 3138, 3139 | Sch. A. C. Maxwell..... | 11, 914, 2476 |
| St. Clair Flats Canal, Mich.: Anchor ² | 03, 2047 | Sakonnet H., R. I.: Str. Queen City..... | 08, 96, 994 |
| Str. John N. Glidden..... | 04, 591, 3139 | Salem R., N. J.: Sc. John E. King..... | 12, 328, 1619 |
| St. Clair R., Mich.: Sch. M. F. Tremble..... | 91, 361, 2801 | Salisbury H., Md.: Sch. Compact..... | 10, 281, 1334 |
| Sch. Hannah Moore..... | 92, 344, 2483 | Sandusky H., Ohio: Sch. Benson..... | 01, 584, 3269 (05, 619, 2368 |
| Sch. Mary..... | 96, 357, 2896 | Str. Philip Minch..... | 06, 693, 1921 |
| Sch. Fontana..... | (01, 570, 3198 02, 494, 2244 | San Francisco B., Cal.: Sh. May Flint ⁷ | 01, 613, 3434 |
| Sch. Martin..... | (01, 570, 3198 02, 494, 2244 | San Francisco H.: Str. Escambia..... | (82, 317, 2636 83, 330, 1992 84, 333, 2201 85, 359, 2339 86, 352, 1915 87, 319, 2426 |
| Sch. George H. Wand..... | (02, 494, 2245 03, 542, 2046, 2047 | San Joaquin R., Cal.: Brg. | 85, 360, 2339 |
| Sch. Gleniffer..... | 03, 542, 2046, 2047 | San Juan H., P. R.: Str. Cristobal Colon..... | 01, 657, 3635 |
| Sch. Champion..... | 04, 591, 3139 | Sankaty Head, Mass.: Sch. Dora Mathews..... | (04, 86, 929 |
| Str. Minnesota ³ | (04, 591, 3139 05, 601, 2288 | Sch. Agnes E. Manson..... | |
| Str. Germanic..... | 05, 2288 | San Pedro H., Cal.: Sailboat..... | 02, 525, 2346 |
| Str. City of Rome ⁴ | (05, 2288 06, 676, 1891 | Sassafras R., Md.: Brg. Rose Hagen ⁸ | 97, 171, 1289 |
| Str. Linden..... | (07, 698, 2057 08, 742, 2138, 2139 | Saugerties H., N. Y.: Sl. Courier..... | 04, 125, 1052 |
| Sch. Home..... | 06, 676, 1891 | Savannah H., Ga.: Str. Habersham..... | (91, 184, 1602 |
| Str. Geo. T. Burroughs..... | (06, 676, 1891, 1892 | Str. Milledgeville..... | 93, 198, 1608 |
| Sch. J. Duvall..... | 07, 698, 2057 | Str. General Lee..... | 94, 182, 1209 |
| Str. Nelson Mills..... | 08, 743, 2139 | Bk. Undine..... | |
| Str. Fred Pabst..... | | Str. David Clarke..... | |
| St. Georges R., Md.: Sch. Samuel W. Thomas..... | 94, 145, 970 | T. Leon..... | 94, 182, 1209 |
| St. Jeromes Creek, Md.: Sch. Geo. W. Krebs ⁵ | 10, 307, 1373 | P. b. | |
| St. Johns R., Fla.: Str. Maple Leaf..... | (83, 186, 955 88, 151, 1122 89, 174, 1352 | 3 wrecks..... | 95, 207, 1519 |
| Br. Neva..... | 88, 151, 1122 | 4 wrecks..... | 96, 186, 1308 |
| Brg. | 89, 174, 1352 | Wreckage..... | 96, 186, 1302 |
| Sch. Ridgewood..... | 05, 309, 1320 | 5 wrecks..... | (99, 266, 1592 00, 306, 1961 |
| Str. Commodore Barney..... | 06, 331, 1240 | Bl. lighter Cypress..... | 99, 266, 1592 |
| Wreck..... | 07, 347 | Sc. dump..... | 01, 334, 1660 |
| Str. Ruby ⁶ | 08, 368 | Str. W. S. Cook..... | (03, 271, 1171 04, 279, 1668 |
| | | Sch. Livingston ⁹ | (07, 327, 1302 08, 346, 1359 |
| | | Sch. Arthur C. Wade ⁹ | |

¹ Removed by owners.² Removed by U. S. str. *Hancock*.³ Removed by Canadian Government.⁴ Owners made contract for raising.⁵ No obstr. to navigation.⁶ Removed by U. S. dr. *Florida*.⁷ Removed by owner.⁸ Removed by wrecking company.⁹ Removed by U. S. snag boat *Tugaloo*.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|---|---|---|---|
| Savannah R., Ga.: | | Southwest Pt., R. I.: | |
| L. ——— | {00, 306, 1961 01, 334, 1660 01, 334, 1660 02, 264, 1200 | Brg. Nora..... | 04, 86, 930 |
| Str. Pete Craig..... | | Stamford H., Conn.: | |
| Schuylkill R., Pa.: | | Sch. yacht Adrienne..... | {11, 148, 1251 12, 176, 1463 |
| Bk. Felix..... | 93, 1183 | Starve Isld. Reef: | |
| C. b. William Cummings..... | 00, 206, 1588 | Sch. Amorette Mosher..... | 03, 556, 2105 |
| C. b. James Gillan..... | 00, 206, 1589 | Stonington H., Me.: | |
| Yacht David B. Sellers ¹ | 98, 136, 1104 | Sch. A. H. Whitmore..... | 05, 800 |
| T. Fleetwing ¹ | 01, 263, 1350 | Stoney Pt., Ohio: | {04, 608, 3208 05, 618, 2367, 2368 |
| C. b. Edward I. Meyers..... | 01, 262, 1352 | Sch. General Franz Sigel..... | |
| C. b. Meadowbrook..... | 01, 263, 1352 | Sturgeon B., Wis.: | |
| C. b. Peter A. Rogers..... | | Sc. ——— | 01, 527, 2970 |
| L. No. 33..... | {02, 190, 1063 | Superior B., Minn.: | |
| Sl. Three Brothers ² | 03, 194, 1024 | Str. Winnipeg..... | 98, 385, 2287 |
| C. b. ——— | 04, 156, 1201 | Superior Entry, Wis.: | |
| C. b. ——— | 05, 163, 1085 | T. Edward Gillen..... | 03, 1828 |
| C. b. ——— | 06, 176, 1040 | Swan Creek, Ohio: | |
| Sc. Macyck ³ | 12, 289, 1576 | Sand sucker Syracuse..... | 09, 797, 2141 |
| Brg. ——— ⁴ | 12, 289, 1578 | Sycamore Slough, Cal.: | |
| Seppernong R., N. C.: | | Dr. ——— | 09, 884, 2197 |
| Sch. Lawrence..... | {85, 164, 1044 86, 159, 970 | Tacoma H., Wash.: | |
| Seabright, N. J., near: | | Str. Messenger..... | 96, 417, 3391 |
| Str. Macedonia ⁴ | {00, 1516 01, 223, 1247 | Tallahatchie R., Miss.: | |
| Seal H., Me.: | | Str. Star of the West..... | 97, 308, 1932 |
| Sch. Vicksburg..... | 00, 62, 1100 | Tanners Creek, Va.: | |
| Sch. Island Queen..... | 08, 43, 939 | Sch. Maggie Shearer..... | 11, 350, 1510, 1511 |
| Seyern R., Md.: | | Tampa, Fla.: | |
| Sc. ——— ⁵ | 04, 193, 1273 | Piling..... | 06, 331, 1240 |
| Sharps Isld. Lighthouse, Chesapeake B., Md.: | | Tampa B., Fla.: | |
| Trunk of a large tree ⁶ | 96, 972 | Str. Millie Wales..... | {95, 221, 1560 96, 198, 1337 97, 251, 1566 00, 326, 2032 |
| Sheboygan H., Wis.: | | Sch. Henry Stanbery..... | |
| Sch. Petrel..... | 84, 284, 1860 | Tampa H., Fla.: | |
| Sch. R. H. Pecker..... | 08, 669, 1984 | Str. Dictator..... | {85, 199, 1279 86, 197, 1157 87, 162, 1256 |
| Sheep Pen Hill, Va., near: | | Tanana R., Alaska: | |
| Str. Oakdene..... | 10, 255, 1310 | Str. Rock Isld..... | {07, 802, 2232 08, 851, 2311 |
| Sheepshead B., N. Y.: | | Tangler Sound, Md.: | |
| Sch. John B. Conover..... | 97, 139, 1158 | Sch. Columbia..... | 01, 272, 1390 |
| Shelter Isld., N. Y.: | | Sch. Angy MacNamara..... | {04, 193, 1273 04, 193, 1273 |
| Sch. Wm. Everett ¹ | 99, 1278 | Sch. Emma J. Thomas..... | |
| Ship Isld. H., Miss.: | | Sch. Mary A. Kirwan..... | 10, 281, 1334 |
| Bk. Bruce..... | {91, 228, 1837 92, 223, 1513 94, 232, 1384 | Tangler Sound, Va.: | |
| Wreckage..... | | Sch. Mary L. Colbourne..... | 05, 202, 1147 |
| Shovelful Shoal, Mass.: | | Tarpaulin Cove H., Mass.: | |
| Sch. Ellen Morrison ⁷ | 95, 70, 716 | Sch. E. K. Hart..... | 95, 70, 714 |
| Brg. Wadena..... | 03, 103, 819 | Teche Bayou, La.: | |
| Sch. Viola May..... | 05, 93, 668, 669 | Str. J. M. Chambers..... | 85, 225, 1428 |
| Shovelful Shoal and Monomoy Pt. (between), Mass.: | | Str. Maria A..... | 87, 188, 1392 |
| Sch. Ada Ames..... | 12, 135, 1430 | Brg. ——— | 92, 223, 1513 |
| Shrewsbury R., N. J.: | | 2 brgs. ——— | 93, 250, 1839 |
| Sl. Success..... | 01, 223, 1247 | 3 coal brgs..... | 06, 365, 1456 |
| Smith Creek, N. C.: | | Logs..... | 07, 409, 1430 |
| Sch. R. D. Bateman..... | 07, 288 | 4 brgs..... | |
| Smith Creek, Va.: | | Steam launch..... | 08, 431, 1483 |
| Sch. Briton M. Tilton..... | 95, 176, 1295 | Old hull..... | |
| Brg. ——— ⁸ | {07, 263, 1219 08, 279, 1275 08, 279, 1275 | Tennessee R., Ala.: | |
| Sch. Edith Fowle..... | | Brg. ——— | 07, 536, 1652 |
| Smyrna R., Del.: | | Thoroughfare, connecting East Creek with Dennis Creek, N. J.: | |
| Sch. Mary H. Rhoads..... | 91, 131, 1201 | Sch. James D. Godfrey..... | 11, 277, 1401 |
| Sc. ——— | {93, 175, 1172 99, 202, 1398 01, 263, 1352 02, 190, 1062 | Thunder B., Mich.: | |
| C. b. Zeus..... | | Str. New Orleans ⁹ | {07, 698, 2058 10, 860, 2281 11, 914, 2475 |
| Southampton, N. Y.: | | Sch. or brg. ——— | |
| T. Panther..... | 94, 82, 713 | Str. Oscar T. Flint ¹⁰ | |
| Southend H., Wash.: | | Toledo H., Ohio: | |
| Sch. Challenger..... | 05, 710, 2560 | Sch. Ferrell..... | 96, 368, 2972 |
| South Chan., Charleston, S. C.: | | Toledo Light, Ohio, near: | |
| Bk. Red Earl..... | 91, 178, 1487 | Str. Lucille..... | 07, 716, 2096 |
| South Manitow H., Mich.: | | Tortugas, Fla.: | |
| Sch. Margaret Dall..... | 12, 1057, 2613 | Sch. Nannie Bohlin..... | 10, 484 |

¹ Removed by owners.

² No obstr.

³ R. moved by U. S. plant.

⁴ Removed by U. S. and private parties.

⁵ Removed by U. S. str. *Sentinel*.

⁶ Removed by ice and waves.

⁷ Drifted to Powder Hole H., Mass.

⁸ Removed by U. S. snag boat *Roanoke*.

⁹ Removed by U. S. t. *Johnson*.

¹⁰ Removed by U. S. str. *Hancock*.

| Locality and vessel. | Reports of Chief of Engineers. | Locality and vessel. | Reports of Chief of Engineers. |
|--|--------------------------------------|--|--------------------------------------|
| Townsend Inlet, N. Y.: | | Vineyard Sound, Mass.—Contd. | |
| Str. Nuphar..... | 92, 119, 940 | Sch. Demozelle (Br.)..... | 08, 96, 995 |
| Tucker Beach Light, N. J., near: | | Sch. Charles J. Willard..... | 10, 112, 1147 |
| Sch. R. & T. Hargraves..... | 03, 194, 1026 | Wachapreague Inlet, Va., near: | |
| Turners Cut, N. C.: | | Str. Amy Dora..... | 03, 194, 1025 |
| Brg Kingston..... | 02, 226, 1126 | | 04, 193, 1274 |
| Urbana Creek, Va.: | | Waiska B.: | |
| Sch. Kate Lawson..... | 98, 192, 1221 | L. Monitor..... | 99, 522, 3015 |
| | 99, 222, 1442 | Warrior R., Ala.: | |
| Vermillion Bayou, La.: | | Str. Baltimore..... | 03, 324, 1272 |
| Str. Exchange..... | 96, 225, 1520 | Washington, D. C.: | |
| Vineyard Haven H., Mass.: | | Str. Lady of the Lake..... | 96, 152, 1064 |
| Sch. Mary E. Oliver..... | 92, 65, 639 | Washington Park, N. J.: | |
| Sch. Alma..... | 89, 55, 640 | C. b. Elk ² | 96, 939 |
| | 94, 62, 609 | Watch Hill, R. I.: | |
| R. H. Shannen ¹ | | Brg. Excelsior..... | 08, 96, 994 |
| Julia or Juliette ¹ | 94, 62, 609 | Brg. No. 701..... | |
| 4 wrecks..... | | Weymouth, Fore R., Mass.: | |
| Sch. Mary B. Smith..... | 98, 84, 931 | Wreckage..... | 99, 81, 1095 |
| Sch. Hector..... | | Wicomico R., Va.: | |
| Sch. E. C. Willard..... | 00, 110, 1281 | Sch. Itinerant..... | 12, 390, 1695 |
| Sch. J. D. Ingraham ² | | Willapa H., Wash.: | |
| Sch. Nellie Doe ² | | Sch. Challenger..... | 06, 786, 2047 |
| Sch. Viola..... | 06, 92, 919 | Willoughby B., Va.: | |
| Vineyard Sound, Mass.: | | Sl. A. M. C. Smith..... | 11, 350, 1510 |
| Sch. T. P. Dixon ¹ | 95, 71, 722 | Wilmington H., Cal.: | |
| Sch. Josiah R. Smith..... | 95, 71, 725 | Bk. Adelaide Cooper..... | 07, 2136 |
| Sch. Harry L. Whiton..... | 95, 70, 718 | Wilmington H., Del.: | |
| Sch. Dora M. French..... | 95, 69, 708 | 5 wrecks..... | 97, 170, 1288 |
| Wreckage ³ | 95, 701 | Wing Pt., Wis.: | |
| Wreckage ² | 97, 80, 928 | Sch. Lumberman..... | 93, 358, 2777 |
| Sch. R. L. Dewis..... | 98, 83, 931 | Woodbury Creek, N. J.: | |
| | 98, 84, 932 | Brg. Lydia & Mary..... | 10, 255, 1309 |
| Sch. Angola..... | 99, 96, 1144 | Woods Hole H., Mass.: | |
| Sch. Lunet..... | 00, 110, 1281 | Wreckage..... | 95, 69, 706 |
| Sch. George S. Tarbell..... | 93, 69, 852 | Wysocking B., N. C.: | |
| Sch. Marriott..... | 04, 86, 929 | Sch. Hooper ⁴ | 01, 309, 1511 |
| Sch. Joseph Hay..... | 06, 92, 919 | Yazoo R., Miss.: | |
| Sch. Mail..... | | Str. Ferd R. ⁵ | 01, 420, 2048 |
| Str. Trogan..... | 07, 94, 953 | Shaft of str. Rover ⁵ | |
| Brg. Pemberton..... | 07, 94, 954 | Str. J. A. Townes..... | 09, 531 |
| Sch. Sagmore..... | | York R., Va.: | |
| Sch. James S. Steel..... | 08, 96, 994 | Sch. Anna M Harris..... | 03, 218, 1071 |

¹ Supposed to be.² Removed by owners.³ Removed by gunboat *Vesuvius*.⁴ No serious menace to navigation.⁵ Removed by U. S. snag boat *Columbia*.

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

SECTION 5.—SUMMARY OF APPROPRIATIONS—RIVER AND HARBOR WORKS.¹

| NOTES.—The matter in this section is composed of the following: | | Pages of this index. |
|---|--|----------------------|
| Part A: | | |
| Table 1.—Appropriations by act, 1802 to 1915..... | | 2279 |
| Table 2.—Appropriations, South Pass, Mississippi River, Eads project..... | | 2283 |
| Table 3.—Expenditures, wreck removal..... | | 2284 |
| Table 4.—Expenditures, operating and care of canals..... | | 2284 |
| Table 5.—Expenditures, examinations and surveys, at South Pass, Mississippi River..... | | 2284 |
| Table 6.—Maintenance by United States of South Pass Channel, Mississippi River..... | | 2285 |
| Table 7.—Expenditures, snag and dredge boats, Upper Mississippi River..... | | 2285 |
| Table 8.—Expenditures, removal of snags and wrecks, Mississippi River..... | | 2285 |
| Table 9.—Expenditures, gauging, Mississippi River..... | | 2286 |
| Table 10.—Expenditures, snag boats, Ohio River..... | | 2286 |
| Recapitulation and grand total..... | | 2286 |
| Part B: | | |
| Table 11.—Totals, by works of improvement, as detailed in this index, pages 28 to 1690..... | | 2287 |
| Table 12.—Totals, by districts, as detailed in this index, pages 28 to 1690..... | | 2302 |

PART A.

TABLE 1.—*River and harbor appropriations, by acts, Apr. 6, 1802, to Mar. 4, 1915.*

Quoted from H. D. 1491, 63d, 3d, p. 387.

| Date of act. | Rivers. | Harbors. | Canals. | Examinations, surveys, and contingencies. | Total. |
|--------------------|-------------|-------------|-------------|---|-------------|
| Apr. 6, 1802..... | \$30,000.00 | | | | \$30,000.00 |
| Apr. 18, 1806..... | 448.71 | | | | 448.71 |
| Feb. 10, 1809..... | | | \$25,000.00 | | 25,000.00 |
| Feb. 15, 1819..... | | | | \$6,500.00 | 6,500.00 |
| Apr. 14, 1820..... | | | | 9,500.00 | 9,500.00 |
| Mar. 3, 1821..... | 150.00 | | | | 150.00 |
| Do..... | | | | 2,500.00 | 2,500.00 |
| May 7, 1822..... | | \$34,200.00 | | | 34,200.00 |
| Mar. 3, 1823..... | | 6,000.00 | | 150.00 | 6,150.00 |
| Apr. 30, 1824..... | | | | 30,000.00 | 30,000.00 |
| May 24, 1824..... | 75,000.00 | | | | 75,000.00 |
| May 26, 1824..... | | 40,000.00 | | | 40,000.00 |
| Feb. 21, 1825..... | | | | 28,587.00 | 28,587.00 |
| Mar. 6, 1825..... | | 52,972.56 | | | 52,972.56 |
| Mar. 3, 1825..... | | | 300,000.00 | | 300,000.00 |
| Do..... | | 11,712.00 | | 400.00 | 12,112.00 |
| Mar. 3, 1826..... | | | | 20,000.00 | 20,000.00 |
| Mar. 25, 1826..... | | 20,184.90 | | 50,000.00 | 70,184.90 |
| May 13, 1826..... | | | 100,000.00 | | 100,000.00 |
| May 18, 1826..... | | | 150,000.00 | | 150,000.00 |
| Do..... | | 50,000.00 | | | 50,000.00 |
| May 20, 1826..... | 25,000.00 | 57,320.00 | | 3,000.00 | 85,320.00 |

¹ For a summary of appropriations for fortifications, see p. 1801 of this index. No summary of appropriations for miscellaneous works would serve any practical purpose, and hence there is no summary for part III of this index.

| Date of act. | Rivers. | Harbors. | Canals. | Examinations, surveys, and contingencies. | Total. |
|--------------------|-------------|--------------|----------------|---|--------------|
| Mar. 2, 1827..... | | \$2,000.00 | | \$30,000.00 | \$32,000.00 |
| Do..... | \$12,000.00 | 69,476.45 | | 700.00 | 82,176.45 |
| Do..... | 5,383.40 | | | | 5,383.40 |
| Mar. 3, 1827..... | 30,000.00 | | | | 30,000.00 |
| Mar. 19, 1828..... | | 2,000.00 | | | 2,000.00 |
| May 19, 1828..... | 3,500.00 | 73,482.29 | | 30,000.00 | 106,982.29 |
| May 23, 1828..... | 150,513.00 | 158,500.00 | | 2,300.00 | 311,313.00 |
| Do..... | | 250,000.00 | | | 250,000.00 |
| May 24, 1828..... | | | \$1,000,000.00 | | 1,000,000.00 |
| Mar. 2, 1829..... | 30,000.00 | 146,097.00 | | 2,710.00 | 178,807.00 |
| Do..... | | | 200,000.00 | | 200,000.00 |
| Do..... | | | | 30,000.00 | 30,000.00 |
| Do..... | | | 133,500.00 | | 133,500.00 |
| Do..... | | 7,310.54 | | | 7,310.54 |
| Mar. 3, 1829..... | 50,000.00 | 55,003.25 | | | 105,003.25 |
| Apr. 23, 1830..... | 95,694.72 | 271,428.76 | | | 367,123.48 |
| May 31, 1830..... | | | | 40,400.00 | 40,400.00 |
| Mar. 2, 1831..... | | 5,000.00 | | | 5,000.00 |
| Do..... | 46,880.00 | 389,484.34 | | 187.50 | 436,551.84 |
| Do..... | 200,000.00 | | | 25,000.00 | 225,000.00 |
| Feb. 24, 1832..... | | 9,000.00 | | | 9,000.00 |
| July 3, 1832..... | 154,970.32 | 528,590.43 | | 30,000.00 | 713,560.75 |
| July 4, 1832..... | | | | 3,000.00 | 3,000.00 |
| Mar. 2, 1833..... | 15,000.00 | 25,000.00 | | 500.00 | 40,500.00 |
| Do..... | 95,900.00 | 384,900.00 | | 25,000.00 | 505,800.00 |
| Do..... | | 8,430.62 | | | 8,430.62 |
| Do..... | 48,266.60 | | | | 48,266.60 |
| June 27, 1834..... | | 262.16 | | 2.84 | 265.00 |
| June 28, 1834..... | 155,527.00 | 547,756.00 | | 24,000.00 | 727,283.00 |
| June 30, 1834..... | | | 28,337.55 | | 28,337.55 |
| Do..... | | | | 500.00 | 500.00 |
| Do..... | 70,000.00 | | | | 70,000.00 |
| Do..... | 6,240.63 | | | | 6,240.63 |
| Feb. 24, 1835..... | | 30,000.00 | | | 30,000.00 |
| Do..... | 17,000.00 | | | | 17,000.00 |
| Mar. 3, 1835..... | 231,000.00 | 227,057.03 | | | 458,057.03 |
| Do..... | | | | 25,000.00 | 25,000.00 |
| July 2, 1836..... | 395,600.05 | 283,719.90 | | 25,000.00 | 704,319.95 |
| July 4, 1836..... | 160,000.00 | 303,000.11 | 15,000.00 | 5,100.00 | 483,100.11 |
| Mar. 3, 1837..... | 754,963.00 | 600,759.00 | 300,000.00 | 11,000.00 | 1,666,722.00 |
| Do..... | | | | 30,000.00 | 30,000.00 |
| Apr. 20, 1838..... | 70,000.00 | | | | 70,000.00 |
| July 7, 1838..... | | | | 2,000.00 | 2,000.00 |
| Do..... | 408,573.00 | 1,058,744.16 | 10,000.00 | | 1,477,317.16 |
| Do..... | | | | 2,000.00 | 2,000.00 |
| Mar. 3, 1839..... | | 500.00 | | 2,000.00 | 2,500.00 |
| Do..... | | | | 500.00 | 500.00 |
| Do..... | 15,000.00 | | | 500.00 | 15,500.00 |
| Do..... | | | | 1,500.00 | 1,500.00 |
| May 8, 1840..... | | | | 150.29 | 150.29 |
| July 20, 1840..... | 1,075.39 | | | | 1,075.39 |
| Mar. 3, 1841..... | | 17,500.00 | | | 17,500.00 |
| Do..... | | 4,369.00 | | | 4,369.00 |
| Do..... | 75,000.00 | | | | 75,000.00 |
| Sept. 9, 1841..... | | 5,000.00 | | 40,000.00 | 45,000.00 |
| June 4, 1842..... | | | | 8,000.00 | 8,000.00 |
| Aug. 23, 1842..... | 100,000.00 | | | 45,000.00 | 145,000.00 |
| Aug. 31, 1842..... | | 2,000.00 | | | 2,000.00 |
| Mar. 1, 1843..... | 150,000.00 | | | | 150,000.00 |
| Do..... | 3,471.57 | | | | 3,471.57 |
| Mar. 3, 1843..... | | 16,000.00 | | | 16,000.00 |
| Do..... | | 80,000.00 | | | 80,000.00 |
| Do..... | | 2,680.01 | | | 2,680.01 |
| June 11, 1844..... | 305,000.00 | 350,000.00 | | | 655,000.00 |
| June 15, 1844..... | | 12,500.00 | | | 12,500.00 |
| Do..... | | 12,500.00 | | | 12,500.00 |
| Do..... | 7,500.00 | | | | 7,500.00 |
| Do..... | 14,000.00 | | | | 14,000.00 |
| Do..... | | 320.89 | | | 320.89 |
| Do..... | | 1,150.00 | | | 1,150.00 |
| Do..... | | 536.74 | | | 536.74 |
| Do..... | | 412.12 | | | 412.12 |
| Feb. 13, 1845..... | | 18,437.27 | | | 18,437.27 |
| Feb. 26, 1845..... | | | 5,000.00 | | 5,000.00 |
| Mar. 3, 1845..... | 240.00 | | | | 240.00 |
| Do..... | | 5,266.96 | | | 5,266.96 |
| Do..... | | 15,000.00 | | | 15,000.00 |
| Do..... | 7,000.00 | | | | 7,000.00 |
| Aug. 10, 1846..... | | | | 4,988.00 | 4,988.00 |
| Mar. 2, 1847..... | 7,751.92 | | | | 7,751.92 |

¹ \$15,000 were also appropriated for surveys in reference to military defenses of the frontier, inland and Atlantic, including a survey of the direct communication from Albemarle Sound to the Atlantic Ocean, with a view to reopening a ship channel.

| Date of act. | Rivers. | Harbors. | Canals. | Examinations, surveys, and contingencies. | Total. |
|----------------|--------------|--------------|--------------|---|---------------|
| Mar. 3, 1847 | \$6,479.25 | | | | \$6,479.25 |
| Do. | | \$645.30 | | | 645.30 |
| July 20, 1848 | | 40,000.00 | | | 40,000.00 |
| Mar. 3, 1849 | | | | \$1,500.00 | 1,500.00 |
| Do. | | 5,000.00 | | | 5,000.00 |
| Do. | 651.76 | | | | 651.76 |
| Sept. 30, 1850 | | | | 50,000.00 | 50,000.00 |
| Aug. 30, 1852 | 1,074,590.00 | 940,000.00 | | 84,700.00 | 2,099,290.00 |
| Aug. 31, 1852 | | | | 50,000.00 | 50,000.00 |
| Mar. 3, 1853 | | 877.42 | | | 877.42 |
| July 22, 1854 | 140,000.00 | | | | 140,000.00 |
| Mar. 2, 1855 | | 922.65 | | | 922.65 |
| Mar. 3, 1855 | | 161,000.00 | | | 161,000.00 |
| Do. | | 1,696.15 | | | 1,696.15 |
| Do. | | 8,617.81 | | | 8,617.81 |
| July 8, 1856 | 330,000.00 | | | | 330,000.00 |
| Do. | 100,000.00 | | | | 100,000.00 |
| Do. | 45,000.00 | | | | 45,000.00 |
| Aug. 16, 1856 | | 100,000.00 | | | 100,000.00 |
| Do. | 200,000.00 | | | | 200,000.00 |
| Mar. 3, 1857 | | 20,833.00 | | | 20,833.00 |
| June 7, 1858 | | 2,502.11 | | | 2,502.11 |
| Feb. 9, 1859 | | 809.65 | | | 809.65 |
| June 9, 1860 | 1,350.00 | | | | 1,350.00 |
| June 12, 1860 | 1,406.94 | | | | 1,406.94 |
| Apr. 9, 1864 | | 1,778.36 | | | 1,778.36 |
| Do. | | 2,224.00 | | | 2,224.00 |
| Do. | | 99.00 | | | 99.00 |
| May 19, 1864 | | 308.00 | | | 308.00 |
| June 28, 1864 | | 350,000.00 | | | 350,000.00 |
| July 1, 1864 | | | \$225,276.83 | | 225,276.83 |
| July 2, 1864 | | 87,500.00 | | | 87,500.00 |
| Feb. 28, 1865 | | 23,000.00 | | | 23,000.00 |
| June 12, 1866 | | 125,000.00 | | | 125,000.00 |
| June 23, 1866 | 1,558,900.00 | 1,604,147.91 | 280,000.00 | 255,000.00 | 3,698,047.91 |
| July 28, 1866 | | 8,000.00 | | | 8,000.00 |
| Mar. 2, 1867 | 1,374,688.00 | 2,423,093.70 | 650,000.00 | 255,000.00 | 4,702,781.70 |
| Do. | 36,000.00 | 2,500.00 | | | 38,500.00 |
| July 25, 1868 | 712,000.00 | 418,530.00 | 471,000.00 | | 1,601,530.00 |
| Apr. 10, 1869 | 708,188.00 | 769,022.27 | 498,980.00 | 23,829.73 | 2,000,000.00 |
| Dec. 23, 1869 | | | 200,000.00 | | 200,000.00 |
| May 5, 1870 | | | | 500.00 | 500.00 |
| July 11, 1870 | 1,768,500.00 | 1,210,900.00 | 816,500.00 | 150,000.00 | 3,945,900.00 |
| July 15, 1870 | 5,000.00 | 225,000.00 | | 50,000.00 | 280,000.00 |
| Jan. 18, 1871 | | | 541,000.00 | | 541,000.00 |
| Feb. 2, 1871 | | | 100,000.00 | | 100,000.00 |
| Mar. 3, 1871 | 1,595,000.00 | 1,886,000.00 | 751,500.00 | 175,000.00 | 4,407,500.00 |
| June 10, 1872 | 13,713.97 | | | | 13,713.97 |
| Do. | 2,430,300.00 | 2,003,700.00 | 1,004,000.00 | 150,000.00 | 5,588,000.00 |
| Jan. 8, 1873 | | 15,000.00 | | | 15,000.00 |
| Mar. 3, 1873 | 2,885,000.00 | 2,292,900.00 | 800,000.00 | 125,000.00 | 6,102,900.00 |
| Do. | 34,988.53 | | | | 34,988.53 |
| Do. | | 8,132.95 | | | 8,132.95 |
| Feb. 25, 1874 | | 20,000.00 | | | 20,000.00 |
| Feb. 27, 1874 | | 193,132.96 | | | 193,132.96 |
| Apr. 3, 1874 | 30,000.00 | | | | 30,000.00 |
| May 11, 1874 | | | 1,675,354.31 | | 1,675,354.31 |
| June 22, 1874 | | | | 25,000.00 | 25,000.00 |
| June 23, 1874 | 2,452,500.00 | 1,875,500.00 | 600,000.00 | 300,000.00 | 5,228,000.00 |
| Do. | 10,000.00 | | | | 10,000.00 |
| Mar. 3, 1875 | 3,478,000.00 | 2,325,517.50 | 780,000.00 | 65,000.00 | 6,648,517.50 |
| May 1, 1876 | | | | 2,100.28 | 2,100.28 |
| July 31, 1876 | 10,000.00 | | | | 10,000.00 |
| Aug. 14, 1876 | 2,888,500.00 | 1,636,500.00 | 450,000.00 | 40,000.00 | 5,015,000.00 |
| Feb. 7, 1878 | 46,000.00 | | | | 46,000.00 |
| Apr. 30, 1878 | | | 7,500.00 | | 7,500.00 |
| June 7, 1878 | | 75,000.00 | | | 75,000.00 |
| June 18, 1878 | 5,469,900.00 | 2,086,800.00 | 425,000.00 | 220,000.00 | 8,201,700.00 |
| June 20, 1878 | 9,513.00 | | | | 9,513.00 |
| Jan. 13, 1879 | 101,536.72 | | | | 101,536.72 |
| Mar. 3, 1879 | 4,190,600.00 | 2,333,000.00 | 368,000.00 | 205,000.00 | 7,096,600.00 |
| June 28, 1879 | 175,000.00 | | | | 175,000.00 |
| Jan. 23, 1880 | | 25,000.00 | | | 25,000.00 |
| June 14, 1880 | 5,530,500.00 | 2,837,500.00 | 432,755.36 | 180,000.00 | 8,980,755.36 |
| June 16, 1880 | 5,010.00 | | | | 5,010.00 |
| Do. | 150,000.00 | | | | 150,000.00 |
| Jan. 13, 1881 | | | | 50,000.00 | 50,000.00 |
| Mar. 3, 1881 | 150,000.00 | | | 10,000.00 | 160,000.00 |
| Do. | 7,395,000.00 | 3,649,300.00 | 317,000.00 | 80,000.00 | 11,441,300.00 |
| Mar. 4, 1882 | | 100,000.00 | | | 100,000.00 |
| Mar. 21, 1882 | 100,000.00 | | | | 100,000.00 |
| May 4, 1882 | 50,000.00 | | | | 50,000.00 |
| June 19, 1882 | | 10,000.00 | | | 10,000.00 |

| Date o fact. | Rivers. | Harbors. | Canals. | Examinations, surveys, and contingencies. | Total. |
|----------------|-----------------|----------------|--------------|---|-----------------|
| Aug. 2, 1882 | \$12,676,900.00 | \$5,499,475.00 | \$325,000.00 | \$237,500.00 | \$18,738,875.00 |
| Aug. 7, 1882 | 150,000.00 | | | 2,000.00 | 152,000.00 |
| Mar. 3, 1883 | 2,460.00 | | | | 2,460.00 |
| Do | 150,000.00 | | | | 150,000.00 |
| Jan. 19, 1884 | 1,000,000.00 | | | | 1,000,000.00 |
| Mar. 12, 1884 | 8,100.00 | | | | 8,100.00 |
| July 5, 1884 | 9,042,500.00 | 4,200,100.00 | 530,000.00 | 167,600.00 | 13,940,200.00 |
| July 7, 1884 | 81,479.32 | | | | 81,479.32 |
| May 26, 1886 | 6,492.00 | | | | 6,492.00 |
| Aug. 4, 1886 | 129,404.57 | | | | 129,404.57 |
| Aug. 5, 1886 | 8,547,025.00 | 5,083,125.00 | 681,250.00 | 153,500.00 | 14,464,900.00 |
| Feb. 1, 1888 | 176,380.32 | | | | 176,380.32 |
| Mar. 5, 1888 | | | | 5,000.00 | 5,000.00 |
| Mar. 30, 1888 | 8,800.00 | | | | 8,800.00 |
| Apr. 2, 1888 | 7,572.48 | | | | 7,572.48 |
| May 21, 1888 | | 8,174.79 | | | 8,174.79 |
| Aug. 11, 1888 | 12,790,935.19 | 7,689,000.00 | 1,576,250.00 | 180,000.00 | 22,236,185.13 |
| Oct. 1, 1888 | | | | 10,000.00 | 10,000.00 |
| Oct. 2, 1888 | 35,000.00 | | | | 35,000.00 |
| Oct. 19, 1888 | 46,525.06 | | | | 46,525.06 |
| Mar. 2, 1889 | 62,060.00 | | | | 62,060.00 |
| Do | | | | 2,000.00 | 2,000.00 |
| Feb. 22, 1890 | 150,000.00 | | | | 150,000.00 |
| Mar. 17, 1890 | | 6,100.00 | | | 6,100.00 |
| Apr. 4, 1890 | | 10,000.00 | | | 10,000.00 |
| Aug. 30, 1890 | 3,735.00 | | | | 3,735.00 |
| Sept. 19, 1890 | 14,428,050.00 | 7,963,561.85 | 2,367,000.00 | 278,000.00 | 25,036,611.85 |
| Sept. 30, 1890 | 162,178.04 | | | | 162,178.04 |
| Jan. 19, 1891 | 2,128.87 | | | | 2,128.87 |
| Mar. 3, 1891 | 1,950.00 | | | | 1,950.00 |
| Do | 300,000.00 | 1,051,200.00 | 600,000.00 | | 1,951,200.00 |
| Do | 1,000,000.00 | | | | 1,000,000.00 |
| July 13, 1892 | 12,856,529.00 | 7,120,106.00 | 1,018,083.00 | 159,500.00 | 21,154,218.00 |
| July 28, 1892 | 109,067.41 | | | | 109,067.41 |
| Aug. 5, 1892 | 115,000.00 | 699,000.00 | | | 814,000.00 |
| Mar. 1, 1893 | | | | 15,000.00 | 15,000.00 |
| Mar. 3, 1893 | 7,349,500.00 | 4,372,000.00 | 2,444,653.00 | | 14,166,153.00 |
| Do | 95,986.65 | | | | 95,986.65 |
| June 23, 1894 | | 6,391.12 | | | 6,391.12 |
| Aug. 8, 1894 | | 5,434.18 | | | 5,434.18 |
| Aug. 18, 1894 | 6,701,180.00 | 14,207,000.00 | 425,000.00 | 165,000.00 | 11,498,180.00 |
| Do | 5,335,000.00 | 2,765,000.00 | 300,000.00 | | 8,400,000.00 |
| Aug. 23, 1894 | 6,325.28 | | | | 6,325.28 |
| Do | 1,916.97 | | | | 1,916.97 |
| Jan. 25, 1895 | | 200,000.00 | | | 200,000.00 |
| Mar. 2, 1895 | 15,000.00 | | | | 15,000.00 |
| Do | 6,770,700.00 | 4,187,550.00 | 483,865.00 | 10,000.00 | 11,452,115.00 |
| Feb. 26, 1896 | 500.00 | 300,000.00 | | | 300,500.00 |
| Do | | | | 1,500.00 | 1,500.00 |
| May 1, 1896 | 17,811.96 | | | | 17,811.96 |
| May 11, 1896 | | 1,289.33 | | | 1,289.33 |
| June 3, 1896 | 11,340,625.46 | 4,635,540.00 | 335,000.00 | 268,000.00 | 16,579,165.46 |
| June 11, 1896 | 980,000.00 | 2,125,000.00 | 179,597.00 | 15,000.00 | 3,299,597.00 |
| Do | | | 8,265.19 | | 8,265.19 |
| Feb. 26, 1897 | 250,000.00 | | | | 250,000.00 |
| Mar. 31, 1897 | 250,000.00 | | | | 250,000.00 |
| June 4, 1897 | 9,789,333.00 | 7,742,079.91 | 1,575,000.00 | 185,000.00 | 19,291,412.91 |
| July 19, 1897 | 1,156,015.65 | 55,000.00 | | 311.17 | 1,211,326.82 |
| Apr. 11, 1898 | | 2,000.00 | | | 2,000.00 |
| July 1, 1898 | 6,899,739.56 | 5,852,730.00 | 2,029,990.00 | 225,000.00 | 14,507,459.56 |
| July 7, 1898 | 1.42 | 360,000.00 | | | 360,001.42 |
| Mar. 3, 1899 | 5,108,333.00 | 3,109,864.00 | 715,000.00 | | 9,023,197.00 |
| Do | 31.79 | | | | 31.79 |
| Do | 4,738,776.25 | 7,239,265.69 | 205,000.00 | | 15,181,841.94 |
| Feb. 9, 1900 | | | | | 20,000.00 |
| June 6, 1900 | 7,998,964.00 | 6,131,636.75 | 1,110,000.00 | | 15,240,605.74 |
| June 6, 1900 | 18.00 | | | | 18.00 |
| Do | 6,125,368.16 | 99,437.56 | | 7,35,194.28 | 260,000.00 |
| Mar. 1, 1901 | | 10,200.00 | | | 10,200.00 |
| Mar. 3, 1901 | 1,995,046.00 | 3,946,577.00 | 1,120,000.00 | | 7,061,623.00 |
| Do | 4.59 | | | | 4.59 |

¹ Includes payment of \$30,000 to C. P. Goodyear for work at Brunswick outer bar, Georgia.

² Includes payment of \$100,000 to C. P. Goodyear for work at Brunswick outer bar, Georgia.

³ Includes \$10,000 to be expended by the Secretary of the Navy for survey of Pearl Harbor, Hawaii.

⁴ As amended by act of Feb. 20, 1900.

⁵ Includes payment of \$90,000 to C. P. Goodyear for work at Brunswick outer bar, Georgia.

⁶ Does not include app. of \$200,000 for purchase of plant belonging to estate of James B. Eads at South Pass, Mississippi R., the amount not having been expended.

⁷ Includes \$10,000 to be expended by Sec. of Navy for sur. of Guam H.

| Date of act. | Rivers. | Harbors. | Canals. | Examina- tions, surveys, and con- tingencies. | Emergencies. | Total. |
|---------------|----------------|----------------|---------------|---|---------------|----------------|
| Feb. 14, 1902 | \$1.96 | | | | | \$1.96 |
| June 13, 1902 | 16,071,892.00 | \$9,119,550.00 | \$805,000.00 | \$325,000.00 | \$200,000.00 | 26,521,442.00 |
| June 28, 1902 | 1,537,275.00 | 3,503,262.50 | 743,220.00 | | | 5,783,757.50 |
| July 1, 1902 | 25,000.00 | | | | | 25,000.00 |
| Mar. 3, 1903 | 6.01 | | | | | 6.01 |
| Do | 11,559,540.33 | 8,505,610.66 | 178,000.00 | | | 20,243,150.99 |
| Apr. 28, 1904 | 5,295,000.00 | 2,592,200.00 | | | | 7,887,200.00 |
| Do | | | | | 835,274.34 | 835,274.34 |
| Mar. 3, 1905 | 10,096,483.41 | 6,854,392.00 | 606,000.00 | 325,000.00 | 300,000.00 | 18,181,875.41 |
| Do | 5,421,316.00 | 5,137,816.00 | | | | 10,559,132.00 |
| Apr. 23, 1906 | 400,000.00 | | | | | 400,000.00 |
| June 28, 1906 | | | 10,000.00 | | | 10,000.00 |
| June 30, 1906 | 21.42 | | | | | 21.42 |
| Do | 11,104,868.63 | 5,964,181.41 | 200,000.00 | | | 17,269,050.04 |
| Mar. 2, 1907 | 21,968,650.92 | 13,823,021.08 | 666,411.00 | 350,000.00 | 300,000.00 | 37,108,083.00 |
| Mar. 4, 1907 | 2,791,065.00 | 3,616,665.00 | | | | 6,407,730.00 |
| May 27, 1908 | 9,359,800.00 | 8,083,145.00 | 665,000.00 | | | 18,107,945.00 |
| Mar. 3, 1909 | 4,848,250.00 | 3,169,000.00 | 168,500.00 | 700,000.00 | 500,000.00 | 9,385,750.00 |
| Mar. 4, 1909 | 11,777,214.00 | 7,702,300.00 | 290,000.00 | | | 19,769,514.00 |
| Jan. 19, 1910 | | 10,000.00 | | | | 10,000.00 |
| June 25, 1910 | 23,393,890.70 | 14,459,272.80 | 1,124,075.00 | 500,000.00 | 300,000.00 | 40,277,238.50 |
| Do | 5,415,918.00 | 2,650,510.00 | | | | 8,066,428.00 |
| Do | 600.00 | | | | | 600.00 |
| Feb. 27, 1911 | 16,491,880.00 | 6,425,962.00 | 542,500.00 | 300,000.00 | | 23,760,342.00 |
| Mar. 4, 1911 | 4,016,000.00 | 2,877,077.00 | 150,000.00 | | | 7,043,077.00 |
| Apr. 3, 1912 | 350,000.00 | | | | | 350,000.00 |
| Apr. 16, 1912 | 300,000.00 | | | | | 300,000.00 |
| Apr. 30, 1912 | 1,500,000.00 | | | | | 1,500,000.00 |
| May 9, 1912 | 50,000.00 | | | | | 50,000.00 |
| July 25, 1912 | 21,890,890.50 | 6,514,980.00 | 1,049,500.00 | 300,000.00 | | 29,455,370.50 |
| Aug. 24, 1912 | 5,385,000.00 | 3,630,250.00 | 500,000.00 | | | 9,515,250.00 |
| Aug. 26, 1912 | 4.67 | 177.21 | | | | 181.88 |
| Mar. 4, 1913 | 30,495,390.00 | 9,166,749.00 | 1,309,225.00 | 250,000.00 | | 41,221,364.00 |
| June 23, 1913 | 6,597,150.00 | 2,363,645.00 | 1,100,000.00 | | | 10,060,795.00 |
| Aug. 1, 1914 | 4,609,500.00 | 1,968,000.00 | 426,000.00 | | | 7,003,500.00 |
| Oct. 2, 1914 | 15,640,350.09 | 3,134,030.00 | 367,400.00 | | 858,220.00 | 20,000,000.00 |
| Mar. 3, 1915 | 3,797,000.00 | 200,000.00 | | | | 3,997,000.00 |
| Mar. 4, 1915 | 18,098,571.50 | 2,968,850.00 | 398,550.00 | 500,000.00 | 3,034,028.50 | 25,000,000.00 |
| Total..... | 475,211,250.47 | 269,273,040.59 | 42,989,018.24 | 9,271,891.09 | 76,027,522.84 | 802,772,723.23 |

¹ As amended by act of June 28, 1902.

² Includes payment of \$45,000 to C. P. Goodyear for work at Brunswick outer bar, Georgia.

³ This is the actual amount allotted from the app. of \$3,000,000 made by this act; the balance, \$2,164,725.66, by the terms of sec. 8 of the act of Mar. 3, 1905, being made available to apply upon the cost of imps. enumerated in that act, thereby reducing to \$16,017,149.75 the actual amount app. by the act of 1905.

⁴ Does not include \$50,000 app. for expenses of the Permanent International Association of Navigation Congresses, \$1,875 for services of Hon. John H. Bankhead, and \$1,000,000 for waterway from Lockport to mouth of Illinois R., repealed by act of Mar. 4, 1915.

⁵ Does not include \$1,500,000 deducted from app. for Mississippi R. in accordance with the provisions of the act of Apr. 30, 1912, and \$300,000 allotted to ex., sur., and contingencies from previous app. for emergencies.

⁶ Reserved for emergencies.

⁷ Omits \$300,000 applied to examinations, surveys, and contingencies under the provisions of the act of July 25, 1912.

South Pass Jetties.

TABLE 2.—Statement of appropriations and expenditures provided by act of Mar. 3, 1875, and amendatory acts for improvement of South Pass, Mississippi River, by James B. Eads and his legal representatives.

| | | | |
|--|-------------|--|-----------|
| Under the act of Mar. 3, 1875, and amendatory acts, there was to be paid James B. Eads or his legal representatives, upon securing certain widths and depths of channel, the sum of..... | \$4,250,000 | One-half of the \$1,000,000 retained to be then released..... | 500,000 |
| 80 quarterly payments of \$25,000 each for maintenance..... | 2,000,000 | 20 semiannual payments of 5 per cent interest on the \$500,000 still retained as a pledge, amounting to..... | 250,000 |
| 20 semiannual payments of 5 per cent interest on the \$1,000,000 retained as pledge, amounting to..... | 500,000 | Remaining one-half of the \$1,000,000 retained to be then released..... | 500,000 |
| | | Total..... | 8,000,000 |

Wrecks.

TABLE 3.—*Expenditures under permanent indefinite appropriations provided by acts of June 14, 1880, and Mar. 3, 1899, for removing sunken vessels or craft obstructing or endangering navigation.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|------------|-----------------------------|--------------|
| 1881 | | 1900 | \$37,345.39 |
| 1882 | \$8,574.58 | 1901 | 47,582.00 |
| 1883 | 24,392.24 | 1902 | 49,797.28 |
| 1884 | 28,857.50 | 1903 | 51,512.70 |
| 1885 | 46,818.98 | 1904 | 80,652.05 |
| 1886 | 43,633.39 | 1905 | 69,960.77 |
| 1887 | 18,222.39 | 1906 | 76,451.60 |
| 1888 | 29,877.37 | 1907 | 52,083.87 |
| 1889 | 9,515.06 | 1908 | 50,380.08 |
| 1890 | 43,254.68 | 1909 | 49,828.85 |
| 1891 | 48,661.60 | 1910 | 49,522.41 |
| 1892 | 31,912.93 | 1911 | 83,520.41 |
| 1893 | 34,498.57 | 1912 | 64,848.74 |
| 1894 | 46,697.61 | 1913 | 115,208.81 |
| 1895 | 3,254.17 | 1914 | 108,872.42 |
| 1896 | 37,503.03 | 1915 (to Mar. 4) | 72,173.19 |
| 1897 | 31,409.40 | | |
| 1898 | 49,321.76 | Total | 1,668,237.57 |
| 1899 | 78,291.74 | | |

Canal Operation.

TABLE 4.—*Expenditures under permanent indefinite appropriations provided by acts of Mar. 3, 1881, July 5, 1884, and Mar. 3, 1909, for operating and care of canals and other works of navigation.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|--------------|-----------------------------|---------------|
| 1882 | \$132,201.28 | 1900 | \$846,538.18 |
| 1883 | 180,714.17 | 1901 | 849,689.03 |
| 1884 | 129,049.54 | 1902 | 1,019,256.31 |
| 1885 | 224,909.10 | 1903 | 1,091,515.05 |
| 1886 | 224,377.48 | 1904 | 1,101,510.27 |
| 1887 | 248,583.42 | 1905 | 1,145,644.82 |
| 1888 | 485,012.03 | 1906 | 1,108,710.29 |
| 1889 | 489,700.64 | 1907 | 1,441,390.88 |
| 1890 | 676,084.25 | 1908 | 1,588,330.89 |
| 1891 | 730,922.52 | 1909 | 1,700,458.77 |
| 1892 | 705,779.73 | 1910 | 1,889,687.31 |
| 1893 | 496,492.61 | 1911 | 1,923,517.11 |
| 1894 | 604,909.39 | 1912 | 2,222,709.71 |
| 1895 | 551,884.40 | 1913 | 2,222,906.87 |
| 1896 | 636,603.52 | 1914 | 2,162,235.38 |
| 1897 | 707,259.16 | 1915 (to Mar. 4) | 1,791,367.88 |
| 1898 | 691,547.76 | | |
| 1899 | 743,133.39 | Total | 32,764,633.14 |

Examination—South Pass.

TABLE 5.—*Expenditures under permanent annual appropriations provided by acts of Aug. 11, 1888, and June 13, 1902, for examinations and surveys at South Pass, Mississippi River.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|-------------|-----------------------------|------------|
| 1890 | \$10,000.00 | 1904 | \$9,135.39 |
| 1891 | 10,000.00 | 1905 | 10,231.79 |
| 1892 | 9,200.90 | 1906 | 11,087.14 |
| 1893 | 8,946.73 | 1907 | 8,929.88 |
| 1894 | 10,699.40 | 1908 | 10,450.00 |
| 1895 | 8,933.33 | 1909 | 9,050.00 |
| 1896 | 11,085.08 | 1910 | 11,000.00 |
| 1897 | 10,000.00 | 1911 | 10,320.00 |
| 1898 | 9,709.57 | 1912 | 8,480.00 |
| 1899 | 9,878.45 | 1913 | 11,490.00 |
| 1900 | 9,107.87 | 1914 | 9,375.00 |
| 1901 | 6,637.63 | 1915 (to Mar. 4) | 6,390.00 |
| 1902 | | | |
| 1903 | 9,115.80 | Total | 239,953.96 |

¹The expenditures for each year represent the amounts drawn from the Treasury, less repayments.

Maintenance—South Pass.

TABLE 6.—*Expenditures under permanent annual appropriations provided by act of June 6, 1900, for maintenance by the United States of South Pass Channel, Mississippi River.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|-------------|-----------------------------|--------------|
| 1901..... | \$29,974.87 | 1910..... | \$109,848.59 |
| 1902..... | 99,528.27 | 1911..... | 82,125.53 |
| 1903..... | 108,861.20 | 1912..... | 78,234.60 |
| 1904..... | 65,964.08 | 1913..... | 127,840.09 |
| 1905..... | 105,214.12 | 1914..... | 96,077.24 |
| 1906..... | 104,786.14 | 1915 (to Mar. 4)..... | 53,039.34 |
| 1907..... | 99,888.74 | | |
| 1908..... | 97,852.27 | Total..... | 1,213,821.72 |
| 1909..... | 93,089.78 | | |

Snagging and Dredging—Upper Mississippi.

TABLE 7.—*Expenditures under permanent annual appropriations provided by act of Aug. 11, 1888, for operating snag boats and dredge boats on Upper Mississippi River, as modified by the acts of Mar. 2, 1907, and Mar. 3, 1909, to include operations on the Illinois and Minnesota Rivers and other tributaries of the Upper Mississippi River.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|-------------|-----------------------------|-------------|
| 1890..... | \$25,000.00 | 1904..... | \$25,000.00 |
| 1891..... | 25,000.00 | 1905..... | 25,000.00 |
| 1892..... | 25,000.00 | 1906..... | 25,000.00 |
| 1893..... | 25,000.00 | 1907..... | 25,000.00 |
| 1894..... | 25,000.00 | 1908..... | 25,000.00 |
| 1895..... | 25,000.00 | 1909..... | 25,000.00 |
| 1896..... | 25,000.00 | 1910..... | 25,000.00 |
| 1897..... | 25,000.00 | 1911..... | 24,391.00 |
| 1898..... | 25,000.00 | 1912..... | 23,442.40 |
| 1899..... | 25,000.00 | 1913..... | 26,557.60 |
| 1900..... | 24,944.00 | 1914..... | 24,475.15 |
| 1901..... | 25,000.00 | 1915 (to Mar. 4)..... | 18,062.51 |
| 1902..... | 25,000.00 | | |
| 1903..... | 25,000.00 | Total..... | 641,872.68 |

Snagging and Wrecks—Mississippi River.

TABLE 8.—*Expenditures under permanent annual appropriations provided by act of Aug. 11, 1888, for removing snags and wrecks from Mississippi River, as modified by act of Mar. 3, 1909, to include Atchafalaya and Old Rivers, La.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|-------------|-----------------------------|--------------|
| 1890..... | \$49,089.17 | 1904..... | \$88,245.25 |
| 1891..... | 92,720.97 | 1905..... | 81,822.81 |
| 1892..... | 98,250.00 | 1906..... | 85,662.36 |
| 1893..... | 96,497.23 | 1907..... | 85,669.59 |
| 1894..... | 88,252.46 | 1908..... | 97,889.35 |
| 1895..... | 100,000.00 | 1909..... | 100,021.03 |
| 1896..... | 80,496.26 | 1910..... | 96,782.04 |
| 1897..... | 83,421.64 | 1911..... | 103,157.94 |
| 1898..... | 88,917.74 | 1912..... | 97,978.58 |
| 1899..... | 88,923.15 | 1913..... | 101,442.43 |
| 1900..... | 86,355.29 | 1914..... | 99,856.30 |
| 1901..... | 86,710.05 | 1915 (to Mar. 4)..... | 66,566.25 |
| 1902..... | 98,085.27 | | |
| 1903..... | 72,587.48 | Total..... | 2,310,370.64 |

Gauging—Mississippi and Tributaries.

TABLE 9.—*Expenditures under permanent annual appropriations provided by acts of Aug. 11, 1888, and June 13, 1902, for gauging the waters of Mississippi River and its principal tributaries.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|------------|-----------------------------|------------|
| 1890..... | \$3,323.53 | 1904..... | \$7,086.61 |
| 1891..... | 5,761.96 | 1905..... | 9,942.14 |
| 1892..... | 6,269.23 | 1906..... | 7,750.86 |
| 1893..... | 5,929.67 | 1907..... | 7,189.00 |
| 1894..... | 6,062.22 | 1908..... | 9,251.10 |
| 1895..... | 6,023.37 | 1909..... | 8,888.49 |
| 1896..... | 5,854.19 | 1910..... | 8,794.87 |
| 1897..... | 6,000.00 | 1911..... | 8,744.71 |
| 1898..... | 5,998.39 | 1912..... | 8,727.23 |
| 1899..... | 6,001.61 | 1913..... | 9,072.25 |
| 1900..... | 5,470.19 | 1914..... | 8,586.83 |
| 1901..... | 5,265.96 | 1915 (to Mar. 4)..... | 4,270.15 |
| 1902..... | 5,885.82 | | |
| 1903..... | 8,378.64 | Total..... | 185,559.02 |

Snagging—Ohio River.

TABLE 10.—*Expenditures under permanent annual appropriations provided by acts of Sept. 19, 1890, and June 3, 1896, for operating snag boats on Ohio River.*

| Fiscal year ending June 30— | | Fiscal year ending June 30— | |
|-----------------------------|-------------|-----------------------------|-------------|
| 1891..... | \$12,264.45 | 1905..... | \$34,688.23 |
| 1892..... | 25,135.55 | 1906..... | 33,094.17 |
| 1893..... | 23,178.13 | 1907..... | 35,784.13 |
| 1894..... | 24,849.27 | 1908..... | 37,083.40 |
| 1895..... | 20,782.19 | 1909..... | 36,391.95 |
| 1896..... | 30,216.90 | 1910..... | 34,497.89 |
| 1897..... | 27,739.80 | 1911..... | 31,058.04 |
| 1898..... | 18,426.83 | 1912..... | 40,283.83 |
| 1899..... | 26,937.78 | 1913..... | 34,018.89 |
| 1900..... | 37,079.05 | 1914..... | 30,873.41 |
| 1901..... | 43,385.12 | 1915 (to Mar. 4)..... | 18,438.23 |
| 1902..... | 42,004.14 | | |
| 1903..... | 32,655.08 | Total..... | 775,036.29 |
| 1904..... | 36,229.83 | | |

RECAPITULATION OF TOTAL APPROPRIATIONS BY ACTS.

| | | | |
|--------------|------------------|---------------|------------------|
| Table 1..... | \$802,772,723.23 | Table 7..... | \$641,872.68 |
| Table 2..... | 8,000,000.00 | Table 8..... | 2,310,370.64 |
| Table 3..... | 1,668,237.57 | Table 9..... | 185,559.02 |
| Table 4..... | 32,764,633.14 | Table 10..... | 775,036.29 |
| Table 5..... | 239,453.96 | | |
| Table 6..... | 1,213,821.72 | Total..... | 1,850,551,708.25 |

¹ Includes all appropriations pertaining directly to the improvement of rivers and harbors, but does not include appropriations for prevention of deposits in New York Harbor, National Waterways Commission, International Waterways Commission, enlargement of Governors Island, Permanent International Association of Congresses of Navigation, U. S. Lake Survey, building for river and harbor instruction at U. S. Engineer School, and other appropriations not directly connected with the execution of river and harbor improvements.

PART B.

TABLE 11.—Totals of river and harbor appropriations, by works of improvement or waterways, as detailed in this index, pages 28 to 1690.

NOTE.—This table is not an attempt to arrange the appropriations by States, but by watershed districts. For example, District A contains waterways in both Maine and New Hampshire, and District B contains waterways in New Hampshire and Massachusetts. What might be termed the "New York districts" pertain to waterways in New York, Vermont, and New Jersey. The arrangement, in brief, is according to the natural situation of the waterways with respect to one another, rather than an arrangement within purely arbitrary State lines.

The simplest method of making the appropriations for the Mississippi, the Missouri, the Ohio, and the Columbia stand out clearly is to treat these waterways by themselves rather than in connection with any waterway district.

In considering the totals for Districts S, and from V-KK, the total for HH (Mississippi River) should be considered as connected therewith.

In considering the totals for Districts AA-FF, the total for CC (Ohio River) should be considered as connected therewith.

In considering the total for GG, it is to be remembered that it includes the total for the Missouri.

In considering the totals of Districts VV, WW, and XX, it is to be remembered that the total for the Columbia (p. 1616 of this index) should be considered therewith.

There should be pointed out that intracoastal waterways, as on the Atlantic coast and on the Gulf coast, might be considered apart from the waterway groups, as they serve a special purpose, like the Mississippi, the Ohio, the Missouri, and the Columbia, in linking or connecting waterways. The same might be said of St. Marys River, and of Detroit River, these two waterways linking together the various waterways of the Great Lakes in a special manner.

Nor should it be forgotten that harbors of refuge serve the commerce of the whole United States, with no reference to the benefit of a particular locality.

It should be pointed to, also, that in order to have an equitable consideration of some of the totals of the table below, some harbors should be considered as though they served not local but wholly national purposes. Some of these harbors are as follows:

Portland, Me.
Boston, Mass.
Newport, R. I.
New London, Conn.
New York, N. Y.
Philadelphia, Pa.
Wilmington, Del.
Baltimore, Md.
Norfolk, Va.
Wilmington, N. C.
Charleston, S. C.
Savannah, Ga.
Jacksonville, Fla.

Key West, Fla.
Tampa, Fla.
Mobile, Ala.
New Orleans, La.
Galveston, Tex.
Los Angeles, Cal.
San Francisco, Cal.
Portland, Oreg.
Seattle, Wash.
Honolulu, Hawaii.
San Juan, P. R.
Etc.

DISTRICT A.—PORTLAND, ME.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|----------------------------|-------------|---------------------|---------------------------|-------------|
| 30 | St. Croix R., Me..... | \$80,000.00 | 40 | Bucksport H., Me..... | \$20,000.00 |
| 31 | Cobscook B., Me..... | 5,300.00 | 40 | Stockton H., Me..... | 38,000.00 |
| 31 | Lubec Chan., Me..... | 319,000.00 | 40 | Carvers H., Me..... | 45,000.00 |
| 32 | Machias R., Me..... | 32,000.00 | 41 | Matineus H., Me..... | 14,000.00 |
| 32 | Moosabec Bar, Me..... | 114,000.00 | 42 | Belfast B. and H., Me.... | 62,000.00 |
| 33 | Pleasant R., Me..... | 3,500.00 | 43 | Camden H., Me..... | 102,400.00 |
| 33 | Narraguagus R., Me..... | 72,000.00 | 43 | Rockport H., Me..... | 47,000.00 |
| 34 | Sullivan Falls H., Me..... | 55,000.00 | 44 | Rockland H., Me..... | 925,500.00 |
| 35 | Bar H., Me. (breakwater). | 356,391.12 | 45 | Owlshhead H., Me..... | 17,902.11 |
| 36 | Union R., Me..... | 190,950.00 | 46 | Georges R., Me..... | 26,000.00 |
| 37 | Bagaduce R., Me..... | 28,000.00 | 46 | New H., Me..... | 10,500.00 |
| 38 | Penobscot R., Me..... | 506,300.00 | 47 | Damariscotta R., Me..... | 5,000.00 |

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|-------------------------------|--------------|---------------------|--------------------------------------|--------------|
| 47 | S. Bristol H., Me..... | \$3,500.00 | 59 | Wells H., Me..... | \$5,000.00 |
| 47 | E. Boothbay H., Me..... | 6,500.00 | 59 | York H., Me..... | 57,400.00 |
| 48 | Boothbay H., Me..... | 18,000.00 | 60 | Piscataqua R., Me. and N. H..... | 8,450.00 |
| 48 | Kennebec R., Me..... | 847,445.71 | 60 | Portsmouth H., N. H..... | 137,000.00 |
| 50 | Richmond H., Me..... | 20,000.00 | 61 | Pepperells Cove, Me..... | 95,000.00 |
| 50 | Sasanoa R., Me..... | 108,500.00 | 61 | Cocheco R., N. H..... | 311,771.00 |
| 51 | Cathance R., Me..... | 21,000.00 | 63 | Bellamy R., N. H..... | 35,000.00 |
| 52 | Harraseeket R., Me..... | 31,000.00 | 63 | Lamprey R., N. H..... | 20,000.00 |
| 53 | Royal R., Me..... | 30,000.00 | 63 | Exeter R., N. H..... | 63,200.00 |
| 53 | Portland H., Me..... | 1,506,477.05 | 64 | Little H., N. H..... | 145,000.00 |
| 55 | Portland (Back Cove), Me..... | 116,250.00 | 65 | Isle of Shoals H., Me. and N. H..... | 84,000.00 |
| 56 | Richmond Islid., Me..... | 120,000.00 | | Total..... | 7,490,686.99 |
| 56 | Saco R., Me..... | 406,775.00 | | | |
| 58 | Cape Porpoise H., Me..... | 126,000.00 | | | |
| 58 | Kennebunk R., Me..... | 91,675.00 | | | |

DISTRICT B.—BOSTON, MASS.

| | | | | | |
|----|----------------------------------|---------------|-----|--|---------------|
| 71 | Newburyport H., Mass..... | \$448,500.00 | 92 | Dorchester B. and Neponset R., Mass..... | \$124,233.00 |
| 72 | Merrimac R., Mass. and N. H..... | 395,366.72 | 93 | Weymouth R., Mass..... | 267,250.00 |
| 74 | Powow R., Mass. and N. H..... | 51,000.00 | 94 | Town R., Mass..... | 37,577.41 |
| 75 | Lake Winnipiseogee, N. H..... | 7,500.00 | 94 | Hingham H., Mass..... | 39,000.00 |
| 75 | Ipswich R., Mass..... | 7,500.00 | 95 | Cohasset H., Mass..... | 10,000.00 |
| 76 | Essex R., Mass..... | 30,000.00 | 95 | Scituate H., Mass..... | 104,680.00 |
| 76 | Sandy B., Mass..... | 1,950,000.00 | 96 | Duxbury Beach and H., Mass..... | 37,000.00 |
| 78 | Rockport H., Mass..... | 91,232.57 | 97 | Kingston H., Mass..... | 10,000.00 |
| 78 | Gloucester H., Mass..... | 542,083.00 | 98 | Plymouth Beach and H., Mass..... | 309,581.90 |
| 80 | Manchester H., Mass..... | 24,300.00 | 100 | E. Dennis, Barnstable B., Mass..... | 1,500.00 |
| 80 | Beverly H., Mass..... | 48,500.00 | 100 | Wellfleet H., Mass..... | 16,000.00 |
| 81 | Salem H., Mass..... | 65,000.00 | 101 | Provincetown H., Mass..... | 365,828.44 |
| 82 | Marblehead, Mass..... | 1,900.00 | 103 | Chatham H., Mass..... | 13,732.79 |
| 82 | Lynn H., Mass..... | 391,437.00 | | Total..... | 17,860,649.93 |
| 84 | Winthrop H., Mass..... | 9,000.00 | | | |
| 84 | Boston H., Mass..... | 12,012,947.10 | | | |
| 90 | Mystic R., Mass..... | 258,005.12 | | | |
| 91 | Mystic and Malden Rs., Mass..... | 188,994.88 | | | |

DISTRICT C.—NEWPORT, R. I.

| | | | | | |
|-----|-----------------------------------|--------------|-----|---|--------------|
| 108 | Nantucket Sound, Mass..... | \$125,000.00 | 121 | Newport H., R. I..... | \$728,741.67 |
| 108 | Bass R., Mass..... | 20,150.41 | 123 | Taunton R., Mass..... | 213,250.00 |
| 109 | Hyannis H. of Refuge, Mass..... | 197,267.07 | 124 | Fall R. H., Mass..... | 368,912.00 |
| 110 | Woods Hole H. and Chan, Mass..... | 344,000.00 | 125 | Warren R., R. I..... | 5,000.00 |
| 111 | Little H., Woods Hole, Mass..... | 18,000.00 | 125 | Providence R. and H., R. I..... | 2,367,077.00 |
| 112 | Canapisset Chan, Mass..... | 9,800.00 | 128 | do..... | 104,250.00 |
| 112 | Vineyard Haven H., Mass..... | 60,000.00 | 128 | Pawtucket R., R. I..... | 506,584.00 |
| 113 | Martha's Vineyard, Mass..... | 30,000.00 | 130 | Greenwich B., R. I..... | 2,000.00 |
| 114 | Nantucket H., Mass..... | 525,161.50 | 131 | Potowomut R., R. I..... | 5,000.00 |
| 116 | Buzzards B., Mass..... | 2,500.00 | 131 | Wickford H., R. I..... | 16,300.00 |
| 117 | Wareham H., Mass..... | 96,236.00 | 132 | Point Judith Pond, R. I..... | 20,000.00 |
| 117 | New Bedford H., Mass..... | 754,810.00 | 133 | Point Judith, R. I..... | 2,223,000.00 |
| 119 | Westport H., Mass..... | 3,000.00 | 134 | Block Islid., R. I..... | 242,500.00 |
| 119 | Churches Cove H., R. I..... | 28,200.00 | 135 | Block Islid., R. I., H. of Refuge..... | 588,500.00 |
| 119 | Sakonnet R., R. I..... | 40,000.00 | 137 | Little Narragansett B., Conn. and R. I..... | 36,000.00 |
| 120 | Sakonnet Pt. H., R. I..... | 39,000.00 | | Total..... | 9,740,889.65 |
| 121 | Coasters Islid. H., R. I..... | 18,650.00 | | | |

DISTRICT D.—NEW LONDON, CONN.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------------|------------------------------------|--------------|---------------------------|-------------------------------------|--------------|
| 142 | Pawcatuck R., R. I. and Conn. | \$190,500.00 | 160 | Milford H., Conn. | \$72,500.00 |
| 143 | Stonington H., Conn. | 337,453.83 | 162 | Housatonic R., Conn. | 310,150.00 |
| 145 | Mystic R., Conn. | 40,100.00 | 163 | Bridgeport H., Conn. | 938,500.00 |
| 145 | New London H., Conn. | 178,800.00 | 166 | Black Rock H., Conn. | 72,900.00 |
| 146 | Thames R., Conn. | 539,400.00 | 167 | Southport H., Conn. | 67,435.94 |
| 149 | Connecticut R., Conn. and Mass. | 957,640.69 | 168 | Westport H. and Saugatuck R., Conn. | 35,214.99 |
| 153 | Westbrook H., Conn. | 130.00 | 169 | Norwalk H., Conn. | 202,413.00 |
| 153 | Eightmile R., Conn. | 9,000.00 | 170 | Wilson Pt. H., Conn. | 55,000.00 |
| 153 | Duck Isld. H., Conn. | 336,202.00 | 170 | Fivemile R. H., Conn. | 47,000.00 |
| 154 | Clinton H., Conn. | 8,500.00 | 171 | Stamford H., Conn. | 180,360.53 |
| 155 | Branford H., Conn. | 18,000.00 | 172 | Coscob H. and Miamus R., Conn. | 19,000.00 |
| 156 | New Haven H. and West R., Conn. | 836,773.90 | 173 | Greenwich H., Conn. | 26,267.00 |
| 159 | New Haven, Conn. (breakwater) | 1,264,000.00 | | Total | 6,737,241.88 |

DISTRICT E.—NEW YORK, NO. 1.

| | | | | | |
|-----|-------------------------------|--------------|-----|---|---------------|
| 178 | Port Chester H., N. Y. | \$146,500.00 | 203 | Rouse Pt., Lake Champlain, N. Y. | \$98,500.00 |
| 179 | Mamaroneck H., N. Y. | 69,500.00 | | | |
| 180 | Larchmont H., N. Y. | 84,000.00 | 203 | Between North and South Hero Islds. Lake Champlain, N. Y. | 31,000.00 |
| 181 | Echo B. H., N. Y. | 73,110.00 | | | |
| 182 | New Rochelle H., N. Y. | 35,000.00 | 203 | Gordons Landing, Lake Champlain, Vt. | 34,750.00 |
| 182 | East Chester Creek, N. Y. | 159,500.00 | | | |
| 184 | East R., N. Y. (see below) | 6,015,700.00 | 204 | Plattsburg H., N. Y. | 216,180.01 |
| 187 | Westchester Creek, N. Y. | 42,780.00 | 205 | Ticonderoga R., N. Y. | 16,500.00 |
| 188 | Bronx R., N. Y. | 96,500.00 | 206 | Lake Champlain, N. Y. and Vt. Narrows | 98,500.00 |
| 188 | Harlem R., N. Y. | 1,838,000.00 | | | |
| 191 | Hudson R., N. Y. and N. J. | 7,591,524.56 | 207 | Whitehall H., N. Y. | 33,000.00 |
| 196 | Tarrytown H., N. Y. | 36,000.00 | 207 | Otter Creek, Vt. | 62,500.00 |
| 197 | Peekskill H., N. Y. | 32,000.00 | 208 | Burlington H., Vt. | 808,335.20 |
| 198 | Wappingers Creek, N. Y. | 25,500.00 | | | |
| 199 | Saugerties H., N. Y. | 120,000.00 | 210 | St. Albans H., Lake Champlain, Vt. | 5,000.00 |
| 200 | Rondout H., N. Y. | 159,800.00 | | | |
| 202 | Great Chazy R., N. Y. | 18,000.00 | 210 | Swanton H., Vt. | 70,500.00 |
| | | | | Total | 18,018,179.77 |

DISTRICT F.—NEW YORK, NO. 2.

| | | | | | |
|-----|--------------------------|--------------|-----|--|---------------|
| 216 | Flushing B., N. Y. | \$178,900.00 | 228 | Sumpawanus Inlet, N. Y. | \$7,000.00 |
| 217 | Hempstead H., N. Y. | 47,000.00 | 230 | Jamaica B., N. Y. | 550,500.00 |
| 218 | Glen Cove H., N. Y. | 72,000.00 | 230 | Jamaica B. to Long Beach Inlet, N. Y. | 9,460.00 |
| 219 | Huntington H., N. Y. | 63,000.00 | | | |
| 221 | Port Jefferson H., N. Y. | 186,356.35 | 231 | Canarsie B., N. Y. | 75,750.00 |
| 222 | Mattituck H., N. Y. | 114,750.00 | 232 | Sheepshead B., N. Y. | 39,600.00 |
| 224 | Greenport H., N. Y. | 46,000.00 | 233 | New York H., N. Y. | 12,746,590.00 |
| 224 | Peconic R., N. Y. | 25,000.00 | 242 | Newtown Creek, N. Y. | 480,900.00 |
| 225 | Sag H., N. Y. | 59,800.00 | | | |
| 226 | Great South B., N. Y. | 163,000.00 | | Total | 14,904,606.35 |
| 227 | Browns Creek, N. Y. | 39,000.00 | | | |

DISTRICT G.—NEW YORK, NO. 3.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|--|--------------|---------------------|--|--------------|
| 247 | Newark B., N. J..... | \$12,000.00 | 260 | South R., N. J..... | \$252,559.26 |
| 248 | Hackensack R., N. J..... | 50,000.00 | 261 | Cheesequake Creek, N. J..... | 59,604.96 |
| 248 | Passaic R., N. J..... | 1,600,350.00 | 262 | Keyport H., N. J..... | 103,053.71 |
| 252 | Raritan B., N. J..... | 632,500.00 | 263 | Matawan Creek, N. J..... | 75,120.00 |
| 253 | Arthur Kill, Staten Isld. Sound, etc..... | 1,267,500.00 | 263 | Shoal H. and Compton Creek, N. J..... | 65,502.81 |
| 256 | Elizabeth R., N. J..... | 59,944.45 | 264 | Shrewsbury R., N. J..... | 429,500.00 |
| 257 | Rahway R., N. J..... | 37,000.00 | 266 | Manasquan R., N. J..... | 46,000.00 |
| 257 | Woodbridge Creek, N. J.. | 79,750.00 | | Total..... | 5,561,568.00 |
| 258 | Raritan R., N. J..... | 791,182.81 | | | |

DISTRICT H.—PHILADELPHIA, PA.

| | | | | | |
|-----|--|-----------------|-----|---------------------------|----------------|
| 271 | Delaware R., N. J., Pa., and Del..... | \$18,320,103.61 | 290 | Delaware Break'r, Del.... | \$5,652,347.70 |
| 288 | Frankford Creek, Pa..... | 12,000.00 | | Total..... | 24,509,451.31 |
| 288 | Schuylkill R., Pa..... | 525,000.00 | | | |

DISTRICT I.—WILMINGTON, DEL.

| | | | | | |
|-----|--|------------|-----|--|----------------|
| 300 | Cranberry Inlet, N. J..... | \$1,000.00 | 314 | Wilmington H., Del..... | \$1,496,852.00 |
| 300 | Toms R., N. J..... | 11,050.00 | 317 | Chesapeake & Delaware Canal..... | 450,000.00 |
| 301 | Double Creek, N. J..... | 7,800.00 | 317 | Appoquinimink R., Del.. | 62,100.00 |
| 301 | Little Egg H. Inlet, N. J.. | 23,500.00 | 318 | Smyrna R., Del..... | 121,965.00 |
| 301 | Tuckerton Creek, N. J..... | 73,380.00 | 319 | Leipsic R., Del..... | 38,100.00 |
| 302 | Flatbeach or Tuckers Isld., N. J..... | 100.00 | 320 | Little R., Del..... | 14,000.00 |
| 303 | Atlantic City, N. J..... | 195,000.00 | 320 | St. Jones R., Del..... | 108,850.00 |
| 303 | Absecon Creek, N. J..... | 15,000.00 | 321 | Murderkill R., Del..... | 82,860.00 |
| 304 | Cold Spring Inlet, N. J..... | 961,200.00 | 322 | Mispillion Creek, Del.... | 175,650.00 |
| 305 | Goshen Creek, N. J..... | 17,000.00 | 324 | Broadkill Creek, Del.... | 99,030.00 |
| 305 | Dennis Creek, N. J..... | 5,000.00 | 325 | Rehoboth B. to Dela- ware B., Del..... | 50,000.00 |
| 305 | Maurice R., N. J..... | 88,000.00 | 325 | Indian R., Del..... | 10,000.00 |
| 306 | Cohansey Creek, N. J..... | 101,300.00 | 326 | Chincoteague B. to Dela- ware B..... | 195,250.00 |
| 307 | Alloway Creek, N. J..... | 45,500.00 | 328 | Delaware Line to Chin- coteague Inlet, Md. and Va..... | 2,170.64 |
| 308 | Salem R., N. J..... | 80,300.00 | 328 | Cat R. and Bogues B., Va. | 12,100.00 |
| 309 | Oldmans Creek, N. J..... | 45,000.00 | | Total..... | 4,916,007.64 |
| 310 | Raccoon Creek, N. J..... | 69,500.00 | | | |
| 310 | Mantua Creek, N. J..... | 141,450.00 | | | |
| 311 | Woodbury Creek, N. J.... | 7,500.00 | | | |
| 312 | Cooper R., N. J..... | 57,500.00 | | | |
| 313 | Rancocas R., N. J..... | 45,000.00 | | | |
| 314 | Chester and Ridley Creeks, Pa..... | 6,000.00 | | | |

DISTRICT J.—BALTIMORE, MD.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------------|---|-------------|---------------------------|--|---------------|
| 340 | Pocomoke R., Md. and Va..... | \$42,210.02 | 357 | Queenstown H., Md..... | \$56,558.02 |
| 341 | Broad Creek, Md..... | 57,200.00 | 357 | Corsica R., Md..... | 35,368.00 |
| 342 | Crisfield H., Md..... | 90,079.50 | 358 | Rockhall H. and Inner H. at Rockhall, Md..... | 86,471.72 |
| 342 | Manokin R., Md..... | 61,562.49 | 359 | Fairlee Creek, Md..... | 10,000.00 |
| 343 | Deal Isld., Md. (Upper) | 5,000.00 | 359 | Worton (Creek) H., Md..... | 12,000.00 |
| 343 | Deal Isld., Md. (Lower) | 12,300.00 | 360 | Elk and Little Elk Rs., Md..... | 108,008.00 |
| 344 | Wicomico R., Md..... | 127,516.00 | 361 | Chesapeake to Delaware (Bs.) (ship-canal surs.) | 51,000.00 |
| 346 | Nanticoke R., Del. and Md..... | 65,960.00 | 361 | Northeast R., Md..... | 20,640.00 |
| 347 | Tyaskin Creek, Md..... | 25,236.94 | 362 | Susquehanna R., Md. and Pa..... | 310,390.00 |
| 347 | Broad Creek, Del..... | 77,020.00 | 365 | Battery Isld., Chesapeake B., Md..... | 17,275.00 |
| 348 | Twitch Cove and Big Thoroughfare R., Md..... | 2,900.00 | 365 | Chesapeake B. (head- waters of) and Havre de Grace H., Md..... | 500.00 |
| 348 | Slaughter Creek, Md..... | 4,140.00 | 366 | Baltimore H., Md..... | 8,969,530.00 |
| 349 | Choptank R., Md..... | 91,946.17 | 369 | Annapolis H. (South R.), Md..... | 10,000.00 |
| 350 | Cambridge H., Md..... | 66,708.43 | | Total..... | 10,642,435.50 |
| 351 | Warwick R., Md..... | 38,981.82 | | | |
| 352 | Tuckahoe Creek, Md..... | 15,600.00 | | | |
| 352 | La Trapp R., Md..... | 18,831.84 | | | |
| 353 | Tred Avon R., Md..... | 15,200.00 | | | |
| 354 | Tilghman Isld. H., Md..... | 7,820.00 | | | |
| 354 | Claiborne H., Md..... | 53,848.77 | | | |
| 355 | Chester R., Md..... | 74,632.78 | | | |

DISTRICT K.—WASHINGTON, D. C.

| | | | | | |
|-----|---|--------------|-----|----------------------------------|--------------|
| 375 | Patuxent R., Md..... | \$14,000.00 | 395 | Nomini Creek, Va..... | \$96,000.00 |
| 376 | St. Jerome Creek, Md..... | 26,500.00 | 396 | Lower Machodoc Creek, Va..... | 11,180.00 |
| 377 | Potomac R., Va., D. C., and Md..... | 5,997,800.00 | 398 | Dymers Creek, Va..... | 9,000.00 |
| 387 | Breton B., Md. (Leonard- town H.)..... | 53,500.00 | 398 | Rappahannock R., Va..... | 565,145.97 |
| 389 | Shenandoah R., Va. and W. Va..... | 17,500.00 | 400 | Carters Creek, Va..... | 30,588.48 |
| 390 | Accotink B. and Creek, Va..... | 5,000.00 | 401 | Totuskey R., Va..... | 10,000.00 |
| 390 | Ocequan Creek, Va..... | 97,571.44 | 401 | Urbana Creek, Va..... | 66,000.00 |
| 392 | Neabsco Creek, Va..... | 5,000.00 | 403 | Milford Haven, Va..... | 28,000.00 |
| 393 | Aquia Creek, Va..... | 53,000.00 | 404 | York R., Va..... | 284,038.89 |
| 394 | Upper Machodoc Creek, Va..... | 23,200.00 | 405 | Mattaponi R., Va..... | 96,081.31 |
| | | | 406 | Pamunkey R., Va..... | 58,320.37 |
| | | | | Total..... | 7,547,426.46 |

DISTRICT L.—NORFOLK, VA.

| | | | | | |
|-----|--|--------------|-----|---|---------------|
| 414 | Cape Charles City H., Va..... | \$145,000.00 | 428 | Nansemond R., Va..... | \$100,000.00 |
| 415 | Nandua Creek, Va..... | 6,150.00 | 429 | Elizabeth R., Va..... | 455,080.00 |
| 416 | Onancock (H. and) R., Va..... | 34,011.00 | 430 | Norfolk H., Va..... | 3,710,282.00 |
| 417 | Hampton Roads, Va. (Middle Ground Bar)... | 237,500.00 | 434 | Norfolk to Cape Fear R., waterway..... | 1,432,270.00 |
| 418 | Hampton Roads, Va.— Ps., Jamestown Expo- sition..... | 465,000.00 | 440 | North Landing R., N. C. and Va..... | 55,500.00 |
| 418 | Hampton R. (Creek) and Bar, Va..... | 22,000.00 | 441 | Pasquotank R., N. C..... | 7,080.00 |
| 419 | James R., Va..... | 3,125,500.00 | 442 | Perquimans R., N. C..... | 13,750.00 |
| 422 | Archers Hope R., Va..... | 10,000.00 | 442 | Edenton B. and H., N. C..... | 23,000.00 |
| 423 | Jamestown Isld., James R., Va..... | 40,000.00 | 444 | Blackwater R., Va..... | 22,000.00 |
| 423 | Jamestown Isld., Va. (permanent landing p.) | 15,000.00 | 444 | Nottoway (Creek) R., Va..... | 7,000.00 |
| 424 | Chickahominy R., Va..... | 20,000.00 | 445 | Meherrin R., N. C..... | 11,000.00 |
| 424 | Appomattox R., Va. (from Petersburg to mouth)..... | 853,830.00 | 445 | Roanoke R., N. C. and Va..... | 246,000.00 |
| 427 | Pagan R. (Creek), Va..... | 26,470.00 | 447 | Staunton R., Va..... | 52,500.00 |
| | | | 448 | Dan R., N. C. and Va..... | 50,500.00 |
| | | | | Total..... | 11,195,423.00 |

DISTRICT M.—WILMINGTON, N. C.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|--|-------------|---------------------|--|--------------|
| 457 | Mackays Creek, N. C. | \$15,000.00 | 477 | Newbern to Beaufort, N. C. (inland line of navigation between, via Clubfoot, Harlowe, and Newport Rs.) | \$37,000.00 |
| 457 | Scuppernong R., N. C. | 32,000.00 | 478 | Beaufort Inlet, N. C., and waterways to or from. | 82,500.00 |
| 458 | Shallowbag (Manteo) B., N. C. | 14,750.00 | 479 | Cape Lookout, N. C. (H. of refuge at) | 300,000.00 |
| 459 | Albemarle Sound, N. C., and Atlantic Ocean (communication between). (Croatian Sound) | 65,000.00 | 480 | Ocracoke Inlet, N. C. | 238,750.00 |
| 459 | Swan Quarter B. and Deep B., N. C. (waterway connecting) | 14,575.00 | 481 | Morehead City, N. C. (H. at) | 20,000.00 |
| 460 | Pamlico R., N. C. | 303,063.00 | 482 | New R. to Swansboro, N. C. (inland waterway) | 36,830.80 |
| 463 | Fishing Creek, N. C. | 28,250.00 | 483 | New R., N. C. | 92,200.00 |
| 464 | South R. (Creek), N. C. | 16,000.00 | 484 | Cape Fear R., N. C. | 6,047,978.92 |
| 465 | Bay R., N. C. | 22,000.00 | 491 | Northeast Cape Fear R., N. C. | 35,000.00 |
| 465 | Neuse R., N. C. | 386,250.00 | 492 | Lillington R., N. C. | 6,000.00 |
| 467 | Smiths Creek, N. C. | 16,250.00 | 492 | Black R., N. C. | 34,800.00 |
| 467 | Swift Creek, N. C. | 2,100.00 | 493 | Town Creek, Brunswick County, N. C. | 9,500.00 |
| 468 | Contentna Creek, N. C. | 81,000.00 | 494 | Lockwoods Folly R., N. C. | 18,000.00 |
| 469 | Trent R., N. C. | 133,750.00 | 494 | Shallotte R., N. C. | 3,000.00 |
| 471 | Pamlico Sound to Beaufort Inlet, N. C. (inland waterway via Adams Creek) | 517,000.00 | | Total | 8,914,223.72 |
| 472 | Beaufort H., N. C. | 230,676.00 | | | |
| 476 | Beaufort H., N. C., New R. to (waterway) | 75,000.00 | | | |

DISTRICT N.—CHARLESTON, S. C.

| | | | | | |
|-----|--|----------------|-----|--|----------------|
| 501 | Winyah B., S. C. | \$2,927,991.67 | 519 | Charleston H., S. C. | \$5,356,350.00 |
| 503 | Waccamaw R., N. C. and S. C. | 222,700.00 | 522 | Charleston, S. C., and Beaufort, S. C. (inland waterway between) | 50,000.00 |
| 504 | Great Pedee R., N. C. and S. C. | 315,300.00 | 523 | Ashley R., S. C. | 5,500.00 |
| 506 | Little Pedee R., N. C. and S. C. | 46,700.00 | 524 | Wappoo Cut, S. C. | 73,000.00 |
| 507 | Lumber R., N. C. and S. C. | 19,000.00 | 525 | Town Creek, Cooper R., and Stono R., near Charleston, S. C. (removing obstrs.) | 7,500.00 |
| 507 | Yadkin R., N. C. | 107,000.00 | 525 | Fdisto R., S. C. | 33,785.00 |
| 508 | Lynch R. and Clark Creek, S. C. | 2,000.00 | 527 | Ashenoo R., S. C. | 1,300.00 |
| 509 | Clarks (R.) Creek, S. C. | 7,500.00 | 527 | Salkehatchie R., S. C. | 18,000.00 |
| 510 | Mingo Creek, S. C. | 41,600.00 | 528 | Beaufort (Port Royal) R., S. C. | 33,000.00 |
| 511 | Sampit R., Georgetown H., S. C. | 48,500.00 | 529 | Archers Creek, S. C. | 25,000.00 |
| 511 | Santee R. (and Estherville-Minin Creek Canal), S. C. | 382,350.00 | | Total | 10,737,366.49 |
| 513 | Wateree R., S. C. | 181,800.00 | | | |
| 515 | Congaree R., S. C. | 620,199.82 | | | |
| 518 | Charleston H., S. C., and Alligator Creek, opposite McClellanville, S. C. (inland waterways between) | 211,290.00 | | | |

DISTRICT O.—SAVANNAH, GA.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|---|-----------------|---------------------|--|---------------|
| 537 | Savannah R. and H., Ga. | \$11,118,563.58 | 558 | Brunswick (St. Simons Sound) Outer Bar, Ga. | \$310,000.00 |
| 546 | Savannah, Ga., and Fernandina, Fla. (inside water route between)... | 242,500.00 | 558 | Club and Plantation Creeks, Ga. | 40,700.00 |
| 547 | Savannah, Ocmulgee, Flint, and Choctawhatchee Rs. | 10,000.00 | 559 | Brunswick H., Ga. | 1,039,900.00 |
| 547 | St. Augustine Creek (Thunderbolt R.), Ga. | 5,000.00 | 561 | Jekyl Creek, Ga. | 24,000.00 |
| 548 | Cow Head (Cowhead Cut) R., Ga. | 3,000.00 | 561 | Satilla R., Ga. | 10,000.00 |
| 548 | Skidaway Narrows, Ga. | 55,000.00 | 562 | Cumberland Sound and Fernandina, Ga. and Fla. | 3,607,500.00 |
| 548 | Romerly Marsh, Ga. (water route through) | 42,108.77 | 565 | St. Marys R., Ga. and Fla. | 19,450.00 |
| 549 | Sapelo (R. and) H., Ga. | 21,000.00 | 566 | St. Marys, Ga., and St. Johns, Fla. (inland passage between) | 78,000.00 |
| 550 | Darien H., Ga. | 281,161.36 | | Total..... | 17,813,133.71 |
| 552 | Altamaha R., Ga. | 202,000.00 | | | |
| 553 | Oconee R., Ga. | 261,750.00 | | | |
| 555 | Ocmulgee (Ockmulgee, Ockmulhee) R., Ga. | 441,500.00 | | | |

DISTRICT P.—JACKSONVILLE, FLA.

| | | | | | |
|-----|---|--------------|-----|---|---------------|
| 572 | Atlantic Ocean to the Gulf of Mexico (canal between)..... | \$550,400.00 | 592 | Orange R., Fla. | \$6,100.00 |
| 572 | Florida, Louisiana, and Texas waterways (hyacinth removal)..... | 331,580.00 | 593 | Kissimmee R., Fla. | 32,821.00 |
| 575 | Florida R. and H. imps. | 70,000.00 | 594 | Charlotte H. and Peace Creek (R.), Fla. | 126,000.00 |
| 575 | St. Johns R. and Fernandina, Fla. (inside passage between)..... | 7,000.00 | 595 | Peace (Pease) R. (Creek), Fla. | 13,000.00 |
| 575 | St. Johns R., Fla. | 6,255,869.02 | 596 | Tampa B. and Hillsboro B. and R., Fla. | 2,601,956.76 |
| 582 | Ocklawaha (Ocklawaha) R., Fla. | 88,710.00 | 599 | Sarasota B., Fla. | 110,000.00 |
| 584 | St. Augustine H., Fla. | 104,569.80 | 600 | Manatee R., Fla. | 155,108.37 |
| 585 | Indian R., Fla., and connecting waterways..... | 115,500.00 | 601 | St. Petersburg, Fla. (H. at)..... | 32,000.00 |
| 587 | Biscayne B. (Miami), Fla. | 662,500.00 | 602 | Clearwater H. and Boca Ceiga B., Fla. | 70,000.00 |
| 589 | Key West H., Fla. (including entrance thereto)..... | 800,500.00 | 603 | Anclote B., H., and R., Fla. | 56,500.00 |
| 591 | Caloosahatchee R., Fla. | 174,500.00 | 604 | Crystal R., Fla. | 32,000.00 |
| | | | 605 | Withlacoochee R., Fla. | 319,100.00 |
| | | | 606 | Cedar Keys H., Fla. | 104,500.00 |
| | | | 607 | Suwanee R., Fla. | 90,658.00 |
| | | | | Total..... | 12,419,872.95 |

DISTRICT Q.—MONTGOMERY, ALA.

| | | | | | |
|-----|---|--------------|-----|---|--------------|
| 612 | St. Marks R., Fla. | \$37,530.00 | 623 | St. Josephs B., Fla. (entrance to)..... | \$20,000.00 |
| 612 | Ocklockonee (Ochlockonee) R., Ga. and Fla. | 5,000.00 | 624 | St. Andrews B., Fla. | 203,560.00 |
| 613 | Carrabelle Bar and H. (including East Pass), Fla. | 194,204.08 | 624 | Choctawhatchee B. including Santa Rosa Sound Chan., Fla. | 24,000.00 |
| 614 | Apalachicola B., Fla. | 446,250.29 | 625 | Choctawhatchee R., Fla. and Ala. | 226,300.00 |
| 616 | Apalachicola (including Chipola R.) R., Fla. | 181,250.00 | 626 | Holmes R., Fla. and Ala. (and Lagrange Bayou, Fla.)..... | 23,000.00 |
| 618 | Chattahoochee and Flint Rs., Ala., Fla., and Ga. | 1,408,150.00 | 628 | Pensacola H., Fla. | 1,355,956.94 |
| 623 | Gulf of Mexico, n. shore (waterway) | 3,000.00 | 630 | Yellow R., Fla. | 500.00 |
| 623 | Apalachicola R. and St. Andrews B., Fla. (chan. between)..... | 320,000.00 | 630 | Blackwater R., Fla. and Ala. (including Blackwater and East Bs.)..... | 45,000.00 |

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|---|--------------|---------------------|---|--------------|
| 630 | Escambia and Conecuh Rs., Fla. and Ala..... | \$190,500.00 | 641 | Oostenaula and Coosawattee Rs., Ga..... | \$33,155.80 |
| 633 | Alabama R., Ala..... | 1,064,000.00 | 642 | Cahaba R., Ala..... | 45,000.00 |
| 635 | Tallapoosa R., Ala. and Ga..... | 44,000.00 | | Total..... | 8,300,173.44 |
| 635 | Coosa R., Ala. and Ga..... | 2,428,516.33 | | | |
| 640 | Etowah R., Ga..... | 1,300.00 | | | |

DISTRICT R.—MOBILE, ALA.

| | | | | | |
|-----|--|--------------|-----|--|---------------|
| 647 | Mississippi Coast Hs. (dr. for)..... | \$200,000.00 | 668 | Chickasahay R., Miss..... | \$28,250.00 |
| 647 | Mobile Bar, Ala..... | 197,000.00 | 669 | Leaf R., Miss..... | 34,500.00 |
| 648 | Mobile R. and H., Ala..... | 7,031,630.60 | 669 | Bluff Creek, Miss..... | 1,000.00 |
| 651 | Black Warrior, Warrior, and Tombigbee Rs., Ala. and Miss..... | 8,883,832.20 | 670 | Biloxi B. and H., Miss..... | 82,000.00 |
| 662 | Old Town Creek, Miss..... | 3,000.00 | 671 | Ship Isld. H. and Pass, Miss..... | 40,000.00 |
| 663 | Noxubee R., Ala. and Miss..... | 62,000.00 | 672 | Gulfport to Ship Isld. H., Miss. (chan. from)..... | 874,199.85 |
| 664 | Mobile B. and Mississippi Sound, Ala. (chan. connecting)..... | 50,000.00 | 673 | Wolf and Jordan Rs., Miss..... | 40,000.00 |
| 664 | Pascagoula R. and H. Horn Isld. H. and Horn Isld. Pass, Miss.... | 1,255,830.00 | 674 | Pearl R., Miss. and La..... | 385,911.19 |
| | | | 678 | Bogue Chitto, La..... | 28,000.00 |
| | | | | Total..... | 19,197,153.84 |

DISTRICT S.—NEW ORLEANS, LA.

| | | | | | |
|-----|--|--------------|-----|---|---------------|
| 688 | Lake Pontchartrain (including vicinity of Pass Manchac), La..... | \$34,000.00 | 703 | Grossetete Bayou, La..... | \$18,000.00 |
| 689 | Chefunte (Tchefuncte) R. and Bogue Falia (Falaya), La..... | 41,000.00 | 704 | Courtableau Bayou, La..... | 58,700.00 |
| 691 | Tangipahoa R., La..... | 11,500.00 | 705 | Teche Bayou, La..... | 427,200.00 |
| 691 | Ticklaw R. (and tributaries), La..... | 25,157.46 | 708 | Vermilion Bayou, R., and Passes, La..... | 62,100.00 |
| 693 | Amite R. and Bayou Manchac, La..... | 65,494.01 | 709 | Inland waterway, Donaldsonville, La., to Rio Grande, Tex..... | 501,792.00 |
| 694 | Carondelet Canal, La..... | 25,000.00 | 711 | Mermontau (Mermonton) R. and tributaries, La..... | 50,115.25 |
| 694 | Homochitto R., Miss..... | 24,000.00 | 712 | Queue de Tortue Bayou, La..... | 25,000.00 |
| 695 | Plaquemine Bayou, La..... | 2,026,917.34 | 712 | Plaquemine Brule Bayou, La..... | 12,800.00 |
| 699 | Lafourche Bayou, La..... | 270,000.00 | 712 | Calcasieu Pass, Lake, and R., La..... | 649,500.00 |
| 700 | Terrebonne Bayou, La..... | 73,800.00 | | Total..... | 14,967,076.06 |
| 701 | Atchafalaya B. and R., La..... | 540,000.00 | | | |
| 702 | Black Bayou..... | 25,000.00 | | | |

¹ See note on p. 2287 of this index.

DISTRICT T.—DALLAS, TEX.

| | | | | | |
|-----|--|--------------|-----|--|----------------|
| 717 | Sabine Lake, La. and Tex..... | \$781,500.00 | 725 | Trinity R., Tex..... | \$1,805,305.92 |
| 719 | Johnsons Bayou, La..... | 9,500.00 | 729 | Sulphur R., Tex. and Ark..... | 45,988.99 |
| 719 | Sabine R., La. and Tex..... | 48,700.00 | 729 | Jefferson, Tex., and Shreveport, La. (waterway)..... | 100,000.00 |
| 721 | Neches R., Tex. (including sur. of Angelina R., Tex.)..... | 33,000.00 | 730 | Cypress Bayou, La. and Tex..... | 73,500.00 |
| 721 | Port Arthur Canal, Tex. (operating and care)..... | 309,069.53 | | Total..... | 8,283,114.44 |
| 722 | Sabine Pass H., Tex..... | 5,076,550.00 | | | |

DISTRICT U.—GALVESTON, TEX.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|--|---------------|---------------------|---|---------------|
| 735 | Sabine, Galveston, Pass Cavallo, Velasco, Brazos Santiago, and Corpus Christi Hs., and Sabine, Brazos, and Trinity Rs..... | \$7,000.00 | 754 | West Galveston B., Tex.. | \$218,529.00 |
| 736 | Galveston to Port Bolivar, Tex. (chan.)..... | 241,080.00 | 755 | Chocolate Bayou, Tex.... | 21,353.25 |
| 737 | Galveston B. to Sabine Lake, Tex..... | 3,000.00 | 756 | Bastrop Bayou, Tex..... | 18,730.29 |
| 737 | East Bay Bayou, Tex. (including chan. across Hannas Reef)..... | 3,299.67 | 756 | Inland waterway, coast of Texas—West Galveston B. to Rio Grande R..... | 604,555.33 |
| 738 | Double Bayou, Tex..... | 25,952.65 | 760 | Oyster Creek, Tex..... | 10,000.00 |
| 739 | Anahusc Chan., Tex..... | 24,100.00 | 760 | Brazos R., Tex..... | 1,676,250.00 |
| 739 | Turtle Bayou, Tex..... | 10,000.00 | 765 | Colorado R., Tex..... | 20,000.00 |
| 740 | Cedar Bayou, Tex..... | 52,750.00 | 767 | Pass Cavallo to Port Lavaca, Tex. (chan.)..... | 10,000.00 |
| 740 | Galveston Ship Chan. and Buffalo Bayou, Tex..... | 3,597,326.85 | 767 | Pass Cavallo H. and Inlet..... | 327,500.00 |
| 745 | Clear Creek, Tex..... | 27,480.16 | 768 | Guadalupe R., Tex..... | 232,700.00 |
| 746 | Dickinson Bayou, Tex..... | 20,739.48 | 769 | San Antonio R., Tex..... | 1,500.00 |
| 746 | Galveston H. to Texas City, Tex. (chan.)..... | 610,000.00 | 769 | Aransas Pass, Tex..... | 2,653,750.00 |
| 747 | Galveston, Tex..... | 13,803,000.00 | 773 | Aransas Pass to Corpus Christi, Tex. (including Turtle Cove Chan.)..... | 284,610.17 |
| | | | 773 | Brazos Santiago H., Tex.. | 233,500.00 |
| | | | 775 | Rio Grande R., Tex., Mex., and N. Mex..... | 21,735.00 |
| | | | | Total..... | 24,780,441.85 |

DISTRICT X.—VICKSBURG, MISS.

| | | | | | |
|-----|--|--------------|-----|--|---------------------------|
| 785 | Pierre Bayou, Miss..... | \$5,000.00 | 807 | Roundaway and Vidal Bayous, La..... | \$2,000.00 |
| 786 | Big Black R., Miss..... | 15,000.00 | 807 | Boeuf R., Ark. and La..... | 81,169.22 |
| 786 | Yazoo R., Miss..... | 475,000.00 | 808 | Bartholomew Bayou, Ark. and La..... | 79,000.00 |
| 788 | Tchula Lake, Miss..... | 38,000.00 | 810 | Saline R., Ark..... | 30,400.00 |
| 789 | Yalobusha (Yallabusha) R., Miss..... | 11,000.00 | 810 | Little Missouri R., Ark..... | 20,000.00 |
| 789 | Tallahatchie and Coldwater Rs., Miss..... | 135,878.78 | 811 | D'Arbonne and Corney (Corney or Cornie R.) Bayous, La..... | 32,600.00 |
| 792 | Bear Creek (branch of the Yazoo R.), Miss..... | 4,540.66 | 812 | Little R., La..... | 2,500.00 |
| 792 | Big Sunflower R., Miss..... | 307,365.51 | 812 | Loggy Bayou, Lake Bistenau, and Lake Dorcheat, La..... | 5,000.00 |
| 794 | Steele and Washington Bayous, and Lake Washington, Miss..... | 21,549.81 | 813 | Pierre Bayou, La..... | 8,600.00 |
| 795 | Red R., La., Tex., and Ark..... | 3,369,877.50 | 813 | Cane R., La..... | 4,500.00 |
| 802 | Black and Ouachita Rs., La. and Ark..... | 2,926,869.00 | | Total..... | ¹ 7,648,350.48 |
| 805 | Tensas R. and Bayou Macon, La..... | 72,500.00 | | | |

DISTRICT Y.—LITTLE ROCK, ARK.

| | | | | | |
|-----|---|----------------|-----|--|---------------------------|
| 818 | Arkansas R., Ark., Okla., and Kans..... | \$3,279,141.87 | 835 | Current R., Ark. and Mo. | \$59,835.00 |
| 825 | Petit Jean R., Ark..... | 9,500.00 | 836 | Little Red R., Ark..... | 8,405.14 |
| 826 | Fourche Le Fevre R. (Fourche La Faive (Feve)), Ark..... | 33,500.00 | 836 | St. Francis R., Ark. and Mo..... | 241,737.53 |
| 827 | White, Black, Little Red, and St. Francis Rs., Ark..... | 236,500.00 | 839 | Little R., Ark. and Mo. (from Homersville to its junction with the St. Francis)..... | 8,000.93 |
| 829 | White R., Ark..... | 1,509,499.32 | 840 | L'Anguille R., Ark..... | 17,000.00 |
| 833 | Cache R., Ark..... | 32,000.00 | | Total..... | ¹ 5,643,769.79 |
| 834 | Black R., Ark. and Mo..... | 208,650.00 | | | |

¹ See note p. 2287 of this index.

DISTRICT AA.1-CHATTANOOGA AND NASHVILLE, TENN.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|---|---------------|---------------------|---|-----------------|
| 851 | Wolf R., Tenn..... | \$35,000.00 | 872 | French Broad and Little Pigeon Rs., N. C. and Tenn..... | \$185,000.00 |
| 851 | Hatchee (Big Hatchie) R., Tenn..... | 35,500.00 | 874 | Holston R., Tenn. and Va..... | 6,017.17 |
| 852 | Obion R., Tenn..... | 29,618.50 | 875 | Clinch R., Tenn. and Va.. | 61,825.43 |
| 853 | Forked Deer R., Tenn..... | 37,818.50 | 877 | Elk R., Ala. and Tenn... | 4,000.00 |
| 855 | Tennessee R., Ky., Tenn., and Ala..... | 10,114,506.28 | 877 | Duck R., Tenn..... | 13,000.00 |
| 869 | Mississippi to Atlantic. ("Transportation Routes to Seaboard," Tennessee R., Coosa R., Ocmulgee R., Altamaha R., and Hiwassee R.) | 46,000.00 | 878 | Cumberland R., Ky. and Tenn..... | 5,225,715.54 |
| 870 | Hiwassee (Hiwassee) R., Tenn..... | 126,282.40 | 886 | Caney Fork R., Tenn..... | 28,000.00 |
| 871 | Little Tennessee R., Tenn..... | 7,000.00 | 887 | Obey (Obeyes) R., Tenn..... | 11,500.00 |
| | | | 887 | Cumberland R., Ky. (S. Fork)..... | 12,000.00 |
| | | | 888 | Red R., Tenn..... | 5,000.00 |
| | | | | Total..... | 1 15,983,783.82 |

DISTRICT BB.1-LOUISVILLE, KY.

| | | | | | |
|-----|-------------------------------|--------------|-----|---------------------------|----------------|
| 891 | Tradewater R., Ky..... | \$16,500.00 | 898 | Wabash R., Ill. and Ind.. | \$902,858.02 |
| 892 | Green and Barren Rs., Ky..... | 2,388,888.79 | 902 | White R., Ind..... | 120,000.00 |
| 896 | Rough R., Ky..... | 125,362.74 | | Total..... | 1 3,553,609.55 |

DISTRICT CC.1-FIRST CINCINNATI, OHIO.

| | | | | | |
|-----|---|-----------------|--|--|--|
| 912 | Grand total of appropriations for Ohio R..... | \$41,696,492.66 | | | |
|-----|---|-----------------|--|--|--|

DISTRICT DD.1-SECOND CINCINNATI, OHIO.

| | | | | | |
|-----|----------------------------------|----------------|-----|-------------------------|-----------------|
| 963 | Kentucky R..... | \$6,317,848.26 | 974 | Muskingum R., Ohio..... | \$2,273,675.79 |
| 967 | Licking R., Ky..... | 16,000.00 | | Total..... | 1 10,530,000.48 |
| 969 | Big Sandy R., Ky. and W. Va..... | 1,922,476.43 | | | |

DISTRICT EE.1-WHEELING, W. VA.

| | | | | | |
|-----|--------------------------------------|--------------|-----|-------------------------------|----------------|
| 985 | Guyandot (Guyandotte) R., W. Va..... | \$27,500.00 | 996 | Elk R., W. Va..... | \$31,000.00 |
| 986 | Kanawha R., W. Va..... | 5,561,647.03 | 997 | Little Kanawha R., W. Va..... | 595,941.86 |
| 994 | New R., Va. and W. Va.. | 112,000.00 | | Total..... | 1 6,343,088.89 |
| 995 | Gauley R., W. Va..... | 15,000.00 | | | |

1 See note on p. 2287 of this index.

DISTRICT FF.1—PITTSBURGH, PA.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|------------------------------------|-----------------|---------------------|------------------------|----------------------------|
| 1003 | Monongahela R., Pa. and W. Va..... | \$11,773,201.00 | 1013 | Pittsburgh H., Pa..... | \$168,662.90 |
| 1011 | Buckhannon R., W. Va..... | 5,500.00 | 1014 | Allegheny R., Pa..... | 2,651,624.68 |
| 1012 | Cheat R., W. Va..... | 13,000.00 | | Total..... | ¹ 14,721,988.58 |
| 1012 | Youghiogheny R., Pa..... | 110,000.00 | | | |

DISTRICT GG.1—KANSAS CITY, MO.

| | | | | | |
|------|---|------------------------------|------|--|----------------------------|
| 1037 | Missouri R., Mo., Kans., Nebr., Iowa, S. Dak., N. Dak., and Mont..... | ¹ \$15,497,578.35 | 1062 | Republican and Smoky Hill Rs. (Fort Riley Military Reservation), Kans..... | \$33,500.00 |
| 1060 | Yellowstone R., N. Dak., Mont., and Wyo..... | 128,750.00 | 1063 | Osage R., Mo..... | 1,035,000.00 |
| 1061 | Wyoming and Colorado (arid regions)..... | 5,000.00 | 1065 | Gasconade R., Mo..... | 172,000.00 |
| 1062 | Kansas R., Kans..... | 7,000.00 | | Total..... | ¹ 16,878,828.35 |

DISTRICT HH.1—MISSISSIPPI RIVER.

| | | | | | |
|------|--|-------------------------------|--|--|--|
| 1089 | Grand total apps. for the Mississippi R..... | ¹ \$148,992,955.71 | | | |
|------|--|-------------------------------|--|--|--|

DISTRICT II.1—ST. LOUIS, MO.

| | | | | | |
|------|------------------------|--------------------------|--|--|--|
| 1229 | Kaskaskia R., Ill..... | ¹ \$10,500.00 | | | |
|------|------------------------|--------------------------|--|--|--|

DISTRICT JJ.1—ROCK ISLAND, ILL.

| | | | | | |
|------|--|--------------|------|--------------------|---------------------------|
| 1235 | Rock R., Ill. and Wis..... | \$1,000.00 | 1243 | Cuivre R., Mo..... | \$12,000.00 |
| 1235 | Illinois and Mississippi Canal, Ill..... | 8,653,311.56 | | Total..... | ¹ 8,940,546.26 |
| 1241 | Galena R., Ill..... | 273,234.70 | | | |
| 1243 | Des Moines and Iowa Rs., Iowa..... | 1,000.00 | | | |

DISTRICT KK.1—ST. PAUL, MINN.

| | | | | | |
|------|--|--------------|------|--|---------------------------|
| 1249 | Chippewa R., Wis..... | \$208,214.86 | 1259 | Otter Tail Lake and R., Red Lake and Red Lake R., Big Stone Lake and Lake Traverse, Minn. and S. Dak., Minn..... | \$13,000.00 |
| 1251 | St. Croix Lake and R., Minn. and Wis..... | 158,565.00 | 1261 | Warroad H. and R., Minn..... | 111,900.00 |
| 1253 | Lake Minnetonka, Minn. (sur.)..... | 7,000.00 | 1262 | Zippel (R.) B., Minn..... | 27,781.00 |
| 1254 | Minnesota R., Minn..... | 146,200.00 | | Total..... | ¹ 1,063,293.86 |
| 1256 | Red River of the North, Dak. and Minn..... | 383,123.00 | | | |
| 1259 | Lake Traverse, Minn. and S. Dak..... | 7,510.00 | | | |

¹ See note on p. 2287 of this index.

DISTRICT LL.—DULUTH, MINN.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|--|--------------|---------------------|--|---------------|
| 1265 | Grand Marais H., Minn. | \$174,350.00 | 1284 | Ontonagon H., Mich. | \$423,500.00 |
| 1267 | Grand Marais, Mich. (H. of refuge) | 535,598.32 | 1286 | Eagle H., Mich. | 97,000.00 |
| 1269 | Agate B. H., Minn. | 260,852.88 | 1288 | Keweenaw Waterway, Mich. | 2,049,814.21 |
| 1271 | Duluth - Superior H., Minn. and Wis. | 7,317,648.69 | 1291 | Marquette H., Mich. | 885,230.00 |
| 1280 | Lake Superior to Mississippi R. (canal). | 10,000.00 | 1293 | Presque Isle Pt., Marquette B., Mich. (H. of refuge at). | 62,500.00 |
| 1281 | Port Wing H., Wis. | 69,992.00 | | Total..... | 12,455,966.10 |
| 1282 | Ashland H., Wis. | 569,500.00 | | | |

DISTRICT MM.—MILWAUKEE, WIS.

| | | | | | |
|------|--|--------------|------|--|---------------|
| 1297 | Manistique H., Mich. | \$344,462.00 | 1322 | Kewaunee H., Wis. | \$270,800.00 |
| 1298 | Gladstone H. (Little Bay de Noc), Mich. | 14,000.00 | 1324 | Two Rivers (East and West Twin Rs.) H., Wis. | 346,600.00 |
| 1299 | Cedar R. H., Mich. | 30,000.00 | 1326 | Manitowoc H., Wis. | 946,560.00 |
| 1300 | Menominee H. and R., Mich. and Wis. | 427,420.00 | 1328 | Sheboygan H., Wis. | 791,168.12 |
| 1302 | Oconto H., Wis. | 171,000.00 | 1331 | Port Washington (Ozaukee) H., Wis. | 241,400.00 |
| 1304 | Pensaukee H. and R., Wis. | 16,000.00 | 1333 | Milwaukee, Wis. | 2,473,975.36 |
| 1304 | Green B. H., Wis. | 602,078.39 | 1337 | Milwaukee and Rock R. Canal, Wis. | 225,276.83 |
| 1306 | Fox and Wisconsin Rs., Wis. | 5,495,403.24 | 1338 | South Milwaukee H., Wis. | 5,000.00 |
| 1315 | Wolf R., Wis. | 1,500.00 | 1338 | Racine H., Wis. | 808,719.67 |
| 1316 | Lake Winnebago (Fox R.), Wis. | 3,900.00 | 1341 | Kenosha (Southport) H., Wis. | 564,807.41 |
| 1317 | Sturgeon B. and Lake Michigan Canal and H. of Refuge, Wis. | 978,917.42 | 1343 | Waukegan H., Ill. | 690,500.00 |
| 1320 | Ahnapee (Algoma) H. and R., Wis. | 354,000.00 | | Total..... | 15,808,488.44 |

DISTRICT NN.—CHICAGO, ILL.

| | | | | | |
|------|--|----------------|------|--|---------------|
| 1349 | Illinois R., Ill. | \$2,740,006.26 | 1367 | Indians H., Ind. | \$87,000.00 |
| 1356 | Chicago H., Ill. | \$,636,005.00 | 1368 | Michigan City H., Ind. | 1,824,338.92 |
| 1359 | Chicago R., Ill. | 1,666,457.00 | 1371 | Lake Michigan to Wabash R., Ind. and Ohio (canal). | 2,000.00 |
| 1361 | Calumet H., Ill. | 1,597,230.00 | 1372 | New Buffalo H., Mich. | 83,000.00 |
| 1364 | Calumet R. (including "Grand" Calumet R.), Ill. and Ind. | 1,273,500.00 | | Total..... | 12,917,537.18 |
| 1366 | Wolf Lake and R., Ill. and Ind. (Wolf Lake Cut; Wolf Lake Outlet). | 8,000.00 | | | |

DISTRICT OO.—GRAND RAPIDS, MICH.

| | | | | | |
|------|--------------------------------------|--------------|------|---|----------------|
| 1378 | St. Joseph H. and R., Mich. | \$926,063.00 | 1402 | Ludington (Pere Marquette) H., Mich. | \$1,582,022.00 |
| 1382 | South Haven H., Mich. | 500,300.00 | 1404 | Manistee H., Mich. | 665,000.00 |
| 1385 | Saugatuck H. and Kalamazoo R., Mich. | 550,939.00 | 1407 | Portage Lake (Manistee County), Mich. (H. of refuge). | 395,500.00 |
| 1388 | Holland (Black Lake) H., Mich. | 770,767.31 | 1408 | Arcadia H., Mich. | 40,000.00 |
| 1390 | Grand Haven H., Mich. | 1,065,251.15 | 1409 | Frankfort (Aux Bacs Seies) H., Mich. | 506,274.85 |
| 1393 | Grand R. (below Grand Rapids), Mich. | 513,000.00 | 1412 | Charlevoix H. and Entrance to Pine Lake, Mich. | 226,500.00 |
| 1395 | Muskegon H., Mich. | 881,500.00 | 1414 | Petoskey H., Mich. | 145,500.00 |
| 1398 | White Lake H. (White R. H.), Mich. | 373,550.00 | | Total..... | 9,476,987.31 |
| 1400 | Pentwater H., Mich. | 334,820.00 | | | |

DISTRICT PP.—DETROIT, MICH.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|---|----------------|---------------------|--|---------------|
| 1420 | Great Lakes ("Ship Chan. connecting Waters of the Great Lakes") | \$3,365,000.00 | 1444 | Black R., Port Huron at mouth, and vicinity of Black R. mouth in St. Clair R., Mich. | \$169,000.00 |
| 1422 | St. Marys R. and St. Marys Falls Canal, Mich. | 23,464,591.68 | 1446 | Pine R., at St. Clair City, Mich. | 15,560.00 |
| 1430 | Mackinac H., Mich. | 60,000.00 | 1447 | Belle R., Marine City (including ice H. of refuge), Mich. | 29,000.00 |
| 1431 | Cheboygan H., Mich. | 198,500.00 | 1448 | St. Clair Flats and Ship Canal, Mich. | 1,374,235.44 |
| 1432 | Rogers City H., Mich. | 6,000.00 | 1451 | Clinton R., Mich. | 89,564.00 |
| 1433 | Alpena H. (Thunder B. R.), Mich. | 70,500.00 | 1452 | Detroit R., Mich. | 11,849,500.00 |
| 1434 | Ausable H. and R., Mich. | 113,970.00 | 1455 | Rouge R., Mich. | 101,690.00 |
| 1435 | Saginaw R., Mich. | 1,418,750.00 | 1457 | Monroe H. (Raisin R.), Mich. | 262,015.27 |
| 1438 | Sebewaing H. (R.), Saginaw B., Mich. | 59,000.00 | 1458 | La Plaisance B., Mich. | 19,713.96 |
| 1441 | Harbor Beach, Lake Huron, Mich. (H. of refuge) | 2,053,500.00 | | Total..... | 44,770,090.35 |

DISTRICT QQ.—CLEVELAND, OHIO.

| | | | | | |
|------|---|----------------|------|--------------------------------------|---------------|
| 1461 | Toledo H. (Maumee B.), Ohio..... | \$2,931,700.00 | 1472 | Vermilion H., Ohio..... | \$167,601.28 |
| 1464 | Maumee R. (above Toledo), Ohio..... | 7,000.00 | 1474 | Lorain (Black R.) H., Ohio..... | 1,218,204.77 |
| 1465 | Wabash and Erie Canal, Ind. and Ohio..... | 28,337.55 | 1477 | Rocky R. H., Ohio..... | 39,000.00 |
| 1465 | Lake Erie to Ohio R. (canal through the State of Ohio)..... | 20,119.47 | 1478 | Cleveland H., Ohio..... | 7,624,631.61 |
| 1466 | Port Clinton H., Ohio..... | 108,000.00 | 1482 | Fairport H. (Grand R. H.), Ohio..... | 1,206,107.71 |
| 1468 | Sandusky R., Ohio..... | 58,000.00 | 1485 | Big (Cunningham Creek), Ohio..... | 19,763.12 |
| 1468 | Sandusky City H., Ohio..... | 1,297,192.00 | 1485 | Ashtabula H., Ohio..... | 2,080,499.31 |
| 1471 | Huron H., Ohio..... | 561,773.71 | 1488 | Conneaut H., Ohio..... | 1,272,597.59 |
| | | | | Total..... | 18,640,528.12 |

DISTRICT RR.—BUFFALO, N. Y.

| | | | | | |
|------|---|----------------|------|---|---------------|
| 1494 | Erie H., Pa..... | \$1,538,156.56 | 1520 | New York Hs. (Hs. on the southern shore of Lake Ontario, between Genesee and Oswego Rs.)..... | \$400.00 |
| 1498 | Portland H., N. Y..... | 56,616.00 | 1521 | Pultneyville H., N. Y..... | 85,000.00 |
| 1498 | Dunkirk H., N. Y..... | 1,089,112.38 | 1522 | Great Sodus H., N. Y..... | 607,784.80 |
| 1501 | Cattaraugus Creek, N. Y..... | 57,410.00 | 1524 | Little Sodus B. H., N. Y..... | 530,441.77 |
| 1501 | Buffalo and Black Rock Hs., N. Y..... | 11,429,138.21 | 1526 | Oswego H., N. Y..... | 2,658,612.87 |
| 1509 | Niagara R., N. Y..... | 789,762.50 | 1531 | Sandy Creek (Big), N. Y..... | 300.00 |
| 1512 | Great Lakes to New York City ("Transportation Routes to Seaboard")..... | 60,000.00 | 1531 | Port Ontario H. (Salmon R.), N. Y..... | 50,000.00 |
| 1513 | Great Lakes, Ship Canal from, to the Hudson R. (sur.)..... | 495,000.00 | 1532 | Sacketts H., N. Y..... | 20,000.00 |
| 1514 | Wilson H., N. Y..... | 74,750.00 | 1532 | Black R., N. Y..... | 45,401.00 |
| 1515 | Olcott H., N. Y..... | 179,500.00 | 1533 | St. Lawrence R..... | 116,000.00 |
| 1516 | Oak Orchard H., N. Y..... | 207,250.00 | 1534 | Cape Vincent H., N. Y..... | 164,000.00 |
| 1518 | Charlotte H., mouth of Genesee R., N. Y..... | 883,556.77 | 1536 | Ogdensburg H., N. Y..... | 536,938.29 |
| | | | 1537 | Waddington H., N. Y..... | 35,500.00 |
| | | | 1538 | Grasse R., Massena, N. Y..... | 9,000.30 |
| | | | | Total..... | 21,719,631.45 |

DISTRICT SS.—LOS ANGELES, CAL.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------|--|--------------|---------------------|------------------------------|--------------|
| 1543 | Colorado R., Ariz., Cal., and Nev..... | \$35,000.00 | 1551 | San Luis Obispo H., Cal..... | \$522,660.00 |
| 1545 | San Diego H., Cal..... | 845,350.00 | | | |
| 1547 | Los Angeles R., Cal..... | 5,753,250.00 | | Total..... | 7,156,260.00 |

DISTRICT TT.—FIRST SAN FRANCISCO, CAL.

| | | | | | |
|------|--|--------------|------|--------------------------------|--------------|
| 1556 | Pacific coast (H. of refuge)..... | \$150,000.00 | 1565 | San Pablo B., Cal..... | \$875,168.41 |
| 1557 | Monterey B. and H., Cal..... | | 1566 | Napa R., Cal..... | 58,929.36 |
| 1558 | San Francisco H., Cal..... | 200,000.00 | 1567 | Petaluma Creek, Cal..... | 131,898.00 |
| 1561 | Alviso Creek, H., R., and Slough, Cal..... | 515,927.84 | 1570 | Humboldt H. and B., Cal..... | 2,855,615.00 |
| 1562 | Oakland H., San Francisco B., Cal..... | 58,000.00 | 1572 | Redwood Creek and H., Cal..... | 43,800.00 |
| 1564 | Suisun Creek (or Chan.), Cal..... | 3,963,803.00 | | Total..... | 8,865,641.61 |
| | | 12,500.00 | | | |

DISTRICT UU.—THIRD SAN FRANCISCO, CAL.

| | | | | | |
|------|-----------------------------------|----------------|------|--------------------------------------|----------------|
| 1577 | San Joaquin R., Cal..... | \$1,006,065.00 | 1585 | Sacramento and Feather Rs., Cal..... | \$1,092,000.00 |
| 1580 | California Débris Commission..... | 1,470,124.09 | | | |
| 1584 | Mokelumne R., Cal..... | 30,000.00 | | Total..... | 3,598,189.09 |

DISTRICT VV.—FIRST PORTLAND, OREG.

| | | | | | |
|------|--|--------------|------|--|----------------|
| 1594 | Oregon and Washington, coast of (dr. plant)..... | \$100,000.00 | 1608 | Nestucca R., Oreg..... | \$6,000.00 |
| 1596 | Coquille R., Oreg..... | 442,000.00 | 1608 | Tillamook Bar and B., Oreg..... | 247,200.00 |
| 1599 | Coos B. and H., Oreg..... | 1,424,640.00 | 1610 | Nehalem B. (Bar and R.), Oreg..... | 110,000.00 |
| 1602 | Coos R., Oreg..... | 22,000.00 | 1611 | Snake R., Oreg., Wash., and Idaho..... | 45,000.00 |
| 1603 | Umpqua R., Oreg..... | 39,501.47 | 1612 | Clearwater R., Idaho..... | 50,000.00 |
| 1604 | Siuslaw R. (and B. and Bar), Oreg..... | 327,000.00 | | Total..... | 1 3,531,341.47 |
| 1605 | Alsea B., H., and R., Oreg..... | 3,000.00 | | | |
| 1606 | Yaquina B., Oreg..... | 715,000.00 | | | |

DISTRICT WW.—SECOND PORTLAND, OREG.

| | | | | | |
|------|--|-----------------|------|------------------------|-----------------|
| 1616 | Columbia R., Oreg., Wash., and Idaho..... | \$22,710,257.68 | 1648 | Long Tom R., Oreg..... | \$3,500.00 |
| 1640 | Youngs and Klaskanine (Klaskanine) Rs., Oreg..... | 1,600.00 | 1649 | Lewis R., Wash..... | 30,350.00 |
| 1641 | Clatskanie R., Oreg..... | 19,200.00 | 1650 | Cowlitz R., Wash..... | 87,250.00 |
| 1642 | Willamette R..... | 1,080,500.00 | 1651 | Grays R., Wash..... | 3,500.00 |
| 1647 | Yamhill R., Oreg..... | 40,644.49 | | Total..... | 1 23,976,802.17 |

1 See note on p. 2287 of this index.

DISTRICT XX.1—SEATTLE, WASH.

| Page of this index. | Waterway. | Total. | Page of this index. | Waterway. | Total. |
|---------------------------|---|--------------|---------------------------|---|-----------------|
| 1657 | Naselle R., Wash..... | \$1,500.00 | 1673 | Snohomish R., Wash..... | \$181,500.00 |
| 1657 | Willapa (Shoalwater) R. and H., Wash..... | 236,350.00 | 1673 | Skagit R., Wash..... | 115,000.00 |
| 1659 | Grays H., Wash..... | 3,059,500.00 | 1674 | Swinomish Slough, Wash. | 225,000.00 |
| 1661 | Chehalis R., Wash..... | 19,000.00 | 1675 | Bellingham B. and H., Wash. (including New Whatcom H., Fair- haven)..... | 152,250.00 |
| 1662 | Hoquiam R., Wash..... | 12,000.00 | 1676 | Pend O'Reille R., Idaho and Wash..... | 42,500.00 |
| 1664 | Puget Sound and its tribu- taries (Skagit, Stila- guamish, Nooksack, Snohomish, and Sno- qualmie Rs.), Wash.... | 510,000.00 | 1677 | Flathead R. and Pend O'Reille R., Mont..... | 10,000.00 |
| 1666 | Puget Sound, Wash. (wa- terway to connect with Lakes Union, Samma- mish, and Washington). | 1,290,000.00 | 1678 | Polson B., Flathead Lake, Mont..... | 6,000.00 |
| 1667 | Hammersley Inlet, Puget Sound, Wash..... | 9,000.00 | 1678 | Kootenai R., Idaho and Mont..... | 10,000.00 |
| 1668 | Puget Sound, Wash. (in- spection of fish traps)... | 35,000.00 | 1679 | Okanogan R., Wash..... | 40,000.00 |
| 1669 | Olympia H., Wash..... | 205,000.00 | 1680 | Portland Chan. (Canal), Alaska..... | 5,000.00 |
| 1669 | Tacoma H., Wash..... | 415,000.00 | 1680 | Yukon R., Alaska..... | 130,000.00 |
| 1672 | Everett H., Wash..... | 422,000.00 | 1681 | St. Michael Canal, Alaska. | 391,000.00 |
| | | | | Total..... | \$ 7,522,600.00 |

¹ See note at head of this table.

DISTRICT YY.1—PORTO RICO, HAWAII, AND THE PHILIPPINES.

| | | | | | |
|------|--|--------------|------|------------------------------------|-----------------|
| 1687 | San Juan H., Porto Rico.. | \$777,500.00 | 1690 | Kahului H., Maui, Ha- waii..... | \$400,000.00 |
| 1688 | Honolulu H., Hawaii..... | 975,000.00 | 1690 | Hilo H., Hawaii..... | 1,026,000.00 |
| 1689 | Honolulu, Hawaii (recla- mation of Quarantine Isld)..... | 20,000.00 | | Total..... | \$ 3,298,500.00 |
| 1689 | Pearl H., Hawaii..... | 100,000.00 | | Grand total..... | 720,051,987.93 |

¹ See note on p. 2287 of this index.

NOTE.—See p. 1691 for Manila H. app.

TABLE 12.—Totals of river and harbor appropriations, by districts, as detailed in this index, pages 28 to 1690.

| District. | Offices. | Total. | District. | Offices. | Total. |
|-----------|---|----------------|-----------|-------------------------|----------------|
| A | Portland, Me..... | \$7,490,686.99 | BB | Louisville, Ky..... | \$3,553,609.55 |
| B | Boston, Mass..... | 17,860,649.93 | CC | (Ohio R.)..... | 41,696,492.66 |
| C | Newport, R. I..... | 9,740,889.65 | DD | Cincinnati, Ohio..... | 10,530,000.48 |
| D | New London, Conn..... | 6,737,241.88 | EE | Wheeling, W. Va..... | 6,343,088.89 |
| E | New York, N. Y..... | 18,018,179.77 | FF | Pittsburgh, Pa..... | 14,721,988.58 |
| F | New York, N. Y..... | 14,904,606.35 | GG | Kansas City, Mo..... | 16,878,828.35 |
| G | New York, N. Y..... | 5,561,568.00 | HH | (Mississippi R.)..... | 148,922,955.71 |
| H | Philadelphia, Pa..... | 24,509,451.31 | II | St. Louis, Mo..... | 10,500.00 |
| I | Wilmington, Del..... | 4,916,007.64 | JJ | Rock Isld., Ill..... | 8,940,546.26 |
| J | Baltimore, Md..... | 10,642,435.50 | KK | St. Paul, Minn..... | 1,063,293.86 |
| K | Washington, D. C..... | 7,547,426.46 | LL | Duluth, Minn..... | 12,455,986.10 |
| L | Norfolk, Va..... | 11,195,423.00 | MM | Milwaukee, Wis..... | 15,803,488.44 |
| M | Wilmington, N. C..... | 8,914,223.72 | NN | Chicago, Ill..... | 12,917,537.18 |
| N | Charleston, S. C..... | 10,737,366.49 | OO | Grand Rapids, Mich..... | 9,476,987.31 |
| O | Savannah, Ga..... | 17,813,133.71 | PP | Detroit, Mich..... | 44,770,090.35 |
| P | Jacksonville, Fla..... | 12,419,872.95 | QQ | Cleveland, Ohio..... | 18,640,528.12 |
| Q | Montgomery, Ala..... | 8,300,173.44 | RR | Buffalo, N. Y..... | 21,719,631.45 |
| R | Mobile, Ala..... | 19,197,153.84 | SS | Los Angeles, Cal..... | 7,156,260.00 |
| S | New Orleans, La..... | 4,967,076.06 | TT | San Francisco, Cal..... | 8,865,641.61 |
| T | Dallas, Tex..... | 8,283,114.44 | UU | San Francisco, Cal..... | 3,598,180.00 |
| U | Galveston, Tex..... | 24,780,441.85 | VV | Portland, Oreg..... | 3,531,341.47 |
| V | See District HH below. | | WW | Portland, Oreg..... | 23,976,802.17 |
| W | See District HH below. | | XX | Seattle, Wash..... | 7,522,600.00 |
| X | Vicksburg, Miss..... | 7,648,350.48 | YY | (Insular)..... | 3,298,500.00 |
| Y | Little Rock, Ark..... | 5,643,769.79 | | | |
| Z | See District HH below. | | | | |
| AA | Chattanooga and Nash- ville, Tenn..... | 15,983,783.82 | | Grand total..... | 730,277,914.70 |

NOTE.—The grand total in this table is merely the total up to 1912 of the amounts reported by the district officers in their individual annual reports, and it is not, hence, to be compared with the grand total of Tables 1-10 (\$850,551,708.25), which covers up to 1915, etc.

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

SECTION 6.—ALPHABETICAL LIST OF ENGINEERS IN DIRECT
CHARGE OF RIVER AND HARBOR WORKS.

NOTE.—The abstracts of reports on river and harbor works embraced within Part I (Rivers and Harbors) of this index give the names of the engineers in charge of each work under the subhead "In charge."

The following is an alphabetical list of those names. The list is so arranged that it shows the last title of the officer or engineer, the period within which he was probably in charge of river and harbor works, and the district or districts within which lie the river and harbor works reported upon by the officer. (See also p. 21 of this index.)

The districts in the last column are named in the order which indicates, approximately, the changes of station of the engineer in charge. It is desirable to lay emphasis on the fact that the last column does not contain a list of the districts of which the engineer named had charge; the list is of the districts embracing the waterways reported upon by the engineer officer, as those districts are shown now on the frontispiece map of this index. It should be borne in mind that with the growth of the work of the Corps of Engineers it was necessary to change the limits of the districts from time to time. As said at the beginning of this paragraph, however, the districts as named show approximately the order in which the engineer officer assumed charge of works throughout the United States.

| Name of engineer officer. | Rank. | Period. | Reports, as engineer in charge, on waterways in the following districts. |
|---------------------------|----------|-----------|--|
| Abbot, F. V. | Col. | 1883-1912 | HH, N, HH, KK, E, B, C. |
| Abert, J. J. | Col. | 1844 | RR. |
| Adams, E. M. | Capt. | 1901-1910 | S, T, HH, N. |
| Adams, H. M. | Lt. Col. | 1871-1905 | U, HH, D, E, F, G, HH, RR, T, HH, P, X, S, R. |
| Adams, M. B. | Col. | 1873-1906 | CC, RR, QQ, Y, E, AA, NN; OO, LL, MM. |
| Alexander, B. S. | Lt. Col. | 1865-1874 | A, SS, TT. |
| Allen, C. J. | Lt. Col. | 1866-1903 | RR, HH, KK, LL, GG, U, HH, II, L, K. |
| Altstaeter, F. W. | Capt. | 1908-1912 | CC, EE. |
| Anderson, J. | Lt. Col. | 1827 | D. |
| Bache, H. | Maj. | 1839-1853 | H. |
| Barden, W. J. | Capt. | 1903 | AA. |
| Barlow, J. W. | Col. | 1871-1901 | D, F, E, C, LL, MM, AA, G. |
| Barnard, J. G. | Maj. | 1853 | A, H. |
| Beach, L. H. | Lt. Col. | 1888-1912 | CC, LL, PP, HH, P, R, U, S. |
| Benham, H. W. | Col. | 1849-1873 | C, B. |
| Benyaurd, W. H. H. | Lt. Col. | 1873-1900 | X, T, Y, HH, AA, JJ, NN, SS, TT, UU, O, P, E, F. |
| Bergland, E. | Capt. | 1884-1887 | HH, AA, X. |
| Biddle, John. | Col. | 1893-1911 | AA, TT, SS, UU. |
| Bingham, T. A. | Maj. | 1885-1903 | GG, AA, RR. |
| Bixby, W. H. | Col. | 1884-1910 | M, N, L, D, C, B, CC, EE, DD, AA, DD, PP, JJ, NN, HH. |
| Black, W. M. | Col. | 1886-1912 | Q, P, A, F, E. |
| Blunt, C. E. | Col. | 1864-1886 | E, B, RR, QQ, PP, A. |
| Boggs, F. C. | Capt. | 1907-1908 | CC, EE. |
| Bond, F. S. | Lt. | 1904 | RR. |
| Bowen, N. | Maj. | 1869-1871 | RR. |
| Brewerton, H. | Maj. | 1834-1853 | E, J. |
| Bromwell, Chas. S. | Maj. | 1902-1911 | T, P, R, S, HH, X, KK, MM, NN. |
| Brown, E. I. | Maj. | 1907-1912 | L, M, N, U. |
| Brown, Lytle. | Capt. | 1908-1912 | BB, CC. |
| Burgess, H. | Maj. | 1903-1912 | BB, CC, HH, P, S, AA. |
| Burnham, A. H. | Capt. | 1871-1873 | HH. |
| Burg, E. | Lt. Col. | 1885-1910 | XX, L, HH, A, B, E. |
| Canfield, A. | Capt. | 1839-1853 | RR, PP. |
| Caples, W. G. | Lt. | 1907 | AA. |
| Carter, O. M. | Capt. | 1888-1897 | O, Q. |
| Casey, T. L. | Col. | 1884-1912 | H, G, F, M, L, X, HH, J. |
| Cavanaugh, J. B. | Maj. | 1903-1912 | Q, R, P, VV, XX. |
| Cheney, S. A. | Maj. | 1911-1912 | UU, SS, TT. |
| Chittenden, H. M. | Maj. | 1889-1908 | GG, HH, KK, XX. |
| Comstock, C. B. | Col. | 1877-1895 | HH, Y. |

| Name of engineer officer. | Rank. | Period. | Reports, as engineer in charge, on waterways in the following districts. |
|---------------------------|--------------------|-----------|--|
| Connor, W. D. | Capt. | 1906-1908 | HH, Y. |
| Cosby, Spencer. | Maj. | 1902-1908 | E, F, G, H, R, L, K. |
| Craighill, W. E. | Lt. Col. | 1897-1912 | M, EE, R, U, A. |
| Craighill, W. P. | Col. | 1866-1895 | J, K, M, L, EE, CC, L, EE. |
| Cram, T. J. | Col. | 1864-1870 | NN, MM, OO, QQ, RR, PP. |
| Crosby, O. T. | Lt. | 1887 | S. |
| Cuyler, J. W. | Maj. | 1870-1883 | LL, MM, NN, BB, DD, EE. |
| Damrell, A. N. | Lt. Col. | 1870-1896 | Q, R, P, A. |
| D'Armit, A. M. | Lt. | 1892-1893 | P. |
| Davis, C. E. L. B. | Col. | 1876-1908 | U, T, MM, LL, KK, L, K, J, TT, UU, SS, YY, PP. |
| Deakyns, Herbert. | Maj. | 1898-1912 | UU, P, I, H. |
| Delafield, R. | Maj. | 1836-1852 | H, E. |
| Derby, G. McC. | Lt. Col. | 1886-1907 | G, HH, CC, BB, KK. |
| Dutton, George. | Capt. | 1852-1853 | D, C. |
| Elliot, G. H. | Lt. Col. | 1882-1887 | C, D. |
| Ernst, O. H. | Col. | 1890-1906 | GG, HH, H, U, HH, J, NN, HH. |
| Farquhar, F. U. | Maj. | 1866-1883 | RR, OO, LL, JJ, GG, HH, KK, CC, PP. |
| Ferguson, H. B. | Capt. | 1908-1911 | Q. |
| Fieberger, G. J. | Capt. | 1889-1892 | K, L. |
| Fisk, W. L. | Lt. Col. | 1888-1911 | X, T, HH, S, LL, WW, VV, B, A, PP, RR. |
| Fitch, G. D. | Lt. Col. | 1893-1912 | HH, RR, Y, LL, Q, P. |
| Flagler, C. A. F. | Maj. | 1899-1912 | Q, I, YY, R, AA. |
| Foster, J. G. | Lt. Col. | 1867-1871 | B, C. |
| Frazer, W. D. | Maj. | 1853-1854 | E. |
| Fries, A. A. | Capt. | 1906-1909 | SS. |
| Gaillard, D. D. | Capt. | 1897-1902 | XX, LL. |
| Gillespie, G. L. | Col. | 1870-1901 | QQ, RR, PP, NN, WW, VV, XX, G, E, F, B, HH. |
| Gillette, C. E. | Capt. | 1891-1904 | CC, SS, TT, UU, O, C. |
| Gillmore, Q. A. | Col. | 1869-1888 | P, N, O, Q, HH. |
| Goethals, G. W. | Maj. | 1885-1902 | DD, CC, AA, C. |
| Graham, J. D. | Col. (Top. Engrs.) | 1854-1867 | MM, OO, NN, RR, PP, QQ, E, A, H, D, B, J, C, F, I, D. |
| Greene, B. O. | Lt. | 1870-1871 | RR. |
| Gregory, J. F. | Maj. | 1876-1910 | U, LL, KK, MM, DD, EE, BB. |
| Griffith, J. E. | Lt. | 1869-1872 | HH. |
| Guthrie, W. L. | Lt. | 1909-1911 | RR. |
| Hains, P. C. | Col. | 1867-1902 | HH, K, L, A, EE, J. |
| Handbury, T. H. | Lt. Col. | 1881-1905 | Y, X, T, JJ, NN, XX, WW, P, II, HH, SS, UU. |
| Haanum, W. T. | Capt. | 1910 | K, L. |
| Harding, C. | Capt. | 1895-1901 | HH, LL, NN, OO. |
| Harrison, L. | Lt. | 1853 | F. |
| Harts, W. W. | Maj. | 1898-1911 | WW, VV, UU, TT, AA. |
| Harwood, F. | Maj. | 1867-1883 | RR, QQ, PP, LL, OO, C. |
| Haupt, L. | Lt. | 1869 | U. |
| Heap, D. P. | Lt. Col. | 1882-1903 | LL, OO, A, M, UU. |
| Heuer, W. H. | Col. | 1865-1906 | HH, T, H, I, J, X, S, UU, TT, CC, DD, SS, YY, SS. |
| Hinman, F. A. | Capt. | 1883-1887 | LL, MM, N, L, M. |
| Hodges, H. F. | Capt. | 1892-1901 | GG, CC, DD, EE. |
| Hodges, J. N. | Lt. | 1912 | HH, KK, LL. |
| Hoffman, G. M. | Capt. | 1905-1907 | X, HH. |
| Houston, D. C. | Col. | 1866-1892 | D, C, B, LL, NN, MM, KK, E, F. |
| Howell, C. W. | Maj. | 1867-1903 | HH, X, T, R, S, U, HH. |
| Howell, G. P. | Maj. | 1901-1912 | HH, U, N. |
| Howell, R. P. | Capt. | 1912 | S. |
| Hoxie, R. L. | Lt. Col. | 1885-1908 | P, O, Q, FF, A, KK, HH, J, K, J. |
| Hughes, G. W. | Capt. | 1843 | E. |
| Ives, J. C. | Lt. | 1857-1858 | SS. |
| Jackson, T. H. | Capt. | 1901-1912 | A, UU, U, X, T. |
| Jadwin, Edgar. | Maj. | 1901-1912 | SS, TT, U, AA. |
| Jervey, H. | Lt. Col. | 1898-1912 | HH, F, R, Q, CC, BB. |
| Jewett, H. C. | Lt. | 1906-1907 | A. |
| Johnston, J. E. | Lt. | 1899 | RR. |
| Johnston, E. P. | Capt. | 1901-1906 | UU, L, M. |
| Jones, W. A. | Col. | 1868-1903 | RR, WW, XX, VV, GG, HH, KK, J. |
| Judson, W. V. | Maj. | 1901-1909 | Q, KK, MM. |
| Kearney, J. | Lt. Col. | 1854-1876 | MM, L. |
| Keller, Chas. | Maj. | 1895-1912 | HH, NN, OO, LL, PP, MM, JJ, HH. |
| King, W. R. | Lt. Col. | 1875-1897 | Q, AA, O, JJ, HH. |
| Kingman, D. C. | Col. | 1886-1912 | HH, S, RR, AA, PP, QQ, O, P, N, O. |
| Knight, C. H. | Lt. | 1908-1910 | HH. |
| Knight, J. G. D. | Col. | 1882-1909 | HH, AA, F, E, F. |
| Kuhn, Jos. E. | Maj. | 1907-1909 | L. |
| Kurtz, J. D. | Lt. Col. | 1870-1877 | H, I, G, I. |
| Kutz, C. W. | Maj. | 1898-1911 | J, A, XX. |
| Ladue, W. B. | Capt. | 1903-1906 | HH. |
| Langfitt, W. C. | Lt. Col. | 1894-1912 | CC, WW, VV, K, L, J. |
| Leach, S. S. | Lt. Col. | 1879-1906 | HH, E, RR, D, L, K. |
| Lee, A. N. | Capt. | 1878-1879 | CC. |
| Leeds, C. T. | Capt. | 1909-1911 | SS, UU, TT. |
| Linnard, T. B. | Lt. | 1839 | H. |
| Livermore, W. R. | Col. | 1880-1907 | U, C, D, G, E, F. |

| Name of engineer officer. | Rank. | Period. | Reports, as engineer in charge, on waterways in the following districts. |
|---------------------------|--------------|-----------|--|
| Lockwood, D. W..... | Col..... | 1877-1910 | HH, PP, OO, NN, FF, DD, EE, BB, D, C, B, HH, KK, LL, E, G. |
| Long, S. H..... | Col..... | 1837 | A. |
| Lucas, E. W. Van C..... | Capt..... | 1899-1905 | M, L, HH. |
| Ludlow, W..... | Col..... | 1871-1899 | N, I, H, J, LL, NN, OO, PP, E, F. |
| Lukesh, G. R..... | Capt..... | 1906-1909 | HH, Y. |
| Lusk, J. L..... | Lt. Col..... | 1884-1906 | P, JJ, HH. |
| Lydecker, G. J..... | Col..... | 1877-1904 | NN, JJ, BB, NN, OO, LL, PP, CC. |
| Mackenzie, A..... | Maj..... | 1878-1895 | CC, PP, JJ, HH. |
| Macomb, J. N..... | Col..... | 1856-1882 | PP, HH, GG, KK, JJ, H, I, G, J. |
| Maguire, E..... | Capt..... | 1877-1891 | GG, QQ, RR, BB, CC. |
| Mahan, F. A..... | Maj..... | 1878-1899 | CC, RR, Q. |
| Mallery, J. C..... | Maj..... | 1892 | P. |
| Mansfield, J. K..... | Lt..... | 1835-1837 | M, O. |
| Mansfield, S. M..... | Col..... | 1868-1903 | SS, OO, LL, T, U, B, NN, C, UU, QQ, E, F, G, E. |
| Marshall, W. L..... | Col..... | 1882-1908 | HH, KK, LL, MM, JJ, NN, E, F. |
| Maurice, T. W..... | Capt..... | 1824-1829 | RR. |
| McAlester, M. D..... | Maj..... | 1866-1869 | HH, S, RR. |
| McClellan, W..... | Capt..... | 1839-1853 | M, U. |
| McFarland, W..... | Lt. Col..... | 1868-1889 | QQ, RR, PP, Q, AA, O, DD, E, D, F, G, F. |
| McGregor, R..... | Lt..... | 1899-1900 | Y. |
| McIndoe, J. F..... | Maj..... | 1894-1910 | GG, X, T, P, R, HH, S, VV, WW. |
| McKinsley, C. H..... | Lt. Col..... | 1898-1912 | P, O, UU, SS. |
| Meade, G. G..... | Capt..... | 1859 | OO. |
| Mendell, G. H..... | Col..... | 1866-1895 | B, SS, TT, UU. |
| Mercur, J..... | Capt..... | 1877-1886 | E, G, L, M, N, K, F. |
| Merrill, W. E..... | Lt. Col..... | 1866-1887 | R, NN, CC, DD, HH, FF, EE, BB, EE. |
| Meyler, J. J..... | Capt..... | 1899-1901 | SS. |
| Michler, N..... | Lt. Col..... | 1867-1883 | K, WW, VV, XX, PP, QQ, E, G. |
| Miller, A. M..... | Col..... | 1882-1904 | AA, HH, X, S, T, GG, BB, II, U, E, G, K, L. |
| Millis, John..... | Lt. Col..... | 1890-1912 | HH, XX, QQ. |
| Morrow, J. J..... | Maj..... | 1909-1912 | L, K, WW, VV. |
| Newcomer, H. C..... | Lt. Col..... | 1897-1912 | HH, AA, FF, CC. |
| Newton, J..... | Col..... | 1866-1884 | E, G, F. |
| Oakes, J. C..... | Maj..... | 1907-1912 | U, DD, EE. |
| Otwell, C. W..... | Capt..... | 1905-1909 | A, YY. |
| Overman, L. C..... | Maj..... | 1874-1892 | Q, RR, PP, QQ. |
| Palfrey, C. F..... | Capt..... | 1886-1895 | RR, HH, Y, KK, MM. |
| Parke, J. G..... | Maj..... | 1867-1868 | J. |
| Patrick, M. M..... | Lt. Col..... | 1898-1912 | HH, L. |
| Payne, D. W..... | Lt..... | 1868-1869 | HH. |
| Payson, A. H..... | Capt..... | 1885-1887 | UU, SS, TT. |
| Phillips, C. B..... | Capt..... | 1872-1883 | J, L, M, N. |
| Pillsbury, G. B..... | Capt..... | 1907-1908 | XX. |
| Poe, O. M..... | Col..... | 1870-1892 | PP, MM, GG, LL, KK. |
| Post, J. C..... | Maj..... | 1883-1895 | O, BB, DD, EE, P, JJ, FF, WW. |
| Potter, C. L..... | Lt. Col..... | 1896-1912 | SS, HH, X, T, LL, YY, HH. |
| Powell, C. F..... | Lt. Col..... | 1878-1905 | HH, WW, VV, XX, HH, GG, FF, D. |
| Prescott..... | Lt..... | 1828 | C. |
| Price, P. M..... | Capt..... | 1879-1893 | HH, Q. |
| Prime, F. E..... | Maj..... | 1868-1869 | HH. |
| Putnam, A. B..... | Capt..... | 1908-1912 | AA, YY. |
| Quinn, J. B..... | Col..... | 1882-1907 | HH, GG, LL, S, T, U, L, O, P, KK. |
| Rand, L. H..... | Capt..... | 1908-1912 | I, M. |
| Raymond, C. W..... | Lt. Col..... | 1883-1904 | B, HH, J, I, H, G. |
| Raymond, R. R..... | Maj..... | 1902-1912 | Q, I. |
| Raynolds, W. F..... | Lt. Col..... | 1866-1873 | PP, LL, GG, HH, Y, X, JJ, Q, R, P. |
| Rees, T. H..... | Lt. Col..... | 1900-1912 | P, NN, KK, MM, TT, UU. |
| Reese, C. B..... | Maj..... | 1865-1870 | E, RR, Q, R. |
| Rhett, E. M..... | Lt..... | 1901-1902 | P. |
| Riche, C. S..... | Maj..... | 1899-1912 | U, JJ, HH, LL, MM, OO. |
| Robert, H..... | Col..... | 1871-1899 | WW, VV, LL, MM, E, RR, J, H, I, AA, D, F, U. |
| Rössler, S. W..... | Col..... | 1890-1912 | HH, A, VV, WW, G, F, YY. |
| Russell, W. T..... | Col..... | 1881-1912 | A, P, Q, HH, R, CC, HH, G. |
| Ruffner, E. H..... | Col..... | 1892-1909 | RR, N, E, F, G, BB, EE, DD, CC, HH, S, P. |
| Sanford, J. C..... | Lt. Col..... | 1899-1910 | GG, N, I, J, H, C. |
| Schulz, E. H..... | Maj..... | 1904-1912 | E, F, HH, KK, GG. |
| Sears, C. B..... | Col..... | 1884-1908 | HH, GG, LL, AA, HH, S, YY, HH. |
| Sherrill, C. O..... | Capt..... | 1912 | HH. |
| Shunk, F. R..... | Lt. Col..... | 1903-1912 | P, KK, HH, LL. |
| Sibert, W. L..... | Maj..... | 1895-1906 | Y, BB, CC, FF. |
| Simpson, J. H..... | Col..... | 1868-1880 | J, P, M, R, Q, Y, X, HH, GG. |
| Sitgreaves, L..... | Lt. Col..... | 1865-1866 | NN, MM. |
| Slattery, J. R..... | Capt..... | 1905-1912 | YY, P. |
| Smead, R. C..... | Lt..... | 1833-1836 | RR. |
| Smith, C. S..... | Maj..... | 1908-1911 | X, HH, Y. |
| Smith, H..... | Capt..... | 1834 | PP. |
| Smith, H. L..... | Lt..... | 1853 | T. |
| Smith, J. A..... | Col..... | 1867-1904 | B, C, BB, NN, JJ, A, PP, QQ, UU, H, I, J, L. |
| Smith, J. L..... | Capt..... | 1836 | RR. |
| Smith, Wm..... | Capt..... | 1827 | RR. |
| Spalding, G. R..... | Capt..... | 1908-1912 | PP, P. |

| Name of engineer officer. | Rank. | Period. | Reports, as engineer in charge, on waterways in the following districts. |
|---------------------------|----------|-----------|--|
| Stansbury, H. | Capt. | 1831-1856 | NN, QQ. |
| Stanton, W. S. | Col. | 1867-1907 | U, L, M, N, RR, A, B, E. |
| Stewart, C. S. | Col. | 1866-1887 | H, UU, TT, SS. |
| Stickley, H. W. | Maj. | 1911-1912 | M, L. |
| Stickney, A. | Col. | 1880-1904 | R, S, HH, DD, BB, RR, FF, CC, HH, GG, F, E. |
| Stokey, W. P. | Capt. | 1910-1912 | SS. |
| Stuart, E. R. | Capt. | 1908 | N. |
| Suter, C. R. | Col. | 1867-1901 | HH, AA, GG, Y, HH, TT, UU, B. |
| Swift, A. J. | Lt. | 1836-1838 | M. |
| Swift, W. H. | Capt. | 1836-1838 | D. |
| Symons, T. W. | Maj. | 1890-1902 | VV, XX, RR. |
| Taber, H. S. | Capt. | 1885-1893 | X, Y, T. |
| Tardy, J. A. | Capt. | 1865-1868 | RR. |
| Taylor, H. | Lt. Col. | 1895-1910 | WW, VV, XX, A, B, E, C, D. |
| Thayer, S. | Lt. Col. | 1852 | B. |
| Thom, G. | Col. | 1866-1886 | A, C, B. |
| Totten, J. G. | Col. | 1827-1836 | C, B. |
| Townsend, C. McD. | Col. | 1891-1912 | HH, LL, NN, OO, HH, JJ, QQ, PP, HH. |
| Turnbull, Wm. | Col. | 1842-1859 | E, RR, M, L. |
| Turtle, T. | Capt. | 1873-1894 | K, CC, J, I, S, T, HH, X, EE, L. |
| Waldron, A. E. | Capt. | 1908-1912 | T, X, U, D. |
| Walker, M. L. | Maj. | 1901-1911 | U, Y, HH, X. |
| Warren, G. K. | Lt. Col. | 1866-1882 | HH, KK, F, C, D, B. |
| Warren, J. G. | Lt. Col. | 1893-1912 | HH, BB, KK, MM, LL, NN, OO, DD, CC, EE, RR. |
| Waterman, H. E. | Capt. | 1895-1898 | HH. |
| Webster, J. D. | Lt. | 1848-1854 | NN. |
| Weitzel, G. | Lt. Col. | 1867-1884 | CC, AA, BB, PP, H, I, J. |
| Wellman, D. W. | Capt. | 1878 | Y. |
| Wheeler, G. M. | Lt. | 1876 | SS. |
| Wheeler, J. B. | Maj. | 1866-1870 | OO, MM, NN, LL. |
| Whipple, A. N. | Capt. | 1859 | PP. |
| Whiting, W. H. C. | Lt. | 1856-1859 | M, L. |
| Willard, J. H. | Lt. Col. | 1886-1907 | AA, X, HH, S, T, NN, JJ, SS, C. |
| Williams, Arthur. | Capt. | 1910 | VV, WW. |
| Williams, W. G. | Capt. | 1839 | RR. |
| Williamson, R. S. | Lt. Col. | 1866-1871 | TT, WW, SS, UU, VV. |
| Willing, W. | Lt. | 1908 | HH. |
| Wilson, J. H. | Lt. Col. | 1866-1871 | HH, JJ. |
| Wilson, J. M. | Maj. | 1870-1883 | RR, WW, XX, VV, PP, QQ. |
| Winder, John H. | Lt. | 1838 | M. |
| Winslow, E. E. | Maj. | 1899-1910 | HH, M, L, YY. |
| Woodbury, D. F. | Capt. | 1853-1859 | M, L. |
| Woodruff, E. A. | Lt. | 1871 | S. |
| Woodruff, I. C. | Lt. Col. | 1856-1872 | RR, I, QQ. |
| Woodruff, J. A. | Capt. | 1911 | X, HH. |
| Wooten, W. P. | Maj. | 1905-1912 | X, T, U, YY. |
| Wright, H. G. | Lt. | 1853 | P. |
| Young, W. | Capt. | 1888-1890 | WW, VV, HH. |
| Zinn, G. A. | Lt. Col. | 1893-1912 | HH, KK, MM, DD, BB, CC, EE, A, NN, JJ, KK. |

SPECIAL SUBJECTS.**REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.****SECTION 7.—ALPHABETICAL LIST OF CONTRACTORS ON RIVER AND HARBOR WORK, 1901-1912.**

NOTE.—The Chief of Engineers reports in his annual reports what contracts have been entered into for public works during the fiscal year. In Part I (Rivers and Harbors) of this index these contracts are referred to under the subtitle "Contracts," the arrangement being according to time only.

As it is often important to know something of the experience of a contractor, without making an extended reference to office files, or having recourse to correspondence with various offices, the following list of contractors on river and harbor work has an obviou value.

The list is composed only of those contracts or contractors reported in the period 1901-1912, it being doubtful if the value of the list would be increased by listing contracts prior to 1901.

The names of contractors are arranged alphabetically. The approximate number of contracts is given, and then follows a brief reference to the nature of the work done. The final column names the districts within which the work was done. The address of the office of a district is printed at the beginning of the abstracts of a waterway group in Part I of this index. A glance through the contracts in the abstracts of a waterway group (pp. 23-1691 of this index) furnishes details concerning prices, etc., and furnishes also the volume and page reference to those reports which give the contract details completely.

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|------------------------------------|----------------------------------|---|-------------------------|
| Abadie Co., E. H. | 1 | Engines and pumps | HH. |
| Abel. (See Rodgers.) | | | |
| A. B. Electric Co. | 1 | Electric-light plant | HH. |
| Acme Boiler & Construction Co. | 1 | Pontoons | HH. |
| Acme Lumber Co. | 1 | Piles for lock | S. |
| Adams, A. W. | 1 | Stone | RR. |
| Adams & Duford Co. | 1 |do | RR. |
| Aderholt & Lawrence | 1 | Levees | HH. |
| Advance Sand & Construction Co. | 1 | Dam work | CC. |
| Ætna Construction Co. | 5 | Land wall; slopes; paving; lock for movable dam; navigable pass; riprap stone. | CC. |
| Ætna Foundry & Machine Co. | 2 | Castings; lock parts | CC. |
| Aiken, A. C. | 1 | Dredging | TT. |
| Albrecht. (See Schoellhorn.) | | | |
| Alexander. (See Eskald.) | | | |
| Allbright & Ferrill | 1 | Riprap stone | Y. |
| Allbright & Ramsey | 1 |do | Y. |
| Allen. (See Penn.) | | | |
| Allis-Chalmers Co. | 2 | Electric plant; rock crusher | CC. |
| Alma Cement Co. | 3 | Cement | DD. |
| Alpena Portland Cement Co. | 2 |do | LL, PP. |
| Alpha Portland Cement Co. | 2 |do | Y, PP. |
| American Bridge Co. | 14 | Steel; dam trestles; flatboats; barges; lock parts; lock gates; iron and steel parts. | CC, DD, FF, HH. |
| American Compressor & Pump Co. | 1 | Machinery | FF. |
| American Cesote Works | 1 | Piles, etc. | U. |
| American Dredging Co. | 18 | Dredging; bulkheads | D, H, I. |
| American Hoist & Derrick Co. | 2 | Derricks; engines | CC, PP. |
| American Paving & Construction Co. | 11 | Dredging | J. |
| American Pile Driving Co. | 1 | Dikes | XX. |
| American Steel & Wire Co. | 1 | Cables, electric | PP. |
| Anderson. (See Johnson.) | | | |
| Anderson, John | 3 | Dredging | R, S. |
| Anderson-Murphy Co. | 1 | Rock removal | E. |
| Anderson, Wm | 1 | Wreck removal | RR. |
| Anderson, Z. T. | 1 | Levees | HH. |
| Antioch Dredging Co. | 1 | Dredging | UU. |
| Armstrong, Chas. | 1 | Barge hire | DD. |
| Arnold. (See Frederick.) | | | |
| Associated Oil Co. | 2 | Oil | WW. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|---|-------------------------------|
| Astoria Iron Works..... | 1 | Boiler..... | WW. |
| Atlantic Dredging Co..... | 17 | Dredging; dams; bridges; piers; flumes; pipe laying; enrockment. | D, G, L. |
| Atlantic, Gulf & Pacific Co..... | 12 | Dredging; dikes; barriers..... | H, K, N, O, R, TT, UU, YY. |
| Atlantic Machine Works..... | 1 | Metal work..... | AA. |
| Atlas Dredging Co..... | 4 | Dredging..... | I. |
| Atlas Portland Cement Co..... | 12 | Cement..... | CC, DD, EE. |
| Avery Planting & Improving Co..... | 1 | Sand and gravel..... | S. |
| Axman, Rudolph..... | 2 | Rock removal; dredging..... | TT. |
| Babcock, A. E..... | 1 | Jetty work..... | SS. |
| Bair & Gazzam Mfg. Co..... | 1 | Machinery..... | FF. |
| Baker & Egan..... | 1 | Building dam..... | CC. |
| Baker & Judson..... | 2 | Lock and dams, stone..... | FF. |
| Baker Construction Co..... | 5 | Building Chanoine dam; removing bear trap gate; mo abie dam; constructing guide and retaining walls; constructing lock. | CC, DD. |
| Baker, E. Brown..... | 1 | Building dam..... | CC. |
| Baker Iron Works..... | 1 | Discharge pipe..... | SS. |
| Baldwin & Co., A..... | 1 | Steel..... | S. |
| Ball-Carden Co..... | 1 | Constructing lock and dam..... | T. |
| Baltimore Bridge Co..... | 1 | Leaves for lock gate..... | AA. |
| Baltimore Construction Co..... | 1 | Constructing bulkhead..... | H. |
| Banfield, M. C..... | 1 | Hire and lease of dock..... | WW. |
| Bangs. (See Hughes.) | | | |
| Banks. (See Kruse.) | | | |
| Barker, George G..... | 3 | Dredging..... | R. |
| Barnes Co., The Chas..... | 3 | Snag boat; constructing towboats; cast-iron pipe for snag boat. | U, CC. |
| Barrett, O. F..... | 13 | Constructing flatboat; constructing stone dam; extension and repair of dikes; building dike; scows; stone, levee work. | CC, FF, HH. |
| Barrie, B..... | 1 | Piles..... | UU. |
| Barristers Hall, trustees of..... | 1 | Office rent..... | B. |
| Barr, J. Carroll..... | 1 | Building concrete foundations for lock keeper's houses. | CC. |
| Barton. (See McHarg.) | | | |
| Bates, Jennie S..... | 1 | Rent of office room..... | UU. |
| Bateson & Co., W..... | 2 | Structural steel; air compressors; winches. | CC. |
| Baumann & Co., J. A..... | 1 | Excavating and constructing outlet for settling basin. | UU. |
| Bay & River Dredging Co..... | 5 | Dredging..... | TT, UU. |
| Bayard, M. L..... | 1 | Power house and machinery..... | CC. |
| Bay State Dredging Co..... | 24 | Dredging..... | A, B. |
| Beans, J. H..... | 2 | Iron castings; iron casting for dam. | CC. |
| Beard, W. H..... | 1 | Dredging, Coney Isld. Chan..... | F. |
| Beattie, John, estate of..... | 2 | Stone, in breakwater..... | D. |
| Beattie, Peter, and John Beattie, jr., executors. | 1 | Building breakwater..... | F. |
| Beattie, R. H..... | 1 | Rock removal..... | C. |
| Beauvais, A. J..... | 1 | Pier work..... | OO. |
| Beauvais & Co..... | 1 | Breakwater work..... | OO. |
| Beckman, C. E..... | 1 | Dredging..... | XX. |
| Bedinger, L. E..... | 1 | Gasoline motor..... | CC. |
| Beeman, Geo. W..... | 3 | Dredging, removing bowlders, etc. | E. |
| Beidler & Co., Francis..... | 1 | Timber..... | JJ. |
| Belanger, Louis..... | 2 | Clay..... | PP. |
| Belden & Sons, E. S..... | 22 | Stone, breakwater; stone, in jetty; stone, and for hire of lighter; stone, breakwater repair; repairing and enlarging breakwater; stone for breakwater extension. | A, C, D, E, F. |
| Belden, E. S..... | 4 | Stone, breakwater; stone, breakwater repair; stone in jetty. | A, C, F. |
| Bell, J. E..... | 1 | Riprap stone..... | Y. |
| Belmont Iron Works..... | 1 | Steel plate..... | LL. |
| Bennett & Co., T. J..... | 3 | Pier work..... | OO. |
| Bennett Fuel & Ice Co., S. P..... | 16 | Coal, fuel..... | OO. |
| Bennett, M..... | 1 | Clay..... | PP. |
| Bennett, Schnorbach & Co..... | 6 | Pier work; stone, breakwater work; constructing revetment, sheet pile. | MM, OO. |
| Bennett, S. P..... | 1 | Earthwork..... | JJ. |
| Benson, Thos..... | 1 | Lease of room..... | U. |
| Beauvais. (See MacDonald.) | | | |
| Benton & Son, Thos. P..... | 1 | Electric-light plant..... | U. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|--|-------------------------------|
| Berry, F. A. | 3 | Dredging | D. |
| Berthold & Jennings Lumber Co. | 1 | Oak timber | PP. |
| Beyworth. (See Christie.) | | | |
| Biddle, W. E. | 1 | Dredging | B. |
| Bigelow, A. G. | 2 | do. | P. |
| Bingham. (See Marsh.) | | | |
| Bingham, F. J. | 2 | Scow hire | VV. |
| Blackmer, F. C. | 1 | Dump scows | M. |
| Blackstaff Engineering Co. | 2 | Jetty work; stone for raising jetty. | O, P. |
| Blaisdell Machinery Co. | 1 | Installing air compressor | CC. |
| Blalock & Hartsfield | 1 | Constructing piers for bridge | M. |
| Blanton & Co., J. B. | 2 | Sand and gravel | DD. |
| Blair Steel Centering Co. | 1 | Structural metal and special winches. | X. |
| Boeckler Lumber Co. | 1 | Timber | JJ. |
| Boehm. (See Van Sant.) | | | |
| Bogle, E. A. | 1 | Constructing dwelling above foundation. | DD. |
| Bone, F. A. | 1 | Reconstructing ice pier | CC. |
| Boole & Son, W. A. | 1 | Constructing snag boat | UU. |
| Bornstein, Jacob | 3 | Stable and storehouse; 1 gray pressed brick power house; blacksmith shop. | CC. |
| Boston & Maine R. R. | 4 | Rent of wharf; use of dock and wharf. | B. |
| Boston & Sons, Chas. | 3 | Hire pile-driver plant; dike repairs; scow construction. | PP. |
| Botsford, H. S. | 4 | Oil | SS. |
| Bouker Contracting Co. | 1 | Repairing and enlarging breakwater. | F. |
| Bowen. (See Tatem.) | | | |
| Bowers Hydraulic Dredging Co. | 2 | Dredging | I, K. |
| Bowers Southern Dredging Co. | 30 | Dredging; removing mattress sill. | M, P, R, S, T, U, HH. |
| Bowles, J. R. | 1 | Steel | WW. |
| Boyd, W. M. | 1 | Hull for steamer | P. |
| Brackett Bridge Co., The | 1 | Steel and iron work for dam | CC. |
| Brady Construction Co. | 3 | Buildings; building power house | CC, FF. |
| Bradley Construction Co., The W. B. | 1 | Jetty work | L. |
| Breakwater Co., The | 20 | Stone, breakwater; stone, jetty; stone, dike repair; stone in dike and breakwater; breakwater; breakwater construction; breakwater repair; dike construction; riprap around pier and relaying stone in pier; breakwater work; breakwater construction. | A, B, C, D, H, I, QQ, RR, YY. |
| Breakwater Construction & Engineering Co. | 2 | Stone, jetty | B, I. |
| Breakwater Construction Co., The | 1 | Jetty work | QQ. |
| Brehm. (See Kaps.) | | | |
| Brewer & Jones | 1 | Sand and gravel | Q. |
| Breyman & Bros., G. H. | 27 | Dredging; rock removal; rock excavation; hire of dredging plant. | B, C, PP, QQ. |
| Breyman Bros. | 4 | Dredging | B, QQ. |
| Breyman, Geo. H. | 1 | do. | B. |
| Briar Bluff Coal & Mining Co. | 1 | Coal | JJ. |
| Briggs, J. M. | 6 | Dredging | F, G. |
| Briner, C. J. & F. E. | 1 | Wiring, lamps, etc. | HH. |
| Brooks. (See Sanford.) | | | |
| Brooks, S. W. K. | 1 | 2 survey scows | B. |
| Brown. (See Tatnall; Sherman.) | | | |
| Brown, Horace | 1 | Sale and removal of U. S. building. | H. |
| Brown, Thos. W. | 1 | Bottom-dump lighter | N. |
| Brubaker, O. G., & A. McKechnie | 1 | Dike work | PP. |
| Bryan Black Lumber Co. | 1 | Waling timbers | HH. |
| Bryant Lumber Co. | 2 | Lumber; white-oak lumber | Y. |
| Buckeye Contracting Co. | 5 | Jetty work, pier repairs | QQ. |
| Bucyrus Co., The | 7 | Pump and engine; machinery for dredge; dredge parts; pump runners; building elevator dredge; machinery. | Q, AA, HH, MM, YY. |
| Bues, A. F. | 3 | Dredging | MM, OO. |
| Buffalo Dredging Co. | 20 | Furnishing and operating drill boat; dredging; lock construction; pier construction; breakwater; stone; concrete work; piers; stone work. | PP, QQ, RR. |
| Builders Sand & Gravel Co. | 1 | Repair of dams and shore protection. | HH. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|--|-------------------------|
| Bullis, Spencer S. | 1 | Dredging | R. |
| Bunker Co., G. W. | 1 | Breakwater work | OO. |
| Burcham & Byrnes Construction & Contracting Co. | 1 | Stone | WW. |
| Burdin, J. J. | 1 | Hire of towboat | S. |
| Burgwyn, C. P. E. | 1 | Dredging | L. |
| Burk, Smith & Nelson | 13 | Pier repairs; breakwater work; revetment work; construction of pier; building breakwater; rebuilding super pier. | MM, OO, PP. |
| Burnham, Williams & Co. | 1 | Locomotives | WW. |
| Burton & Co., W. O. | 3 | Earth filling, dredging | S. |
| Burt Portland Cement Co. | 2 | Cement | PP. |
| Bush Construction Co., Wm. R. | 1 | Stone | HH. |
| Bussen, Albert | 2 | do. | HH. |
| Bussen, H. W. | 2 | do. | HH. |
| Butts, J. F. | 2 | Sand and gravel | DD. |
| Bury Compressor Co. | 3 | 2 air receivers at dams; air compressors, receivers, and accessories, furnishing and installing. | CC. |
| Byrnes. (See Burcham.) | | | |
| Caldwell, Thos. W. & H. B. | 1 | Land for storage | AA. |
| California Construction Co. | 1 | Breakwater work | SS. |
| California Reclamation Co. | 2 | Dredging; excavating material and building embankments. | SS, UU. |
| Callahan. (See Katz.) | | | |
| Callahan Bros. & Katz | 3 | Earthwork | JJ. |
| Callahan, Jos. J. | 2 | Stone for dike; stone in jetties | B. |
| Campbell's Creek Coal Co., The | 3 | Coal | CC. |
| Canal Quarry Co. | 2 | Stone, breakwater construction | RR. |
| Canney, Edwin | 1 | Stone in breakwater | B. |
| Cantrel Construction Co. | 1 | Constructing lock house | EE. |
| Cape Ann Granite Co. (See Pigeon Hill.) | | | |
| Capitol Lumber & Manufacturing Co. | 1 | Yellow-pine timber | DD. |
| Carden. (See Ball.) | | | |
| Carlin's Sons Co., Thos | 4 | Derrick irons; ropes; building maneuver boat; maneuvering boats for dams. | CC, EE. |
| Carlton, F. W. | 2 | Rock excavation | A. |
| Carpenter Co., F. E. | 1 | Iron fence | PP. |
| Carroll. (See Lineham.) | | | |
| Carstens & Earles (Inc.) | 3 | Lumber | MM. |
| Carse, H. E. | 2 | Gasoline launch; hardware | SS. |
| Carter & Clarke | 2 | Lumber; piles | K. |
| Carter Lumber Co., C. J. | 1 | Lumber | Y. |
| Cary & Co. (Inc.) | 2 | Coal | Q. |
| Cary, J. H. | 1 | Levee work | HH. |
| Cascades Construction Co. | 1 | Dredging | WW. |
| Cashman, Jas. E. | 2 | Repair to breakwater; sheathing for repair to breakwater. | E. |
| Cashman, John | 1 | Repair to breakwater | E. |
| Cassady, R. B., & W. H. Hanna | 1 | Guide cribs | EE. |
| Castalia Portland Cement Co. | 1 | Cement | DD. |
| Catt, C. E. | 1 | Dredging | R. |
| Caughren, Winters, Smith & Co. | 1 | Canal construction | WW. |
| Cayuga Lake Cement Co. | 1 | Cement | DD. |
| Central Dredging Co. | 4 | Dredging | PP, RR. |
| Century Fuel Co. | 19 | Coal; fuel | NN, OO. |
| Champion Iron Co. | 1 | Steel trestles | EE. |
| Chandler Dock & Bridge Building Co. | 1 | Hire pile-driver plant | PP. |
| Charleroi Lumber Co. | 1 | Building | FF. |
| Charleston Lumber Co. | 1 | Lumber, etc. | EE. |
| Charleston Terminal Co. | 3 | Lease of wharf | N. |
| Chesapeake Stevedore Co. | 3 | Riprap jetty | K. |
| Chicago & Great Lakes Dredging & Dock Co. | 11 | Superstructure work; dredging | NN, OO, PP. |
| Chicago Bridge & Iron Co. | 3 | Superstructure for highway bridges; bridges. | JJ. |
| Chicago Engineering & Construction Co. | 1 | Constructing locks and dams | X. |
| Chipman. (See Roetzel.) | | | |
| Christiana Construction Co. | 1 | Jetty work | I. |
| Christie & Lowe | 4 | Constructing jetties, sill, mattress; extending east jetty. | HH. |
| Christie, Lowe & Beyworth | 1 | Jetties | O. |
| Christman, Edw. | 1 | Test borings | HH. |
| Churchyard, I. R. | 1 | Pier work | QQ. |
| Cincinnati & Suburban Bell Telephone Co. | 1 | Telephone service | CC. |
| Cincinnati Butchers' Supply Co., The | 1 | Constructing cold-storage room on snag boat. | CC. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|--|---------------------------|
| Cincinnati Forging & Smithing Co., The. | 1 | Iron and steel..... | DD. |
| City of Portland..... | 1 | Dredge hire..... | WW. |
| Clapp, J. M..... | 1 | Dike work..... | XX. |
| Clark & Henry..... | 1 | Dredging..... | YY. |
| Clarke. (See Carter.) | | | |
| Clark, R. J..... | 1 | Timber..... | PP. |
| Clark, R. T..... | 1 | Earthwork..... | HH. |
| Clarke & Co., Chas..... | 13 | Stone; dredging; jetty work..... | S, T, U. |
| Clarke Co., R. P..... | 2 | Piling and lumber..... | E, K. |
| Clarke, Jas. G..... | 2 | Lumber..... | Y. |
| Cleary, John..... | 1 | Piles..... | HH. |
| Clements. (See Sherman.) | | | |
| Clifton Bros..... | 14 | Reconstructing revetments, guide walls; repairs at locks; repairing canal embankment; rebuilding guide and guard crib; reconstructing conduit, dam; derrick stone; furnishing and driving guard piles above river wall; reconstructing top of dam. | DD, EE. |
| Coastwise Dredging Co..... | 14 | Dredging..... | A, C, D, F, L, O P, R. |
| Colbert, C. B..... | 2 | Dredge repair; installing machinery in new dredge. | N. |
| Cole, C. M..... | 16 | Dredging; hire of dredging plant and outfit; removing bowlders. | B, C. |
| Collins, Benj. F..... | 1 | Jetty construction..... | I. |
| Collins, T. D..... | 1 | Timber..... | FF. |
| Colonna, C. J..... | 1 | Rebuilding snag boat..... | L. |
| Columbia Contracting Co..... | 5 | Stone..... | WW. |
| Columbia Dredging Co..... | 5 | Dredging..... | C, E, G. |
| Columbia Engineering Works..... | 2 | Engine and pile driving machinery; machinery for dredge. | WW. |
| Columbia Granite & Dredging Corporation. | 1 | Stone..... | K. |
| Columbia Iron Works..... | 1 | Repairs to snag boat..... | CC. |
| Columbian Construction Co..... | 1 | Pier repairs..... | OO. |
| Commercial Wharf Co..... | 1 | Rent of wharf..... | B. |
| Commonwealth Dredging Co..... | 1 | Dredging..... | B. |
| Cornell. (See Fitz Simons.) | | | |
| Conrad. (See Van Note.) | | | |
| Consumers Coal Co..... | 2 | Coal; berth for dredge..... | N. |
| Consumers Oil Co..... | 1 | Coal..... | N. |
| Continental Engineering & Contracting Co. | 1 | Concrete lock..... | AA. |
| Cooperative Building & Manufacturing Co. | 2 | 2 boat hulls..... | N. |
| Coos Bay Home Telephone Co., The. | 1 | Rental of telephone instruments..... | VV. |
| Coppes. (See Lockow.) | | | |
| Corbaley, W. G..... | 1 | Stone..... | TT. |
| Corbett. (See Jackson.) | | | |
| Corbett, Failing & Robertson (Inc.) | 1 | Iron and steel..... | WW. |
| Cornwell, C. L..... | 1 | Sandstone..... | CC. |
| Cotton, C. E..... | 1 | Paving..... | TT. |
| Cowan & Pound..... | 1 | Pits and foundations..... | JJ. |
| Cox. (See Disken.) | | | |
| Coyle & Co., W. G..... | 5 | Coal..... | HH. |
| Coyle, W. G..... | 1 | do..... | HH. |
| Craig, A. S., and John Exner | 1 | Temporary buildings..... | CC. |
| Crane & Co., C..... | 1 | Timber..... | EE. |
| Crane & Co..... | 1 | Piping, valves, and fitting..... | U. |
| Crawford. (See Newman.) | | | |
| Crawford, Robt..... | 1 | Recovering roof of cement shed..... | DD. |
| Crawley. (See Preslar.) | | | |
| Creech Bros..... | 1 | Dike work..... | XX. |
| Crescent City Machinery & Manufacturing Works. | 1 | Repairs and alterations to dredge..... | HH. |
| Cresson Co., Geo. V..... | 1 | Engine for dredge..... | U. |
| Creswell, T. B..... | 1 | Lease dredging plant..... | PP. |
| Crites, S. M..... | 1 | Lease of towboat and barge..... | S. |
| Crosby. (See Fetter.) | | | |
| Crumrine. (See Hackett.) | | | |
| Cudahy Packing Co., The..... | 1 | Meat..... | HH. |
| Cullen, F. J..... | 1 | Building work at dam..... | DD. |
| Cullen-Friestedt Co..... | 2 | Repairs to breakwater and canal wall. | NN, PP. |
| Cumberland Telephone & Telegraph Co. | 2 | Rent of telephone..... | S. |
| Cummings. (See Morris.) | | | |
| Cummings, R. A..... | 2 | Rebuilding upper guide wall; building Chanoine dam. | CC. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|----------------------------------|----------------------------------|---|-------------------------|
| Cunningham, R. M. | 1 | Lumber. | BB. |
| Cunningham, Wayne. | 1 | Dredging. | O. |
| Currie, Duncan J. | 1 | do. | G. |
| Curtiss, C. B. | 1 | do. | FP. |
| Curtis, Wm. A. | 1 | Vegetables. | UU. |
| Cutter Co., D. G. | 1 | Cement. | LL. |
| Dady, Michael J. | 1 | Rock removal and shoals. | E. |
| Dady, T. J. | 2 | Dredging. | E. |
| Dalhoff, H. | 1 | Levee work. | Y. |
| Daly & Hannan | 1 | Excavating mud and bowlders. | C. |
| Daly & Hannan Dredging Co. | 12 | Dredging; repairing breakwater; rock work. | B, C, E, RR. |
| Daly, W. J. | 1 | Repair to breakwater. | E. |
| Darrah Bros. | 1 | Buildings. | FF. |
| Darrah, G. B. | 1 | do. | FF. |
| Darring, Louis, and L. Mouldons. | 1 | Vegetables. | HH. |
| Davidson & Co., Geo. W. | 1 | do. | HH. |
| Davidson, Jas. | 3 | Dredging. | PP. |
| Davidson, Stephen. | 3 | Frame storehouse; constructing lock keeper's house, etc. | CC, EE. |
| Davis, C. D. | 1 | Stone and spalls. | HH. |
| Davis, C. E. | 2 | Removing rock and bowlders. | C. |
| Davis, J. H. | 1 | Riprap stone. | K. |
| Davis, R. N. | 1 | Files. | HH. |
| Dayton & Francis. | 1 | Constructing lock keeper's houses. | CC. |
| De Haas, N. G. | 3 | Timber. | PP. |
| Delmas, Albert C. | 1 | Dumping dredged material from channel. | R. |
| Denmead Bros. | 1 | Lumber. | K. |
| Dennis, C. A. | 1 | Pier construction. | RR. |
| Des Moines Bridge & Iron Works. | 3 | Steel barge; constructing steel der- rick; steel tower; water tank. | CC, DD. |
| Detroit Dredging Co. | 3 | Dredging. | PP, QQ. |
| Devil's Hollow Stone Co. | 1 | Crushed stone. | DD. |
| De Witt & Shobe. | 3 | Revetment; dike. | GG. |
| Diamond Coal & Coke Co. | 1 | Coal. | HH. |
| Disken & Co., T. W. | 1 | Hire of towboat. | DD. |
| Disken & Cox. | 1 | Stone filling. | DD. |
| Dixie Towing Co. | 2 | Hire of barge and towboat. | DD. |
| Dixon, S. O. | 36 | Dredging. | MM, NN, OO, PP. |
| D'Olier Engineering Co. | 1 | Lock machinery. | RR. |
| Donald & Co., A. | 1 | Stone in place on breakwater. | LL. |
| Dodge. (See Gahren.) | | | |
| Donnelly Contracting Co., The. | 3 | Dredging; repairing pier; con- structing breakwater. | PP, QQ. |
| Donnelly, J. B. | 1 | Pier construction. | RR. |
| Donovan, S. J. | 3 | Dredging. | A, B. |
| Donovan, J. F. | 2 | Stone in breakwater. | C. |
| Douglass, H. A. | 2 | Sand; stone. | EE. |
| Doyen Co., P. H. | 1 | Stone, breakwater. | A. |
| Doyen, P. H. | 3 | Dredging; stone, breakwater; stone, jetty. | A, B. |
| Doyle. (See Dravo.) | | | |
| Drackett & Terrebonne. | 4 | Repairs to dredge; dredge. | S. |
| Dravo Contracting Co., The. | 9 | Building foundations, lock keep- er's houses; constructing lock and dam; Chanoine dam; locks; buildings; excavation. | CC, FF, HH. |
| Dravo, Doyle & Co. | 1 | Machinery. | FF. |
| Drews. (See Lydon.) | | | |
| Driscoll. (See Kirk.) | | | |
| Driscoll, A. C. | 5 | Dredging. | E, G. |
| DuBois Bros. Dredging Co. | 2 | Dredging and removing bowlders. | E. |
| DuBois' Sons Co., Henry. | 1 | Dredging. | D. |
| Dubuque Boat & Boiler Works. | 5 | Constructing dredge; snagging plant; towboats; parts of hy- draulic dredge. | X, Y, CC, GG, HH. |
| Duff Patents Co. (Inc.) | 1 | Tank and tower. | CC. |
| Duffy, J. T. | 1 | Hire of towboat and crew. | CC. |
| Duford. (See Adams.) | | | |
| Duke & Smith (Inc.) | 1 | Lumber. | K. |
| Duluth Dredge & Dock Co. | 5 | Dredging. | LL, MM, PP. |
| Duluth Marine Contracting Co. | 1 | do. | QQ, RR. |
| Duluth-Superior Dredging Co. | 2 | Dredging; rubble mound break- water. | LL. |
| Dunbar. (See McNaughton.) | | | |
| Dunbar & Sullivan. | 1 | Removing rock. | E. |
| Dunbar & Sullivan Dredging Co. | 3 | Furnishing and operating drill boat; dredging. | PP. |
| Dunbar, V. E. | 1 | Hire of scow. | PP. |
| Dunning, Halsey H. | 1 | Culverts. | UU. |
| Durocher. (See Semande.) | | | |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|---|------------------------------------|
| Durocher, Thos. L..... | 14 | Building embankment for breakwater extension; breakwater work; derrick boat; dredging; stone. | LL, OO, PP. |
| Dupuis Co., A. J..... | 3 | Revetment repairs; hire pile-driver plant. | PP. |
| Dutro. (See Gregg.) | | | |
| Du Vall, F. J..... | 1 | Stone for dam. | CC. |
| Du Vall, F. J. & F. C..... | 1 | Constructing ice pier. | CC. |
| Earle, W. B..... | 2 | Oak timber. | PP. |
| Earles. (See Carstens.) | | | |
| Earnheart, R. W..... | 3 | Gravel, stone, and timber. | Y. |
| Eastern Dredging Co..... | 21 | Rock excavation; stone, jetties; dredging; ledge rock removal. | A, B, C. |
| East Shore Dredging Co..... | 1 | Dredging. | OO. |
| Eaton, Chas. W..... | 1 | do. | J. |
| Eckley, W. P..... | 1 | Building dwelling. | DD. |
| Edison Portland Cement Co., The..... | 2 | Cement. | CC. |
| Edward Bros..... | 2 | Dredging. | PP. |
| Edwards & Co., Jos..... | 2 | Elbows and sleeves; parts for dredge. | HH. |
| Egan. (See Baker.) | | | |
| Egan, Smith & Co..... | 1 | Mooring dolphin. | O. |
| Elias & Bro., G..... | 7 | Square timber; surfaced timber for dam; lumber. | E, CC, EE, PP. |
| Elk Cement & Lime Co..... | 3 | Cement. | PP. |
| Ellicott Machine Co..... | 21 | Rehandling machine; machinery and appliances for hydraulic dredge; revolving cutter, etc., for suction dredge; constructing dredge; suction dredge. | H, N, Q, R, T, CC, HH, LL, SS, UU. |
| Ellis, Walter..... | 1 | Raising and reconstruction. | DD. |
| Ellis, W. H..... | 1 | Stone. | B. |
| Elmendorff, Loren H..... | 1 | Piling. | E. |
| Elmore & Co., S..... | 1 | Coal. | WW. |
| Elwell. (See Mervy.) | | | |
| Embrey, W. S..... | 1 | Lumber. | K. |
| Empire Engineering Corporation..... | 2 | Dredging. | RR. |
| Erskine. (See McDevitt.) | | | |
| Eskald & Alexander..... | 2 | Stone for lock; lock gates. | S. |
| Eskald, Peter..... | 3 | Pile driver and derrick plant; constructing dwelling; dams, sheet-pile construction. | HH. |
| Eubank, W. A..... | 1 | Piles. | K. |
| Evans & Justice..... | 1 | Push boat. | DD. |
| Evans Bros. Construction Co..... | 1 | Lock houses. | AA. |
| Evansville Contracting Co..... | 10 | Constructing lock and abutments, Chanoine dam; lock for dam; building masonry piers and south shore abutment; rebuilding lower guide wall; iron and steel trestles and platforms. | N, CC, DD. |
| Everson, E. N..... | 1 | Constructing lock keeper's houses. | CC. |
| Exner. (See Craig.) | | | |
| Fagan. (See MacDonald.) | | | |
| Falling. (See Corbett.) | | | |
| Fairbanks Co., The..... | 2 | Hoisting engine; machines. | HH. |
| Farney, A. W..... | 2 | Dikes. | GG. |
| Favre, Thos. M..... | 3 | Wooden pontoons; barge; survey motor boat. | R. |
| Featherstone Foundry & Machine Co..... | 3 | Dredge machinery; dredge construction. | AA, WW. |
| Federal Contracting Co., The..... | 2 | Stone for breakwater; breakwater construction. | B, QQ. |
| Fellows Coal Co., E. O..... | 1 | Coal. | HH. |
| Ferguson, Hugh..... | 1 | do. | N. |
| Ferguson, W. B..... | 1 | Timber. | Y. |
| Ferrell, A. J..... | 1 | Telephone poles. | EE. |
| Ferrill. (See Allbright.) | | | |
| Fetter, A. V..... | 3 | Construction and repair of dams and shore protection. | HH. |
| Fetter & Crosby..... | 2 | Building dams and shore protections. | HH. |
| Fiborn Limestone Co..... | 3 | Stone. | PP. |
| Field. (See Leek.) | | | |
| Finley Bros. Co..... | 2 | Temporary building dam; lock master's houses. | CC, EE. |
| Finney, Clark..... | 1 | Dredging. | B. |
| Fisher, C. W..... | 1 | Lease of warehouse. | T. |
| Fitch, C. F..... | 1 | Concrete pavement. | CC. |
| Fitzpatrick & Son, J. J..... | 1 | Dredging. | B. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|---|-------------------------|
| Fitzpatrick, J. J. | 2 | Ledge rock removal; rock excavation. | A, C. |
| Fitz Simons & Connell Co., The | 8 | Dredging; concrete superstructure. | LL, NN, OO. |
| Flagler & Vedder. | 1 | Paving stone. | E. |
| Fleming. (See Rye.) | | | |
| Flesher, Benj. T. | 1 | Dump boat; service boat; push boats. | EE. |
| Flynn Bros. | 1 | Earthwork. | JJ. |
| Foltz & Jonte. | 1 | Constructing lock. | DD. |
| Fonder Co., Edw. F. | 1 | Dredging. | I. |
| Fonder, Edw. F. | 1 | do. | I. |
| Fonts, Milton. | 3 | Timber. | DD. |
| Fordyce Manufacturing Co., Thos. | 1 | Iron and steel. | Y. |
| Fortner. (See Henningsen.) | | | |
| Foundation Co., The. | 1 | Constructing lock and dam. | CC. |
| Francis. (See Dayton.) | | | |
| Frankman Bros. & Morris. | 1 | Pile revetment. | MM. |
| Franks, J. C. | 3 | Dredging. | TT, UU. |
| Frederick & Arnold. | 1 | Buildings. | WW. |
| Freeborn, W. J. | 1 | Piles. | PP. |
| Frelinger, J. G. | 1 | Drift bolts. | DD. |
| French, W. H. | 6 | Dredging. | K, L. |
| Frey. (See Hunter.) | | | |
| Frick Co. | 1 | Ice plant. | CC. |
| Fridman Lumber Co., The. | 1 | Oak timber for dike. | CC. |
| Friestedt. (See Cullen.) | | | |
| Fritsch, Arthur. | 1 | Spud lift, suction frame, and fittings. | U. |
| Fuller, J. G. | 1 | Repair to log boom. | P. |
| Fuller, W. D. | 3 | Stone, etc. | E. |
| Fullerton, Humphrey. | 1 | Lease of office room. | HH. |
| Gahren, Dodge & Maltby. | 1 | Constructing lock and dam. | DD. |
| Galloway, P. W. | 2 | Breakwater. | MM. |
| G. & W. Manufacturing Co. | 4 | Rods, bolts, etc.; lock gates and operating machinery; constructing highway bridge. | E, K, N, CC. |
| Garbish. (See Helgason.) | | | |
| Gardner Construction Co., J. H. | 1 | Dredge and snag boat hire. | S. |
| Garrettson, W. F. | 1 | Constructing dam. | DD. |
| Gates & Co., G. W. | 2 | Fir timber. | PP. |
| Gatti. (See Krebs.) | | | |
| Gaylord, L. T. | 2 | Dredging. | U. |
| Gaylord, N. J. | 7 | Constructing extension pier; pier work. | MM, OO. |
| Gazzam. (See Bair.) | | | |
| Geake & Co., G. | 1 | Constructing wharf and bunkers. | XX. |
| Gee Electric Construction Co. | 2 | Furnishing and installing gas engines. | CC. |
| General Electric Co. | 1 | Electric plant for U. S. S. Sentinel. | J. |
| Georgetown Iron Works. | 1 | Installing machinery on snag boat. | N. |
| Gerrish, J. H. | 14 | Dredging; ledge rock removal. | A, B, D, E, G. |
| Gibson, O. A. | 1 | Levee construction. | X. |
| Gilbert, H. P. | 1 | Rebuilding dikes. | K. |
| Gilbert, J. W. | 1 | Constructing bulkhead. | R. |
| Gillen & Gillen. | 1 | Repairing breakwater. | NN. |
| Gillen Dock, Dredging & Construction Co., The Edw. | 2 | Breakwater construction. | QQ. |
| Gillen, W. H. | 4 | Constructing superstructure breakwater; pile work. | MM. |
| Gillespie Co., T. A. | 9 | Constructing lock and guide walls, power house, navigable pass, abutment piers, weirs for dam, lock for movable dam, stone, locks and dams. | CC, FF. |
| Ginzel Co., John. | 1 | Repairs to piers. | PP. |
| Glazier, W. L. | 1 | Constructing ice pier. | CC. |
| Glencoe Lime & Cement Co. | 2 | Cement. | X, Y. |
| Golden Gate Dredging & Reclamation Co. | 1 | Dredging. | UU. |
| Golden Gate Dredging Co. | 1 | do. | UU. |
| Goodsell, E. R. | 1 | Fenders and booms. | E. |
| Goodyear, C. P. | 1 | Dredging. | O. |
| Gordon, N. E. | 1 | Hire of plant for bowlder removal. | B. |
| Grafton Quarry Co. | 1 | Stone. | HH. |
| Graham. (See Vinson.) | | | |
| Graham, L. M. | 1 | Lease of land. | T. |
| Graham, O. P. | 1 | Launch. | VV. |
| Graininger & Co. | 2 | Furnishing and delivering steel; steel and iron parts for Chanoline dam. | U, CC. |
| Graininger, H. G. | 1 | Constructing dike. | CC. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|--|--------------------------------|
| Grange, Loodice..... | 2 | Rent of dwelling..... | S. |
| Grattan Contracting Co..... | 1 | Pier construction..... | RR. |
| Gratto & Reimers..... | 1 | Repairing snag boat..... | UU. |
| Graves, O. F..... | 2 | Gasoline launch..... | WW. |
| Gray. (See Meeds; Welsh.) | | | |
| Grays Harbor Construction Co..... | 1 | Wharf and trestle construction..... | XX. |
| Great Lakes Construction Co..... | 6 | Breakwater construction and repairs; concrete work; pier construction; breakwater and pier heads. | QQ, RR. |
| Great Lakes Dredge & Dock Co..... | 70 | Rock excavation, rubble mound breakwater; dipper dredge; riprap; rubblestone covering; dredging; building crib breakwater; timber superstructure; dock construction; pier work; concrete work; constructing approach to lock; repairs to canal wall; stone; bridge construction. | B, LL, MM, NN, OO, PP, QQ, RR. |
| Great Lakes Towing & Dock Co..... | 1 | Dredging..... | MM. |
| Green, Adolph..... | 3 | Breakwater construction and repairs; pile. | MM, OO. |
| Green Stone & Quarry Co..... | 3 | Stone..... | MM, OO. |
| Gregg & Dutro..... | 1 | Timber..... | DD. |
| Gregg & Co., W. S..... | 2 | do..... | DD. |
| Gregg, Winfield S..... | 1 | Lock gate timber..... | DD. |
| Greiling Bros..... | 15 | Dredging; building pier and breakwater. | MM, NN, OO. |
| Greiling Bros. Co..... | 7 | Dredging; caissons and removing pier. | MM, OO. |
| Griffith, J. B..... | 1 | Lease of tug..... | T. |
| Griffith, McDermott & Watt Co..... | 1 | Dredging..... | NN. |
| Griffiths Iron Works Co..... | 1 | Wrought iron..... | Y. |
| Grim, Chas. F..... | 1 | Dredging..... | L. |
| Grim, Chas. P..... | 7 | do..... | I, K. |
| Grim, John L..... | 5 | do..... | K, L. |
| Griscom-Spencer Co..... | 1 | Joints for dredge..... | HH. |
| Groch & Townsend..... | 1 | Dredging..... | QQ. |
| Guess, jr., C. M..... | 1 | Dredge hire..... | S. |
| Gulf City Boiler Works Co..... | 2 | Boilers and fixtures for snag boats. | Q. |
| Gulfport Construction Co..... | 1 | Creosoting wooden hull..... | Q. |
| Gulfport Creosoting Co..... | 3 | Wooden barges; piles, lumber, etc. | Q, HH. |
| Hackett & Crumrine..... | 1 | Hire of tug..... | PP. |
| Hackett & Mullen..... | 3 | do..... | PP. |
| Hackett, G. G. & F. H..... | 3 | do..... | PP. |
| Haff, W. P. W..... | 1 | Coal..... | F. |
| Hale & Kern Contracting Co..... | 2 | Stone..... | WW. |
| Hall, James H..... | 1 | Launch construction..... | XX. |
| Hall, J. W..... | 2 | Launch, snagging..... | XX. |
| Hall, jr., F. O..... | 1 | Building launch..... | N. |
| Hall Steam Pump Co..... | 3 | Machinery..... | FF. |
| Hamilton, A. C..... | 1 | Dredging..... | UU. |
| Hamilton & Sawyer..... | 4 | do..... | A. |
| Hamilton Lumber Co., The..... | 1 | Timber for dam..... | CC. |
| Hammitt, J. M..... | 2 | Constructing quarter boat and towboat. | EE, FF. |
| Handy, C. M..... | 2 | Pier construction; stone..... | RR. |
| Hanna. (See Cassady.) | | | |
| Hanna, W. H..... | 1 | Buildings, fences, etc..... | EE. |
| Hannan. (See Daly.) | | | |
| Hanson, Alonzo..... | 2 | Constructing core wall; concrete pavements. | DD. |
| Harlan & Hollingsworth Co..... | 2 | Machinery, etc., for new hull; steel hull. | N. |
| Harper, H. T..... | 2 | Oil..... | SS. |
| Harries & Letteney Co..... | 1 | Dredging..... | B. |
| Harris. (See Witter.) | | | |
| Harris, Edward M..... | 1 | do..... | L. |
| Harris, J. D..... | 1 | do..... | TT. |
| Harris, J. W..... | 1 | Timber..... | DD. |
| Harris, Marshall C..... | 5 | Dredging..... | TT, UU. |
| Harris, N. R..... | 6 | do..... | TT, UU. |
| Harris, T. O., estate of..... | 1 | Office rent..... | AA. |
| Hartford & New York Transportation Co..... | 13 | Dredging; removing sunken piers. | D. |
| Hartley Boiler Works..... | 2 | Steel boilers..... | Q. |
| Hartsfield. (See Blalock.) | | | |
| Hartweg, Fred..... | 2 | Coal; piles..... | HH. |
| Hathaway & Co., J. E..... | 2 | Driving pile foundation; repairs to south revetment. | MM, OO. |
| Haubtman & Loeb..... | 1 | Engines for dredge..... | HH. |
| Hausler & Lutz Towing & Dock Co..... | 2 | Rebuilding dock..... | NN. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|--|---------------------------|
| Hausler & Lutz Towing Co..... | 1 | Breakwater..... | MM. |
| Hawaiian Dredging Co..... | 3 | Dredging..... | YY. |
| Hayward Co., The..... | 1 | Dredge bucket..... | DD. |
| Hazard, J. I..... | 2 | Coal..... | N. |
| Healy, Edwin S..... | 1 | Cement..... | Y. |
| Hearin & Ryan..... | 1 | Levee work..... | HH. |
| Heffron, Isaac..... | 2 | Riprap stone..... | U. |
| Hegewald Co., Chas..... | 11 | Machinery; trestles for dam; boilers; constructing steam launch; iron work for lock gates. | AA, CC, DD, EE, FF. |
| Heidenkamp, I..... | 1 | Stone..... | FF. |
| Heinzelman, Martin..... | 1 | Teams..... | HH. |
| Helgason Bros. & Garbish..... | 1 | Levee work..... | HH. |
| Henderson. (See Post.)..... | | | |
| Henhoefter & Vaughn..... | 1 | Repairs, landing piers..... | H. |
| Henningsen & Fortiner..... | 1 | Dredging..... | XX. |
| Henrich, J..... | 1 | Breakwater..... | RR. |
| Henry. (See Clark.)..... | | | |
| Hess, Eli C..... | 1 | Woodwork of house at guard lock. | JJ. |
| Hickler Bros..... | 5 | Dredging; reinforcing dike-derrick scow with diver and crew. | PP. |
| Hickler, H..... | 2 | Hire of boats; dredging..... | PP. |
| Higgins Oil & Fuel Co..... | 5 | Fuel oil..... | T. |
| Higgs. (See Hile.)..... | | | |
| Hildreth. (See Johns.)..... | | | |
| Hile & Higgs..... | 3 | Building power house..... | CC. |
| Hillsboro Dredging Co..... | 10 | Dredging; hire of dredging plant. | P. |
| Hinckley, A. R..... | 1 | Freightage..... | RR. |
| Hingston, E. J..... | 1 | Removal of dikes and dredging near dam. | CC. |
| Hirsch Lumber Co..... | 2 | Lumber..... | E. |
| Hite & Rafetto..... | 1 | Coal..... | F. |
| Hoffman, S. W..... | 4 | Constructing roadway; conduit at lock; revetment, reconstructing storehouse and waiting room. | DD. |
| Hoga. (See Mason.)..... | | | |
| Hollerbach & May..... | 2 | Repairs to dam; renewal of dam and abutment crib. | BB, DD. |
| Hollerbach & May Contract Co., The..... | 9 | Building lock and dam, dikes; movable dam; constructing guide walls; grading, etc., pass for dam, abutments; piers and weirs; foundation for navigable pass; lock. | BB, CC, DD. |
| Hollingsworth. (See Harlan.)..... | | | |
| Holmes, J. W..... | 1 | Coal..... | WW |
| Home Dredging Co..... | 5 | Dredging..... | O, Q, R. |
| Home Telephone Co., The..... | 2 | Constructing telephoneline; rental telephone instruments. | CC, WW. |
| Hope Engineering & Supply Co..... | 1 | Installing gas engines and starting air plant. | CC. |
| Horton, Horace E..... | 1 | Hoisting carriages..... | JJ. |
| Houlton Lumber Co..... | 1 | Piles..... | HH. |
| Houston-Rickards Dredging Co..... | 3 | Dredging..... | I. |
| Howard, E. J..... | 16 | Steam tenders; dump scows, hulls; towboat; repairing dredge hull, barges; constructing snag boat; repairing snag boat. | X, Y, AA, BB, CC, DD, HH. |
| Howard Shipyards Co..... | 4 | Building cabin and works of dredge; constructing hull; repairs to floating plant; constructing ice-making and refrigerating plant. | CC, DD. |
| Hubbard Building & Realty Co..... | 1 | Constructing lock and dam..... | T. |
| Hubbell & Co., H. W..... | 4 | Dredging; hire of boat..... | PP. |
| Hugo & Tims..... | 7 | Revetment work; timber pile construction; pier work and dredging; piles; superstructure pier. | LL, PP. |
| Hughes Bros. & Bangs..... | 9 | Dredging; stone for ice pier and bulkhead; pier construction. | F, H, QQ, RR. |
| Hull, Edmund..... | 1 | Dredging..... | PP. |
| Hunkin Bros. Construction Co., The..... | 2 | Superstructure construction; breakwater work. | QQ. |
| Hunter & Frey..... | 3 | Training and building dikes; repairs to revetment. | O, X, Y. |
| Huthmacher, C. C..... | 2 | Stone and spalls..... | HH. |
| Isenhower, Geo. W..... | 1 | Borings..... | CC. |
| Inland Marine Construction Co..... | 1 | Boat..... | FF. |
| Inland Waterways Co..... | 1 | Breakwater work..... | RR. |
| Illinois Steel Co..... | 1 | Cement..... | LL. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|--|-------------------------|
| Independent Asphalt Paving Co. & Northwest Contract Co. | 1 | Rock..... | XX. |
| Independent Bridge Co..... | 6 | Lock valves, lock gates; steel work for lock gates; bolts; furnishing and erecting lock gates. | U, AA, CC. |
| Indian Refining Co..... | 20 | Crude and fuel oil..... | OO. |
| International Contracting Co..... | 10 | Dredging; rock removal..... | C, D, E, F, G. |
| International Dredging Co..... | 1 | Dike work..... | XX. |
| Interstate Lumber Co..... | 1 | Lumber..... | EE. |
| Ironton Portland Cement Co., The..... | 3 | Cement..... | CC, DD. |
| Jackson & Corbett Co..... | 1 | Pier work..... | NN. |
| Jacobs Lumber Co., B. F..... | 1 | Building..... | FF. |
| Jacobson, John..... | 6 | Dredging..... | T, U. |
| Jahncke, Ernest Lee..... | 1 | Constructing barges..... | HH. |
| Jahncke (Inc.), Fritz..... | 1 | Cement..... | S. |
| Jahncke Navigation & Improvement Co. | 4 | Dredging..... | S. |
| Jahncke Navigation Co..... | 2 | Dredging; hire of dredge..... | S, HH. |
| Jennings. (See Berthold.) | | | |
| Johnson & Anderson..... | 2 | Building..... | FF. |
| Johnson-Anderson Co..... | 1 | Constructing wharf and jetty work | VV. |
| Johnson & Co., Wm..... | 1 | Coal..... | N. |
| Johnson & Roach..... | 1 | Riprap..... | OO. |
| Johnson, E. T..... | 2 | Rock excavation; dike repairs..... | WW. |
| Johnson, Geo. R..... | 1 | Lumber..... | E. |
| Johnson Iron Works..... | 8 | Constructing survey boat; boiler; repairs to dredge and tug; barge construction; rebuilding boat. | HH. |
| Johns, S. F., and W. H. Hildreth..... | 1 | Rebuilding wheelhouse on snag boat. | CC. |
| Johnston & Co., T. H..... | 1 | Timber..... | AA. |
| Johnston & Virden..... | 2 | Rock excavation..... | A, B. |
| Johnston Co., The Wm. T..... | 1 | Material..... | CC. |
| Johnston Contracting Co., The..... | 5 | Constructing lock keeper's houses, office and wareroom. | CC, EE. |
| Johnston, Chas. W..... | 1 | Rock excavation..... | B. |
| Johnston, Thos..... | 1 | Hull and cabin..... | OO. |
| Johnston, Wm. Wirt..... | 1 | Hull..... | HH. |
| Joice, J. K..... | 1 | Timber..... | AA. |
| Jones. (See Brewer; McGuire; Smyth.) | | | |
| Jones & Laughlin Steel Co..... | 2 | Twisted steel bars..... | PP. |
| Jones, Allen..... | 1 | Lease of launch..... | S. |
| Jonte. (See Foltz.) | | | |
| Judson. (See Baker.) | | | |
| Jung Co., J. C..... | 1 | Coal..... | HH. |
| Jung, J. C..... | 1 | do..... | HH. |
| Justice. (See Evans.) | | | |
| Jutte & Co., C..... | 1 | do..... | HH. |
| Jutte, W. C..... | 1 | Dredging..... | FF. |
| Kahului R. R. Co..... | 1 | Breakwater..... | YY. |
| Kammerer & Kern..... | 4 | Buildings..... | FF. |
| Kanawha Dock Co..... | 7 | Towing, docking, and repairing boats; repairing dump scows and floating plant; constructing barges; deck flat, fuel flat, hull for crane boat. | CC, DD, EE. |
| Kanawha Valley Machinery Works..... | 1 | Ironwork..... | EE. |
| Kaps & Brehm..... | 1 | Building power house..... | CC. |
| Katz. (See Callahan.) | | | |
| Katz & Callahan..... | 2 | Earthwork..... | JJ. |
| Keeler Co., E..... | 1 | Boilers..... | CC. |
| Keeney, Thos. Y..... | 2 | Stone for locks..... | EE. |
| Kendall, F. F..... | 1 | Hire and lease of dock..... | WW. |
| Kendall, J. B..... | 1 | Steel..... | K. |
| Kennedy Co., D. J..... | 1 | Cement..... | FF. |
| Kennedy, Eliz. J..... | 1 | Rent of office rooms..... | UU. |
| Kennedy, J. D..... | 1 | Rock..... | PP. |
| Kenney Bros..... | 1 | Hire of barge..... | DD. |
| Kenney Bros. Co..... | 1 | do..... | DD. |
| Kentucky & Ohio Transportation Co., The..... | 3 | Sand; gravel; hire of barge..... | DD. |
| Kentucky River Poplar Co..... | 1 | Hire of towboat..... | DD. |
| Keohane, Patrick..... | 3 | Breakwater construction..... | QQ. |
| Kepler, H. A..... | 2 | Driving piles..... | GG. |
| Kern. (See Hale; Kammerer.) | | | |
| Kern, Daniel..... | 1 | Dump cars..... | XX. |
| Kiel Bros. Plumbing & Heating Co..... | 1 | Pipes..... | CC. |
| Kiernan, John..... | 1 | Mattress, pile and rock work; jetty work. | VV. |
| Killebrew & Co., K. H..... | 1 | Stone and spalls..... | HH. |
| Killebrew & Co., W. L..... | 1 | Brush..... | HH. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|---|-------------------------|
| King Bridge Co..... | 1 | Superstructure of railroad bridge.. | JJ. |
| Kingsford Foundry & Machine Works. | 5 | Scotch boilers; fuel..... | N, U. |
| Kingston, E. J..... | 1 | Dredging..... | PP. |
| Kinney, Jr., Jas..... | 4 | Drilling well and fitting with air, lift; water system. | CC. |
| Kisen & Sons, T. W..... | 1 | Earthwork..... | JJ. |
| Kinsey Co., E. A..... | 1 | Planing machine and feed-roll attachment. | DD. |
| Kirchner, Albert..... | 6 | Building and repair of dams and shore protections. | HH. |
| Kirk. (See Sheridan.) | | | |
| Kirk, W. A..... | 1 | Hire of dredging plant..... | CC. |
| Kirk, Driscoll & Co..... | 7 | Construction and repair of dikes; dredging. | E, F, G. |
| Kirkpatrick, J. D., and W. S. Langford. | 1 | Hire of towboat and crew, quarter boat and barge. | Q. |
| Knoblock & Shelton..... | 1 | Constructing dam..... | CC. |
| Kolkmeier & Co., H. W..... | 1 | Levee..... | GG. |
| Kosmos Portland Cement Co..... | 3 | Cement..... | DD. |
| Kotcher, C. W..... | 1 | Lumber..... | PP. |
| Kratzer & Co., W. N..... | 2 | Steel leaves for bear trap; lock gates. | CC, FF. |
| Krebs, S. E., and T. C. Gatti..... | 1 | Wooden pontoons..... | R. |
| Kruse & Banks..... | 2 | Scow hire..... | VV. |
| Krusi, H..... | 1 | Dredging..... | TT. |
| Lackawanna Steel Co..... | 1 | Steel piling..... | PP. |
| Lafayette Bridge Co..... | 1 | Superstructure of highway bridge. | JJ. |
| Lake Erie Dredging Co..... | 9 | Dredging; hire of dredging plant. | PP, RR. |
| Lake Shore Stone Co..... | 1 | Sand and stone..... | MM. |
| Lake Superior Contracting & Dredging Co. | 5 | Dredging; sand and rock..... | LL, PP. |
| Lamontagne, J. A..... | 2 | Limestone rock; piles..... | PP. |
| Landor, E. J..... | 2 | Reconstructing abutments and miter sill for guard gates; building lock and dam. | DD. |
| Lane Bros. & Co..... | 1 | Constructing shore protection..... | L. |
| Langford. (See Kirkpatrick.) | | | |
| Lanterman, F. D..... | 1 | Jetty work..... | SS. |
| Lassig Bridge & Iron Works..... | 1 | Superstructure of railroad bridge.. | JJ. |
| Latham, C. H..... | 2 | Dredging..... | C. |
| Latta & Terry Construction Co..... | 2 | Jetty construction; stone, jetty.... | I. |
| Laughlin. (See Jones.) | | | |
| Lawhorn & Painter..... | 1 | Dredge tender hire..... | VV. |
| Lawless, T. Cheney..... | 1 | Hire of floating plant..... | S. |
| Lawrance. (See Aderholt.) | | | |
| Lawrence Cement Co., The..... | 2 | Cement..... | CC. |
| Laydon, Darby..... | 3 | Wing dams, and repairs to..... | UU. |
| Lea & Smith..... | 1 | Dredging and jetty construction..... | I. |
| Leake, J. W..... | 1 | Rubblestone..... | DD. |
| Leatham & Smith Towing & Wrecking Co. | 7 | Stone..... | MM, OO. |
| Leek & Field..... | 2 | Dredging..... | F. |
| Leeper. (See Whipple.) | | | |
| Legare & Rhett..... | 1 | Lease of warehouse..... | N. |
| Lehigh Portland Cement Co., The..... | 8 | Cement; sand and gravel..... | CC, DD, PP. |
| Lenning, M. E..... | 2 | Piles; lumber..... | HH. |
| Leonard. (See Lowrence.) | | | |
| Leonard, R. L..... | 1 | Constructing levee..... | Y. |
| Lester. (See Warren.) | | | |
| Letteney. (See Harries.) | | | |
| Lewis Dredging Co., L. M..... | 2 | Excavation; rock removal and building levees; dredging. | L. |
| Lewis Investment Co..... | 2 | Hire and lease of rooms..... | WW. |
| Lewis, L. M..... | 3 | Dredging..... | L. |
| Lidgerwood Manufacturing Co..... | 1 | Engines for snag boat..... | EE. |
| Liebke Hardwood Mill & Lumber Co., C. F..... | 1 | Oak lumber..... | HH. |
| Lindley & Co..... | 1 | Groceries..... | UU. |
| Lineham, Carroll & Co..... | 1 | Stone..... | M. |
| Lingham, John..... | 1 | Foundation and masonry of house at guard lock. | JJ. |
| Littleford Bros..... | 2 | Repairs to snag boat..... | CC. |
| Locher. (See Smith.) | | | |
| Lock City Manufacturing Co..... | 1 | Timber..... | PP. |
| Lockerbie, George..... | 1 | Dredging plant hire..... | PP. |
| Lockhart, Herbert..... | 1 | Rent of office room..... | VV. |
| Lockow, Albert, and John Coppes..... | 1 | Lock master's dwelling..... | MM. |
| Loeb. (See Hauptman.) | | | |
| Lord-Young Engineering Co..... | 1 | Breakwater..... | YY. |
| Love & Co., R..... | 1 | Pier repair..... | OO. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|---|-------------------------|
| Love & Son, R..... | 3 | Dredging; repairs to revetment; pier work. | OO. |
| Love, Robt..... | 5 | Pier work; bank revetment and pier repair. | OO. |
| Lowe. (See Christia.) | | | |
| Lowrance Bros. & Leonard..... | 1 | Constructing levee..... | Y. |
| Lund, C. E..... | 1 | Constructing mattress work and shore protection. | XX. |
| Lutes, C. G..... | 1 | Buildings..... | FF. |
| Lutz. (See Hausler.) | | | |
| Lydon & Drews Co., The..... | 13 | Dredging; revetment..... | MM, NN, OO. |
| Lynam, Peter..... | 1 | Stone in breakwater..... | F. |
| Lyons Lumber Co..... | 1 | Constructing dwellings..... | DD. |
| MacArthur Bros..... | 2 | Excavation and construction; excavating, building dikes. | PP, RR. |
| MacArthur Bros. Co..... | 3 | Rock and earth excavation; constructing west canal; lock construction. | PP, RR. |
| MacDonald, A. B., and Geo. F. Fagan. | 1 | Excavation; constructing wall, etc. | PP. |
| MacDonald & Beauvais..... | 2 | Pier extension..... | OO. |
| Mackey, D. Clinton..... | 3 | Dredging..... | M. |
| Magnetite Foundry Co..... | 1 | Lamp-posts..... | LL. |
| Maltby. (See Gahren.) | | | |
| Malley, Edw..... | 4 | Excavating work; enlarging spillway and building barrier; furnishing and placing earth. | UU. |
| Manitowoc Dry Dock Co..... | 1 | Survey and inspection boat..... | MM. |
| Mansfield Engineering Co..... | 1 | Building concrete locks..... | AA. |
| Marbleized Fibre Co., The..... | 1 | Marbleized fiber covering..... | CC. |
| Marcus Building Co., The M..... | 1 | Building warehouse..... | CC. |
| Marine Iron Works..... | 2 | Repairs to dredge; steam capstan. | WW. |
| Marion-Osgood Co..... | 1 | Purchase of dredge..... | AA. |
| Marion Steam Shovel Co., The..... | 2 | Dipper dredge..... | CC, DD. |
| Maritime Dredging Co..... | 11 | Dredging; removing bowlders and ledge rock. | D, E, F. |
| Marquette Cement Manufacturing Co. | 1 | Cement..... | JJ. |
| Marsch, John..... | 2 | Earthwork; excavating lock pit. | JJ, PP. |
| Marshall, Wallace..... | 2 | Manufacturing and delivery of highway bridges; superstructure for highway bridge. | JJ. |
| Marsh & Bingham Co..... | 2 | White-oak timber; lumber..... | JJ, NN. |
| Maryland Dredging & Contracting Co. | 82 | Dredging..... | H, J, K, L, M. |
| Maryland Steel Co..... | 1 | Hopper dredge..... | H. |
| Mason & Hoge Co..... | 1 | Constructing lock and dam..... | DD. |
| Massachusetts Contracting Co..... | 1 | Breakwater construction..... | A. |
| Massey, A. E..... | 1 | Stone..... | HH. |
| May. (See Hollerbach.) | | | |
| Mayrant. (See Simons.) | | | |
| McAnany, J. S..... | 1 | Dredging..... | TT. |
| McArthur. (See McCallum.) | | | |
| McBryde. (See Palmer.) | | | |
| McCain, S. H..... | 1 | Buildings..... | FF. |
| McCallum & McArthur..... | 1 | Building watchman's house..... | LL. |
| McCaughy, John J..... | 1 | Earthwork..... | JJ. |
| McClure Timber Co..... | 2 | Timber..... | CC, FF. |
| McCoy, C. M..... | 1 | Fir timber..... | PP. |
| McCord, D. C..... | 1 | Constructing lock and dam..... | T. |
| McCormick Lumber Co..... | 1 | Timber and plank..... | MM. |
| McDermott. (See Griffith.) | | | |
| McDevitt & Erskine..... | 2 | Installing pipe line and furnishing natural gas. | CC. |
| McDonald, F. L..... | 1 | Building breakwater embankment. | LL. |
| McEldowney, Thos. P..... | 1 | Rent of room..... | UU. |
| McGee & Co..... | 2 | Levee construction; constructing concrete river wall for bear trap sluice. | A, AA. |
| McGillis & Co., W. A..... | 1 | Dredging..... | QQ. |
| McGuire & Stanton Contracting Co. and Edw. Jones. | 1 | Revetment..... | GG. |
| McGuire, Hugh..... | 1 | Barrier work..... | UU. |
| McGuire, J. P..... | 3 | Lock gates; furnishing cover plates; valve engines. | BB, CC, PP. |
| McHarg-Barton Co..... | 1 | Dike construction..... | E. |
| McIlvaine & Spiegel Boiler & Tank Co., The..... | 2 | Constructing dipper dredge; installing flue boilers. | CC. |
| McKallip & Co., L. S..... | 1 | Cement..... | CC. |
| McKay & Runyon..... | 1 | Stone..... | DD. |
| McKechmie, A. (see Brubaker.) | 1 | Filling and grading..... | PP. |
| McKechmie, A. B..... | 1 | Clay..... | PP. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|---|-------------------------|
| McKim, T. J..... | 1 | Repairs and protection to embankment. | CC. |
| McLean Contracting Co..... | 1 | Dredging..... | L. |
| McMurry Contracting Co., J. W..... | 1 | Revetment..... | GG. |
| McNaughton, P. B., and O. E. Dunbar..... | 1 | Earth and rock excavation..... | PP. |
| McQuade Co., J. H..... | 2 | Dam construction..... | FF. |
| McSpitt, John and Joseph..... | 20 | Dredging; rock removal..... | D, E, F, G. |
| Meads-Gray Lumber Co..... | 1 | Lumber..... | DD. |
| Meinken, D..... | 1 | Constructing 4 lock tenders' dwellings. | CC. |
| Memphis Machine Works..... | 1 | Refrigerating plant..... | U. |
| Menz Lumber Co., The..... | 1 | Fir lumber..... | HH. |
| Merrill-Stevens Co..... | 10 | Repairing dredges; piling and stone; constructing pump boats; building combined dredge and snag boat; hire of dredge. | N, O, P. |
| Merritt-Stevens Engineering Co..... | 1 | Dredge bucket..... | N. |
| Mervy-Elwell Co..... | 2 | Repairing bridges; building highway bridge. | TT, UU. |
| Metzger, Delbert E..... | 1 | Breakwater..... | YY. |
| Michigan Bolt & Nut Works..... | 1 | Bolts, rods, etc..... | PP. |
| Middleton, Robt..... | 1 | Construction of quarter boat and pile driver. | Q. |
| Midland Land & Improvement Co..... | 2 | Dredging..... | G. |
| Midland Bridge Co..... | 1 | Constructing locks..... | X. |
| Miles, B. C..... | 1 | Rock..... | WW. |
| Milholland Co., J. & J. B..... | 13 | Steel, valves, etc.; filling valves; anchorages; steel castings; structural steel; iron and steel; machinery. | S, AA, CC, EE, FF. |
| Millen & Co., Robt..... | 2 | Pier repairs..... | NN, OO. |
| Miller (See Pihl; Sang; Randerson.) | | | |
| Miller, Andrew..... | 1 | Piles..... | K. |
| Miller, Hawley..... | 4 | Dredging..... | E, G. |
| Miller, J. D..... | 1 | Rock removal..... | F. |
| Miller, J. H..... | 2 | Dredging..... | K. |
| Miller, John..... | 7 | do..... | K. |
| Miller Supply Co..... | 1 | Telephone supplies..... | EE. |
| Miller, W. S..... | 2 | Oil and gasoline..... | SS. |
| Mills, John L..... | 1 | Dredging..... | J. |
| Milwaukee Bridge Co..... | 2 | Constructing steel drill boat hull and sluice gates. | HH, PP. |
| Miner, C. A..... | 2 | Dredging..... | I, L. |
| Miner, E. L..... | 1 | do..... | K. |
| Miner Engineering Co..... | 16 | do..... | K, L, M. |
| Minneapolis Steel & Machinery Co..... | 4 | Iron and steel; rods, clevises, etc..... | PP. |
| Missouri Valley Bridge & Iron Co., The..... | 2 | Barges; constructing lock and dam. | CC, GG. |
| Mitchell. (See Powell.) | | | |
| Mitchell & Co..... | 3 | Dredging..... | M. |
| Mitchell, John..... | 1 | Boilers..... | CC. |
| Modern Steel Structural Co..... | 1 | Sluice gates, manufacture and delivery of aqueduct. | JJ. |
| Moffatt, Alex..... | 1 | Clay..... | PP. |
| Mohler Lumber Co..... | 1 | White-oak timber..... | CC. |
| Molt, A. J..... | 1 | Piles..... | HH. |
| Monongahela & Western Dredging Co..... | 7 | Removal, dike, and dredging; hire of dredging plant. | CC, FF. |
| Monongahela River Consolidated Coal & Coke Co..... | 9 | Constructing scows; dump scows; wooden hull gravel barges; hull maneuvering boat; coal. | BB, CC, DD, HH. |
| Montgomery, Samuel..... | 1 | Building barriers..... | UU. |
| Moore & Sieber..... | 5 | Pile and brush dike; bulkhead repairs and construction; removing jetty; hull for dredge; jetty construction. | U. |
| Moore, R..... | 3 | Dredging..... | R. |
| Moreing, Lewis..... | 3 | Barrier building; sand and gravel. | UU. |
| Morgantown Cement Building Block Co..... | 1 | Concrete work..... | FF. |
| Morrell, G. R..... | 1 | Building..... | FF. |
| Morris. (See Frankman.) | | | |
| Morris & Cumings Dredging Co..... | 13 | Dredging..... | A, B, C, D, E, F, G, O. |
| Morris Machine Co..... | 1 | Pump and engines..... | U. |
| Morris Machine Works..... | 1 | Dredge machinery..... | WW. |
| Morrison Bros..... | 2 | Levee work; removing log jam..... | X, XX. |
| Morrison Dredging Co..... | 1 | Dredging..... | G. |
| Morton, A. E..... | 1 | Removing cross banks and building embankments. | JJ. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|--|-------------------------|
| Moscarelli, Jos..... | 1 | Building..... | FF. |
| Mouledons. (See Darring.) | | | |
| Muir-O'Sullivan Dredging & Dock Co. | 5 | Dredging..... | PP. |
| Mullen. (See Hackett.) | | | |
| Municipal Engineering & Construction Co. | 2 | Concrete mixer..... | EE, PP. |
| Munse, Anson B..... | 1 | Constructing embankment fill..... | UU. |
| Murphy. (See Anderson.) | | | |
| Murphy, Richard M..... | 6 | Willows, stone..... | HH. |
| Murray Co..... | 1 | Superstructure of pier..... | PP. |
| Murrell. (See Shore.) | | | |
| Muskegon Dock & Dredging Co..... | 1 | Pier work..... | OO. |
| Muskingum & Ohio River Transportation Co. | 1 | Hire of towboat..... | DD. |
| Muskingum River Stone Co..... | 1 | Stone..... | DD. |
| Myers & Son, P. W..... | 4 | Dredging..... | E. |
| National Contracting Co..... | 2 | Dredging; constructing lock and guide walls, power house, dam, abutment; grading and paving. | G, CC. |
| National Dredging Co..... | 1 | Dredging..... | R. |
| National Iron & Steel Co..... | 1 | Steel..... | T. |
| National Mortar Co..... | 1 | Cement..... | K. |
| Neill, J. M..... | 2 | Constructing dwelling; lock houses, repairs, etc. | DD, EE. |
| Nelson. (See Burk.) | | | |
| Nelson, August..... | 1 | Dredging..... | U. |
| Newbegin Lumber Co..... | 1 | Timber..... | PP. |
| Newbegin, J. G..... | 5 | Timber for dump scows; lumber. | DD, MM. |
| Newburgh Dredging Co..... | 8 | Dredging..... | E, G. |
| New England Granite Co..... | 1 | Stone..... | B. |
| New England Telephone & Telegraph Co. | 1 | Telephone service..... | B. |
| Newhall Chain, Forge & Iron Co..... | 1 | Chain and clevises..... | EE. |
| New Jersey Car Spring & Rubber Co. | 2 | Suction hose; rubber sleeves..... | N, SS. |
| New Jersey Foundry & Machine Co.. | 15 | Chain; steel and cast-iron members for lock gates; distilling plant; furnishing and installing lock-operating mechanism, gate engines for dam; feed-water heater; constructing dam, guide wall, steel service bridge; drift-bolts; steelwork; iron for dams; refrigerating plants. | N, U, CC, DD, EE, HH. |
| New Kensington Lumber Co..... | 1 | Building..... | FF. |
| New London Marine Iron Works..... | 1 | Wooden scow..... | E. |
| Newman William, & Robt. Crawford.. | 1 | Cement sheds..... | DD. |
| New Orleans Coal Co..... | 1 | Coal..... | HH. |
| New York & Hartford Transportation Co. | 1 | Dredging..... | D. |
| New York Shipbuilding Co..... | 1 | Constructing pump casing for dredge. | HH. |
| Nicolette Lumber Co..... | 1 | Timber..... | EE. |
| Niemes, Henry..... | 1 | Plumbing..... | CC. |
| Nina Realty Co..... | 2 | Lease of office and storage rooms. | HH. |
| Niver Coal Co., W. K..... | 1 | Coal..... | F. |
| Norfolk Dredging Co..... | 7 | Dredging and removing wreck, old bridge approach, etc. | L. |
| Norman, H. R..... | 1 | Buildings..... | FF. |
| North *Alabama Construction Co. (See Shippey.) | | | |
| North American Dredging Co..... | 12 | Dredging; retaining wall; filling, soiling, sodding; excavating. | P, U, SS, TT, UU, XX. |
| Northern Dredging & Dock Co..... | 8 | Dredging..... | LL. |
| Northern Dredging Co..... | 1 | do..... | LL. |
| Northern Electric Co..... | 1 | Transformers and oil switch..... | PP. |
| Northwest Construction Co..... | 2 | Rock..... | WW. |
| Northwestern Steam Boiler & Manufacturing Co. | 1 | Boiler..... | LL. |
| Oades, W. H..... | 2 | Rebuilding and repairing boats..... | PP. |
| O'Brien. (See Rogers.) | | | |
| O'Donnell, Michael J..... | 1 | Rock removal..... | B. |
| Ogden Co., J. E..... | 1 | Bolts, spikes, etc..... | E. |
| Ogden, J. E..... | 2 | Bolts and bars..... | PP. |
| Ohio River Contracting Co., The..... | 12 | Hire of dredging plant; building Chanoine dam; dredging; constructing Poiree foundations and extension; constructing lock and dam; repairs and protection of bank; hire of barges; removing ledge. | CC, DD, HH. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|---|--------------------------------------|
| Oliver, B. P..... | 1 | Office rooms..... | UU. |
| Oliver, Joseph..... | 1 | Rebuilding lock master's house..... | DD. |
| Oliver, J. T..... | 1 | Stone and spalls..... | HH. |
| Oregon Rafting Co..... | 1 | Piles..... | WW. |
| Oregonia Bridge Co., The..... | 1 | Constructing steel highway bridge..... | DD. |
| Organ, C. H..... | 4 | Water-front privileges..... | HH. |
| O'Rourke & Co., J. M..... | 2 | Repairing jetties; sea wall..... | U. |
| Osburn, Fred..... | 1 | Removing trestle bents..... | SS. |
| Osgood. (See Marion.) | | | |
| O'Sullivan. (See Muir.) | | | |
| Outzen. (See Shippey.) | | | |
| Pacific Bridge Co..... | 1 | Hire of dredge and scows..... | WW. |
| Pacific Reclamation Co..... | 2 | Dredging..... | TT. |
| Pacific Telephone & Telegraph Co..... | 1 | Rental telephone instruments..... | WW. |
| Packard & Co., R. G..... | 3 | Removing rock; dredging..... | E, G. |
| Packard Co., R. G..... | 13 | Ledge rock removal; dredging, shoals; clearing areas; removing dumps. | C, E, F. |
| Packard Dredging Co., J. S..... | 16 | Dredging; rock removal..... | A, B, C, D. |
| Page & Shnoble..... | 3 | Foundations and walls for locks and piers; excavating. | JJ, NN. |
| Painter. (See Lawhorn.) | | | |
| Palmer & McBryde..... | 3 | Building barrier and inlet wall..... | UU. |
| Palmer, Guy V..... | 1 | Coal..... | Q. |
| Panke, Wm. F..... | 1 | Building lock keepers' houses..... | CC. |
| Paquet, Joseph..... | 1 | Constructing fish ladder..... | WW. |
| Parker. (See Schmidt.) | | | |
| Parkersburg & Marietta Sand Co..... | 2 | Sand and gravel..... | CC, EE. |
| Parkersburg Dock Co..... | 3 | Docking and repairing boats..... | CC, DD. |
| Parkersburg Mill Co., The..... | 3 | Timber..... | CC, EE. |
| Parkhill, G. W..... | 2 | Raising parts of jetties; raising training wall. | O. |
| Parrish. (See Spence.) | | | |
| Parrott, Richard..... | 4 | Dredging; jetty work; building shore protection. | E, I, L. |
| Parrott, Wm..... | 2 | Repairing dikes..... | E. |
| Patterson, E. A..... | 1 | Rubblestone..... | DD. |
| Patterson, J. J..... | 1 | Lease of land..... | T. |
| Pattin Bros. Co., The..... | 1 | Iron, steel, etc..... | EE. |
| Payment, F. X..... | 1 | Constructing boat..... | PP. |
| Pearson. (See Taylor.) | | | |
| Pelissier, Noah..... | 1 | Sand..... | LL. |
| Peninsula Bark & Lumber Co..... | 4 | Timber; piles..... | PP. |
| Penn-Allen Cement Co..... | 1 | Cement..... | DD. |
| Penn Bridge Co..... | 21 | Lock gates; iron and steel; sluice valves; castings and erection of lock gates; horses and irons for Chanoine wickets; reconstructing bear trap gates at dam; dam parts; constructing frame building. | S, T, X, AA, CC, DD, FF, GG, HH, PP. |
| Pennsylvania Dredging Co..... | 9 | Dredging..... | I. |
| Perini, Romano V..... | 2 | Repairing jetties..... | A, F. |
| Perkinson, Frank..... | 1 | Dredging..... | F. |
| Perry, Frank..... | 2 | Hemlock timber..... | PP. |
| Perry, R. A..... | 3 | Dredging..... | SS, TT, XX. |
| Petersburg Iron Works..... | 1 | Constructing wooden hull, sea-going suction dredge. | N. |
| Pfaff & Smith Co..... | 1 | Constructing ice pier..... | EE. |
| Phillips, H. W..... | 1 | Removing ledge rock..... | B. |
| Philpot, C. E..... | 1 | Brush..... | Y. |
| Picton & Co., D. M..... | 2 | Jetty work; constructing stone dike. | T, U. |
| Picton, David M..... | 3 | Jetty construction; stonework on jetties. | U. |
| Picton Island Red Granite Co..... | 1 | Stone..... | RR. |
| Pigeon Hill Granite Co. (see Rockport). | 1 | Stone for breakwater..... | A. |
| Pihl & Miller..... | 1 | Concrete work..... | FF. |
| Pioneer Boat & Pattern Co., The..... | 2 | Gasoline boat..... | CC, DD. |
| Pittsburgh Bridge & Iron Works..... | 1 | Lock gates..... | FF. |
| Pittsburgh Dredging & Construction Co..... | 1 | Dredging..... | FF. |
| Pittsburgh Forge & Iron Co..... | 1 | Bolts, rods, etc..... | PP. |
| Pittsburgh Industrial Iron Works..... | 2 | Iron and steel, pumps, etc..... | CC, EE. |
| Pittsburgh Manufacturing Co..... | 1 | Bars, rods, etc..... | CC. |
| Pittsburgh Screw & Bolt Co..... | 3 | Bolts, rods; manufactured steel..... | CC, PP. |
| Pittsburgh Steel Construction Co..... | 1 | Superstructure of highway bridges..... | JJ. |
| Pittsburgh Trolley & Forge Co..... | 1 | Forgings for dam..... | CC. |
| Pittsburgh Valve, Foundry & Construction Co..... | 2 | Pipe fittings, pipes, air receivers, etc. | CC. |
| Pneumatic Caisson Co..... | 2 | Constructing lock and dam..... | CC. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|--|-------------------------|
| Polhamus, A. A. | 5 | Dredging, stone. | SS. |
| Pomeroy, Warren H. | 1 | Dredging. | TT. |
| Pope & Sons, Lewis. | 1 | Services of towboat. | DD. |
| Port Huron Shipbuilding Co. | 1 | Steel lock gates. | AA. |
| Portland Iron Works. | 1 | Constructing dredge. | VV. |
| Port of Portland. | 4 | Hire of dredge. | WW. |
| Post & Henderson Co. | 1 | Timber. | RR. |
| Poston, Newton. | 2 | Coal. | WW. |
| Potomac Granite Co. | 1 | Stone. | K. |
| Potomac Sand & Gravel Co. | 4 | Riprap stone. | K. |
| Pouliot. (See Rose.) | | | |
| Pound. (See Cowan.) | | | |
| Pound Construction Co. | 1 | Earthwork. | JJ. |
| Powell & Mitchell. | 1 | Pier work. | LL. |
| Power. (See Vermilye.) | | | |
| Power & Co., D. | 2 | Repairing training wall; constructing wharf. | O. |
| Pregnall, Samuel. | 1 | Dredge repairs. | N. |
| Pregnall, S. J. | 1 | do. | N. |
| Preslar-Crawley Co., The. | 2 | Drilling test holes at dams. | CC. |
| Preslar Manufacturing Co., C. F. | 1 | Drilling test holes. | CC. |
| Preslar Prospecting & Engineering Co., The. | 1 | Drilling test holes for dam. | CC. |
| Preston, J. W. | 1 | Repairs to breakwater. | LL. |
| Price, D. F. | 1 | Stone for dam. | CC. |
| Fritchatt & Co., W. H. | 1 | Meats. | HH. |
| Pryor, Jas. | 3 | Dredging. | LL. |
| Puget Sound Bridge & Dredging Co. | 13 | Dredging; removing rock. | XX. |
| Queen City Marine Co. | 2 | Rent of storage room. | CC. |
| Queen City Marine Railway Co., The. | 1 | Repairing dump scows. | CC. |
| Queen City Supply Co., The. | 1 | Boiler, hoisting engines. | EE. |
| Rabbitt & Sons Co., The M. | 2 | Stone; constructing new channel. | PP. |
| Racine Boat Co. | 2 | Tug. | LL. |
| Rafetto. (See Hite.) | | | |
| Ramsey. (See Albright.) | | | |
| Ramsey, James. | 1 | Constructing cement sidewalk. | DD. |
| Randerson & Miller. | 4 | Dredging. | E. |
| Randerson, John P. | 21 | Dredging; removing bowlders. | C, D, F. |
| Rasmussen, Chris & Nels. | 1 | Hire of room. | VV. |
| Reaves, N. C. | 1 | Bottom-dump lighter. | N. |
| Reichsteiner Bros. | 3 | Building dwellings. | DD. |
| Read, T. S. | 1 | Jetty repairs. | T. |
| Rees & Sons Co., J. | 4 | Boilers; machinery. | FF. |
| Rees, T. M. | 1 | Building repair steamer. | FF. |
| Reimers. (See Gratti.) | | | |
| Restein & Co., Clement. | 1 | Suction hose. | N. |
| Rhett. (See Legare.) | | | |
| Richardson & Ward. | 1 | Stone. | H. |
| Rickards. (See Houston.) | | | |
| Rickards Dredging Co. | 19 | Dredging. | I. |
| Rider, A. J. | 1 | do. | I. |
| Riebolt, August, and Joseph Wolter. | 1 | Pile pier. | MM. |
| Riebolt, Wolter & Co. | 8 | Constructing wooden barge, stone barge; stone; dredging. | MM. |
| Righter, G. W. | 1 | Timber. | EE. |
| Ripley, H. C. | 1 | Jetty construction. | U. |
| Ripley Hardware Co. | 1 | Gasoline boat. | EE. |
| Richer, Geo. S. | 3 | Cement. | UU. |
| Risley Bros. & Co. | 1 | Stone. | T. |
| Ritter Lumber Co., W. M. | 1 | White-oak timber. | EE. |
| River & Harbor Improvement Co. | 33 | Dredging. | I, J. |
| Riverside Bridge Co. | 2 | Anchor beams; steel lock gates. | CC, DD. |
| Riverside Iron Works. | 3 | Cast-steel drags; drag, pipe and patterns; constructing new hull and installing machinery. | N, O. |
| Roach. (See Johnson.) | | | |
| Roberts & Co., Fred C. | 1 | Bridge work. | TT. |
| Robertson. (See Corbett.) | | | |
| Robertson Steel & Iron Co., W. F. | 1 | Plates for dredge. | CC. |
| Robinson. (See Smith.) | | | |
| Robinson Lumber, Veneer & Box Co. | 5 | Timber for lock gates; waling timber; piles and lumber. | S, HH. |
| Rockport and Pigeon Hill Granite Cos. | 2 | Breakwater. | B. |
| Rockport Granite Co. | 1 | Stone in dike. | B. |
| Rockport Granite Co. and Pigeon Hill Granite Co. | 3 | Breakwater; rubblestone in jetty; stone. | B. |
| Rockport, Pigeon Hill, and Cape Ann Granite Cos. | 1 | Stone. | B. |
| Rodermond, R. B. | 3 | Dredging; removing bowlders. | B, G. |
| Rodgers & Abel. | 1 | Building concrete wall. | CC. |
| Rodgers Sand Co. | 1 | Sand. | FF. |
| Rodgers, W. C. | 3 | Timber. | AA. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|--|-------------------------|
| Roe & Woodrow..... | 1 | Lock-gate timbers..... | DD. |
| Roetzel & Chipman..... | 1 | Repairs to lock and dam..... | BB. |
| Rogers & O'Brien..... | 3 | Dredging; excavating..... | G, QQ. |
| Rogers, Geo. A..... | 1 | Removing reefs..... | E. |
| Rogers Lumber Co..... | 1 | Lumber..... | HH. |
| Rooney, W. E..... | 1 | Dredging..... | PP. |
| Rose, C. S., and F. X. Pouliot..... | 1 | Constructing buildings..... | PP. |
| Rosedale Foundry & Machine Co..... | 1 | Castings for dam..... | CC. |
| Rosedale Foundry Co..... | 1 | Machinery..... | FF. |
| Ross, P. Sanford..... | 44 | Dredging; removing stone and ledge rock; constructing and repairing jetties; sand; riprap in breakwater; material in training wall. | D, E, F, G, L, N, O, P. |
| Ross, R. G..... | 17 | Constructing mound on jetty; stone; repair training wall; jetty work; stone for revetment; rock removal; dredging; hire of dredging plant. | N, O, P. |
| Rowe Bros. Co..... | 2 | Stone, jetties, dike extension..... | A, B. |
| Runkle & Wright..... | 1 | Piles..... | FF. |
| Runyon. (See McKay.) | | | |
| Russell, W. S..... | 1 | Breakwater work..... | SS. |
| Russell Wheel & Foundry Co..... | 2 | Gates and sluice valves; sluice gates. | JJ, NN. |
| Rust. (See Swift.) | | | |
| Rust, Swift & Co..... | 4 | Revetment; repair of dams and shore protection. | GG, HH. |
| Rutherford, H. S..... | 1 | Hire boathouse..... | I. |
| Ryan. (See Hearin.) | | | |
| Ryan, Geo..... | 1 | Flat scows..... | MM. |
| Rye & Fleming..... | 1 | Clay..... | PP. |
| Sabine Transportation Co..... | 1 | Lumber..... | U. |
| St. Paul Foundry & Machine Co..... | 1 | Grated covers and footwalks..... | HH. |
| Salmen Brick & Lumber Co..... | 9 | Piles; lumber..... | HH. |
| Sammons Co., E. A..... | 2 | Boiler; ice machinery, refrigerating plant, distilling plant. | HH. |
| Sanborn, Geo. W..... | 9 | Coal..... | WW. |
| Sanford & Brooks Co..... | 10 | Timber revetment, piers, sluice, etc., and repairing and retaining banks; dredging; jetty construction; dump scows. | H, J, L, M. |
| San Francisco Bridge Co..... | 8 | Stone; dredging; reclamation..... | SS, TT, UU, YY. |
| Sang, Alex..... | 3 | Pierhead; stone breakwater..... | LL. |
| Sang & Miller..... | 1 | Rubble mound..... | LL. |
| Sang & Preston..... | 1 | Damage to breakwater repaired..... | LL. |
| Savage Construction Co..... | 1 | Pits and foundations..... | JJ. |
| Savannah Dredging Co..... | 2 | Dredging..... | N, O. |
| Savannah Engineering & Construction Co..... | 1 | do..... | O. |
| Sawyer. (See Hamilton.) | | | |
| Scaife Foundry & Machine Co..... | 2 | Wrought-iron and steel horses..... | CC. |
| Scales, Joseph..... | 1 | Stone..... | PP. |
| Schimp, Mary..... | 1 | Rent of house..... | UU. |
| Schmidt & Parker Packing Co..... | 1 | Meats, etc..... | UU. |
| Schmidt, Ernst..... | 2 | Dredging..... | MM. |
| Schnorbach. (See Bennet.) | | | |
| Schnorbach & Co., L. E..... | 2 | Breakwater construction; pier..... | OO. |
| Schoellhorn-Albrecht Machine Co..... | 2 | Marine engines; winches..... | N, HH. |
| Schroeder Lumber Co., John..... | 1 | Fir timber..... | PP. |
| Schwartz Foundry Co..... | 1 | Repairs to dredge..... | HH. |
| Schwarzschild & Sulzberger Co..... | 1 | Meats..... | HH. |
| Scotfield Co..... | 2 | Dredging and change in pier plane; constructing piers. | L. |
| Scott Co., T. A..... | 9 | Hire of lighter; removing bowlders and ledge; dredging. | C, D. |
| Scott, T. A..... | 1 | Dredging..... | C. |
| Sea Coast Construction Co..... | 3 | Stone for breakwater; breakwater construction. | C, D, QQ. |
| Seattle Bridge Co..... | 1 | Dredging..... | XX. |
| Seattle Construction & Dry Dock Co..... | 1 | Constructing dredge..... | VV. |
| Sederquist, J. W..... | 1 | Steel for lock..... | S. |
| Seely-Taylor Co..... | 3 | Dredging..... | E, F. |
| Semande & Durocher..... | 3 | Derrick and diving plant; dredge boat. | PP. |
| Serrel, W. L..... | 1 | Timber..... | JJ. |
| Shafer, J. Clements..... | 1 | Removing dike and jetty..... | L. |
| Shawver Co., W. F..... | 1 | Tinwork..... | EE. |
| Shea, Thos. J..... | 2 | Installing oil tank; oil-burning system. | WW. |
| Shelton. (See Knoblock.) | | | |
| Shelton, W. H..... | 4 | Pier construction; stone; concrete work. | RR. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|--|-------------------------|
| Sheppard, P. H. | 1 | Clay. | PP. |
| Sheridan-Kirk Contracting Co. | 10 | Building section of canal; concrete river wall; lock for movable dam; fitting and connecting pipes; hire of snagging plant; constructing lock and dam; removing wreck. | AA, CC, DD. |
| Sherman, Brown, Clements Co. | 1 | Rods, bolts, etc. | E. |
| Shervan & Sons, Jas. | 1 | Repairs to dredge. | HH. |
| Short, John. | 7 | Repairs and extension of jetty; repairs to brush dams; bank protection; jetty work; constructing dike; renewal of cribs. | S, T, CC, DD. |
| Shippey & Outzen. | 1 | Excavation work. | AA. |
| Shippey, W. A., and The North Alabama Construction Co. | 1 | Excavation, canal trunk. | AA. |
| Shnable. (See Page.) | | | |
| Shobe, R. O. (see DeWitt). | 3 | Revetment; dike. | GG. |
| Shore, Robert, and Bennett Murrell. | 1 | Lock houses. | EE. |
| Sickles, E. C. | 3 | Stone, in dike. | EE. |
| Sickles, E. S. | 3 | Stone; dike repair and extension. | E. |
| Sigler, Chas. | 1 | Railroad construction. | U. |
| Sieber. (See Moore.) | | | |
| Simono, Chas. | 3 | Dredging. | PP. |
| Simons-Mayrant Co. | 9 | Constructing cofferdam dike; dredging; repairing training wall; shore protection; training dikes. | N, O. |
| Simpson, J. K. | 1 | Tug. | WW. |
| Simpson & Co., J. C. | 1 | Lumber and millwork. | JJ. |
| Skene & Sons, James. | 1 | Constructing dam guide walls. | DD. |
| Sliger Bros. | 3 | Lumber. | CC. |
| Smart, Edwin L. | 1 | Removing rock. | E. |
| Smith. (See Burk; Caughren; Duke; Egan; Lea; Leatham; Pfaff.) | | | |
| Smith & Co. (Grant); and Locher. | 2 | Excavation and channel work. | PP. |
| Smith & Robinson. | 3 | Stone, in dike; repairing break-water; dredging. | B, F, L. |
| Smith & Son, C. G. | 7 | Riprap jetties; stone. | K. |
| Smith & Sons, Theo. | 1 | Dredge boat. | M. |
| Smith Co., The L. P. & J. A. | 3 | Dredging. | QQ. |
| Smith, J. B. | 1 | Coal. | UU. |
| Smith, John. | 2 | Dredging. | OO. |
| Smith, Leatham D. | 2 | Stone. | OO. |
| Smith, T. H. | 3 | do. | MM, OO. |
| Smith, T. L. | 1 | Lease of room. | U. |
| Smith, Towles & Co. | 1 | Constructing building. | DD. |
| Smoot, L. E. | 1 | Gravel and sand. | K. |
| Smyth & Jones. | 1 | Canal construction. | WW. |
| Snyder, Augustus. | 5 | Constructing dwellings, etc. | DD. |
| Somerville Bros. | 1 | Lumber. | MM. |
| Soo Hardware Co., The. | 3 | Iron and steel; bolts, washers, etc. | PP. |
| Soo Lumber Co., The. | 4 | Timber. | PP. |
| Soper, O. T. | 1 | Rent of land. | DD. |
| Souther, Charles E. | 2 | Dredging. | B. |
| Southern Bell Telephone & Telegraph Co. | 2 | Telephone service. | N. |
| Southern Dredging Co. | 5 | Dredging and rock removal. | P, Q, R. |
| Southern Sawmill Co. | 1 | Pile and timbers. | HH. |
| Southern States Portland Cement Co. | 1 | Cement. | Q. |
| South Texas Telephone Co., The. | 1 | Lease of telephone. | T. |
| Southwestern States Portland Cement Co. | 1 | Cement. | T. |
| Sower Contracting Co. | 1 | Stone. | G. |
| Sowles Lumber Co., The C. W. | 1 | Lumber. | DD. |
| Spears & Sons, F. B. | 5 | Cement; cement sacks. | LL, PP. |
| Speed & Co., J. B. | 2 | Cement. | DD. |
| Spence & Parrish. | 1 | Wooden revetment. | T. |
| Spencer. (See Griscom.) | | | |
| Spiegel. (See Mellvaine.) | | | |
| Springfield Boiler & Manufacturing Co., The. | 4 | Constructing pontoons; steel plate suction head; dredge and pipe line construction. | CC, HH. |
| Springfield Bridge & Iron Co. | 1 | Aqueducts. | JJ. |
| Standard American Dredging Co. | 6 | Dredging; excavating material; building embankments. | SS, UU, YY. |
| Standard Construction Co. | 1 | Pier construction. | NN. |
| Standard Contracting Co. | 3 | Excavating; dredging. | PP, QQ. |
| Standard Dredging Co. | 2 | Dredging. | YY. |
| Standard Fuel Supply Co. | 1 | Coal. | N. |
| Standard Oil Co. | 1 | Oils. | HH. |
| Standard Underground Cable Co. | 1 | Light and telephone cable. | PP. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|---|----------------------------------|---|-------------------------|
| Stand, J. J. | 1 | Dredging..... | QQ. |
| Stanton. (See McGuire.) | | | |
| Stearns Salt & Lumber Co., The..... | 1 | Hemlock timber..... | PP. |
| Stebbings & Wenzell..... | 1 | Breakwater construction..... | NN. |
| Steels, John R. | 1 | Constructing office building..... | CC. |
| Stern Foundry & Machine Co..... | 5 | Coal chutes; bolts, washers, etc.; suction pipes for dredge; repairs to dredge. | HH. |
| Sterrit-Thomas Foundry Co..... | 1 | Lock parts..... | FF. |
| Stevens. (See Merrill.) | | | |
| Stillwell, Joseph..... | 1 | Repairing dike..... | G. |
| Stoll, John T..... | 1 | Rent of office room..... | UU. |
| Stone, Chas..... | 1 | Pits and foundations..... | JJ. |
| Stoner, R. J..... | 1 | Piling and brush fascines..... | XX. |
| Streater, J. B..... | 1 | Removal snags, etc..... | S. |
| Strong & Co., C. H..... | 1 | Jetty work..... | QQ. |
| Sturgeon Bay Stone Co..... | 1 | Stone..... | MM. |
| Sturgis, H. H..... | 1 | Rock excavation..... | A. |
| Submarine Contracting Co..... | 1 | Ledge removal..... | B. |
| Submarine Signal Co..... | 1 | Steamer..... | L. |
| Suderley & Sons, C. F..... | 2 | Timber and piling..... | E. |
| Sullivan. (See Dunbar.) | | | |
| Sullivan, J. J..... | 1 | Stone..... | RR. |
| Sullivan, J. H. & D..... | 2 | Hire of tug..... | PP. |
| Sullivan, J. K..... | 1 | Removal of ledge rock..... | C. |
| Sullivan, L. S..... | 2 | Hire of tug..... | PP. |
| Sullivan, M..... | 12 | Dredging; hire of tug; dredging plant; drill boat. | PP. |
| Sulzberger. (See Schwarschild.) | | | |
| Sun Pipe Line Co..... | 1 | Fuel oil..... | T. |
| Sunset Lumber Co..... | 1 | Lumber..... | LL. |
| Superior Portland Cement Co., The..... | 3 | Cement..... | CC, EE. |
| Supple, Joseph..... | 8 | Constructing snag boat; scows; dredge; barge; tug. | WW. |
| Sutter, J. L..... | 1 | White-oak timber..... | DD. |
| Swarbrick, Jas. G..... | 3 | Subsistence supplies..... | HH. |
| Sweeney, J. W..... | 1 | Stone..... | WW. |
| Sweeney Shipyard & Foundry Co., M. A..... | 14 | Constructing stern-wheel tugboat; dredge and snag boat; wooden hull steamboat; machinery. | Q, S, U, X, DD, FF, HH. |
| Swift. (See Rust.) | | | |
| Swift & Co..... | 2 | Meats..... | HH. |
| Swift & Rust..... | 2 | Dike..... | GG. |
| Swingle & Co., J. A..... | 1 | Concrete work..... | DD. |
| Tacoma Dredging Co..... | 3 | Dredging..... | SS, XX. |
| Talarico, Carmine, and Hy. Watson..... | 1 | Excavating and depositing material. | PP. |
| Talbott & Co., H. E..... | 3 | Building lock and dam; armored concrete pavement. | DD, FF. |
| Talbott Co., H. E..... | 2 | Constructing lock..... | X. |
| Tanner, Lewis..... | 2 | Hire of towboat and crew and plant for removing snags. | CC, DD. |
| Tatem & Bowen..... | 2 | Hoisting engines..... | WW. |
| Tatnall-Brown Co..... | 6 | Jetty work; sheet piling..... | I. |
| Taylor. (See Seely.) | | | |
| Taylor & Pearson..... | 1 | Removing material and ledge rock. | E. |
| Taylor Dredging Co..... | 1 | Dredging..... | D. |
| Taylor, H. W..... | 1 | Stone..... | WW. |
| Taylor, V. E..... | 2 | Erecting lock keeper's houses..... | CC, EE. |
| Taylor, W. H..... | 4 | Dredging..... | D, F, G. |
| Teasdale, A. B..... | 1 | Building dams and shore protections. | HH. |
| Terrebone. (See Drackett.) | | | |
| Terry. (See Latta.) | | | |
| Thames Tow Boat Co., The..... | 1 | Ledge removal..... | D. |
| Thomas. (See Sterrit.) | | | |
| Thomas, E. J..... | 1 | Lumber..... | CC. |
| Thomas, J. C..... | 1 | Raising crest of lock and dam..... | DD. |
| Thompson Co., H. B..... | 1 | Dam construction..... | T. |
| Thompson, J. G..... | 1 | Piles driven in beach near dike..... | B. |
| Thompson, J. W..... | 1 | Sand and gravel..... | S. |
| Thomson, Thos..... | 1 | Repairs to dam..... | UU. |
| Tims. (See Hugo.) | | | |
| Todd & Sons..... | 1 | Building dwellings, outhouses..... | DD. |
| Toledo Dredging & Dock Co..... | 2 | Dredging..... | PP. |
| Toledo Improvement Co..... | 1 | do..... | PP. |
| Towles. (See Smith.) | | | |
| Trigg Co., Wm. R..... | 1 | Dredge construction..... | HH. |
| Triple-State Electric Co..... | 1 | Electric-light plant..... | EE. |
| Triumph Electric Co., The..... | 2 | Electric-light plant for dredge; refrigerating plant for snag boat. | CC. |
| Twiggs, A. J..... | 5 | Constructing dikes..... | O. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|---|----------------------------|
| Tweedden & Co., A. W. | 1 | Dredging..... | XX. |
| Tymon Lumber Co. | 1 | Timber..... | PP. |
| Underwood, J. C. | 1 | Sidewalks, pavements, etc. | U. |
| Union Foundry & Machine Co. | 1 | Bolts..... | CC. |
| Union Machine Co., The. | 2 | Metal work for dump scows; locomotive-type boiler. | DD. |
| United Kansas Portland Cement Co. | 2 | Cement..... | X. |
| United States Dredging & Contracting Co. | 2 | Dredging..... | G. |
| United States Fidelity & Guaranty Co. | 3 | Construction and repair of dikes; dredging; breakwater construction. | E, G, QQ. |
| United States Lithograph Co. | 1 | Printing charts..... | CC. |
| Universal Portland Cement Co. | 5 | Cement..... | CC, DD, MM, RR. |
| Urania Lumber Co. | 3 | Lumber..... | Y. |
| Van Note & Conrad. | 1 | Dike construction..... | I. |
| Van Sant & Boehm. | 1 | Dredging..... | I. |
| Variety Iron & Steel Works Co. | 1 | Anchorage for lock gates..... | S. |
| Vaughn. (See Henhoeffler.) | | | |
| Vecchione, Lee. | 1 | Stone for raising lock walls..... | AA. |
| Vermilye & Power. | 1 | Air tanks for dam..... | CC. |
| Vinyard, E. W. | 1 | Piles and timber..... | HH. |
| Vinyard, Wilson M. | 1 | Dike work..... | I. |
| Vinson & Graham. | 1 | Stone..... | T. |
| Virden. (See Johnston.) | | | |
| Virginia Portland Cement Co. | 9 | Cement..... | CC, DD. |
| Vodel, A. L. | 1 | Dredging..... | RR. |
| Vogt Machine Co., Henry. | 3 | Repairs to dredge; pontoon pipe line and fittings; boilers. | U, CC. |
| Vulcan Iron Works. | 2 | Lock-gate valves and rods; metal work. | EE, JJ. |
| Vulcan Steam Shovel Co. | 2 | Machinery, etc., for derrick boat and dredge. | AA. |
| Waite Lumber Co., H. B. | 2 | Lumber..... | LL, PP. |
| Wakefield, Robt. | 6 | Removing rock; jetty work; dredging; dike repairs. | TT, VV, WW. |
| Walker Co., J. J. | 3 | Furnishing and installing air compressors and pipe work; boiler-feed pump. | CC. |
| Wallis & Co., B. | 1 | Steel trestles..... | EE. |
| Ward. (See Richardson.) | | | |
| Ward, Chas. | 1 | Building towboat..... | EE. |
| Ward, Zeb. | 1 | Riprap stone..... | X. |
| Warner, Geo. T. | 4 | Dredging..... | O. |
| Warren & Lester. | 1 | Lumber..... | WW. |
| Warrington. (See Blackmer.) | | | |
| Washington Stone Co. | 1 | Riprap..... | K. |
| Waterbury Co. | 2 | Electric cable and wire; telephone and arc cables. | PP. |
| Watson, Henry. | 1 | Excavating and depositing material. | PP. |
| Watt. (See Griffith.) | | | |
| Waxler, C. O. | 3 | Building dwelling; storehouse; quarter boat. | DD. |
| Weaning, L. D. | 11 | Structural metal; lock gates, valves, journal bearings; furnishing material and constructing superstructure of movable dam. | X, AA, CC, DD, FF, JJ, PP. |
| Weimer, E. D. | 1 | Hemlock timber..... | PP. |
| Welsh & Grey. | 1 | Timber..... | E. |
| Wenzell. (See Stebbings.) | | | |
| Western Fuel Co. | 3 | Cement..... | UU. |
| Western Electric Co. | 1 | Engines, dynamos, etc. | HH. |
| West Kentucky Coal Co. | 1 | Coal..... | HH. |
| Wharton, M. F. | 1 | Constructing dwellings..... | DD. |
| Wharton, J. J. | 2 | Buildings..... | FF. |
| Wheeler Condensing & Engineering Co. | 1 | Condenser..... | U. |
| Whipple, C. H., and C. D. Leeper. | 1 | Earthwork..... | HH. |
| White & Co., J. G. | 1 | Lock work..... | T. |
| White, Robt. M. | 2 | Willows..... | HH. |
| White Star Lumber Co. | 1 | Fir timber..... | PP. |
| Whitney, A. J. | 1 | Building dams and shore protection. | HH. |
| Whitney Bros. | 1 | Riprap..... | LL. |
| Whitney Bros. Co. | 5 | Building pier; revetment; gravel. | LL. |
| Whitney Supply Co. | 2 | Suction pipe for dredge..... | HH. |
| Whittlesey Co., Wm. | 1 | Constructing motor launch..... | A. |
| Wieland, G. A. | 2 | Pebbles or gravel; placing stone in breakwater. | LL. |
| Wilkinson, J. A. | 1 | Lease of dredge..... | M. |

| Contractor. | Approximate number of contracts. | For— | For works in districts— |
|--|----------------------------------|---|-------------------------|
| Willamette Iron & Steel Works..... | 3 | Castings for dredge; constructing steamboat. | VV, WW. |
| Williams, Matthew C..... | 2 | Water-front privileges..... | HH. |
| Williams, Rile E. and Frank C..... | 1 | Guard cribs..... | EE. |
| Williams, T. J..... | 4 | Lock keeper's houses; buildings..... | CC, FF. |
| Wills Construction Co., F. K..... | 3 | Timber bulkhead construction; piles, etc.; wing-dam construction. | H, I. |
| Wills, Franklin K..... | 1 | Jetty work..... | I. |
| Wilmington Dredging Co..... | 4 | Dredging..... | L. |
| Winnsboro Granite Corporation..... | 2 | Stone..... | M. |
| Winston Bros. Co..... | 2 | Earthwork..... | JJ. |
| Winters. (See Caughren.) | | | |
| Wisconsin Bridge & Iron Co..... | 1 | Superstructure of single-track railroad bridge. | JJ. |
| Wiseman, W. H..... | 2 | Lumber and posts..... | EE. |
| Witter, W. G..... | 1 | Dredging..... | TT. |
| Witter, W. G., and Marshall C. Harris. | 1 | do..... | TT. |
| Wolter. (See Riebolt.) | | | |
| Wolter, Jos..... | 1 | do..... | MM. |
| Wood Co., W. W..... | 1 | Power house..... | CC. |
| Woodman, Frank..... | 1 | Steel horses for dams..... | EE. |
| Woodward, Roland..... | 1 | Hire of dredging plant..... | P. |
| Woodrow. (See Roe.) | | | |
| Woodward, Wight & Co..... | 4 | Subsistence supplies; provisions; parts; groceries. | HH. |
| Worden, F. E..... | 1 | Timber and plank..... | MM. |
| Wright. (See Runkle.) | | | |
| Wright, J. O..... | 1 | Barges..... | HH. |
| Wright, Perry..... | 2 | Service boats..... | EE. |
| Yant & Co., N. D..... | 2 | Lock gates..... | FF. |
| York Bridge Co..... | 1 | Steel trestles..... | EE. |
| Young. (See Lord.) | | | |
| Yunker, J. H..... | 1 | Piling..... | LL. |
| Yuba Consolidated Gold Fields..... | 1 | Training-wall construction..... | UU. |
| Zenith Dredging Co..... | 10 | Dredging..... | LL, QQ. |

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

SECTION 8.—INDEX TO LAWS AFFECTING THE CORPS OF ENGINEERS, U. S. ARMY.

Copies of laws affecting the Corps of Engineers printed as a part of the annual reports of the Chief of Engineers.—Each annual report of the Chief of Engineers since 1873 has contained, for the convenience of those using the reports, copies of the laws passed by Congress which affect the work or operations of the Corps of Engineers, United States Army.

Classification of the laws.—Most of the laws relate to appropriations for public works, such as fortifications, rivers and harbors, roads, canals, etc. A large number of the laws relate to authorization of private construction of bridges, dams, etc., under the supervision of the Chief of Engineers. Other of the laws relate to the general conduct of public affairs, or to the Corps of Engineers as a part of the Army of the United States.

River and harbor laws.—The "Laws of the United States Relating to the Improvement of Rivers and Harbors, Aug. 11, 1790, to Mar. 4, 1913," have been collected by the Chief of Engineers into a set of three volumes, and printed as H. Doc. 1491, 62d Cong., 3d sess.,¹ with a detailed index thereto. It is not necessary, hence, to make a detailed reference to such laws under the above heading. Some of the titles of the general subjects are given below in order to show what subjects come properly under the head of river and harbor laws. (See also pp. 2090 of this index.)

Laws relating to bridge construction, etc.—The laws which authorize the construction of specific bridges, etc., that is, by name, are covered amply in this index under the heading of "Bridges," or "Structures other than bridges." (See pp. 2137 of this index.)

Laws relating to fortifications, public buildings, etc.—These are referred to in this index, in practical detail, in connection with the subjects of "Fortifications," and "Miscellaneous." (See pp. 1793, 2039 of this index.)

Military laws.—These laws, in greater detail than given in the reports of the Chief of Engineers, will be found in the published volumes of the military laws of the United States. See "The Military Laws of the United States, 4th edition. Prepared under the direction of the Hon. Elihu Root, Secretary of War. By Brig. Gen. George B. Davis, Judge Advocate General, United States Army. With Supplement by Lt. Col. John Biddle Porter, Judge Advocate General, United States Army. 1911." Printed as War Dept. Doc. No. 395. Revised and corrected to date of June 1, 1914, under the supervision of Brig. Gen. E. H. Crowder, Judge Advocate General of the Army, in War Dept. Doc. No. 472.

General laws.—Some of the more general laws which have a bearing upon the work of the Corps of Engineers are referred to very briefly below.

A.

Abandonment of improvements.*

Accounts.

Time extended for examination. (Mar. 2, 1901.)

Allowances to officers for losses in War with Spain. (Mar. 2, 1903.)

Unexpended balances to be covered into Treasury, etc. Permanent appropriations must be created by specific terms. (Mar. 4, 1909, sec. 10.)

Unexpended amounts for river and harbor works not to be covered into Treasury. (June 25, 1909.)

Falsification, etc., prohibited under penalty. (Mar. 4, 1911.)

Additional employees authorized to administer oaths to expense accounts. (Aug. 24, 1912, sec. 8.)

Acids in navigable waters.*

Acquisition of land.*

Adjustments for claims.*

Advertisements.*

Aids to navigation.*

Alaska.

Railroad commission created. (Aug. 24, 1912, sec. 18.)

Allotments.*

*See H. Doc. 1491, 62d Cong., 3d sess.

¹ Volume III (150 pages) of H. D. 1491 was prepared in the office of the Judge Advocate General, U. S. Army, and it is described in its preface as being "an attempt * * * to classify and annotate the statutory provisions having a general application, regulating the improvement, protection from obstructions to navigation, and the bridging, etc., of the rivers and other navigable waters of the United States."

Anchorage grounds.***Anchoring.*****Annual appropriations.*****Annual estimates.*****Annual reports.*****Antiquities, American.**

Penalty for unauthorized excavations, etc.

Historic lands may be set aside by the President.

Regulations concerning collections.

(June 8, 1906.)

Appropriations.*

Army War College, etc. (June 30, 1902.) (And see acts for Army, etc.)

Expenditures in excess of appropriations forbidden. Voluntary service forbidden. Apportionment of appropriations into monthly allotments to prevent deficiencies. (Mar. 3, 1905, sec. 4.)

Acts must declare in specific terms that an appropriation is made, or that a contract may be executed. (June 30, 1906, sec. 9.)

Contingent funds, etc. Apportionment of amount to be expended by each office or bureau. (Aug. 23, 1912, sec. 6.)

Regular appropriations restricted to fiscal year. Exceptions, rivers and harbors, etc. (Aug. 24, 1912, sec. 7.)

Army officers.*

Entrymen under homestead laws who have served in Army or Navy of the U. S. during Spanish-American War shall have certain service deducted. (Mar. 1, 1901.)

Provisions for General Staff, etc. (Feb. 14, 1903.) (See also Military Laws, etc.)

Arrests, offenders against river and harbor laws, etc.***Ashes, depositing in waters, etc.*****Attorney General (in connection with river and harbor violations).*****Awards.*****II.****Badges. (See Military Laws.)****Balances.*****Barges.*****Beacons.*****Bering Sea.*****Bidders.*****Bids.*****Binding.*****Boards and commissions.*****Boats.*****Bonds.***

Required from all persons making U. S. disbursements, except officers of the U. S. Army. (June 23, 1866, sec. 3; Mar. 2, 1867, sec. 3.)

Books.***Brick deposits, navigable waters.*****Breakwaters.*****Bridges.*****Buildings.*****Bulkhead lines.*****Bulkheads.*****Buoys.*****C.****Canada, Dominion of.*****Canals and waterways.*****Causeways. (See Bridges.)****Care and maintenance of rivers and harbors.*****Certification, printing.*****Channels.*****Charges, tonnage.*****Charts.*****Checks.**

Lost cheques may be duplicated. (Mar. 23, 1906; June 19, 1906; Feb. 23, 1909.)

Chief of Engineers.* (See Military Laws, Army Regulations; and Regulations, Engineer Department.)**Cinders.*****City limits and river and harbor improvements.*****Civilian employees.*****Civilian engineers.*****Civil Service. (See reports, etc., Civil Service Commission; Regulations, Engineer Department.)****Claims for damages, etc.***

False claims prohibited, etc., or purchase of claims, etc. (Feb. 25, 1897; May 30, 1908.)

Clams.* (Fishing for, etc.)**Collisions of vessels.***

Regulations to prevent, etc. (June 7, 1897.)

Collection districts, U. S.***Collectors of U. S. customs.*****Coals.**

To be tested for the U. S. free of charge. (Mar. 4, 1907; May 27, 1908.)

Combined works of improvement.***Commerce.*****Commercial statistics.*****Commissions.* (See Boards.)****Committees, congressional.*****Compensation for displacement of tide-water.*****Compensation to U. S. employees for injuries.*****Compilations.*****Completion of projects.*****Concurrent resolutions of Congress.*****Condemnation proceedings, for land, easements, rights of way, etc.*****Congress.*****Congresses of Navigation.*****Congressional committees.*****Congressional documents.*****Consolidated works.*****Contingencies, appropriations for.*****Continuance of works.*****Continuing contracts.*****Contractors.*****Contracts.***

Advertisements for; appropriations; awards; bonds; combined; continuing; eight-hour laws; proposals; prosecution; protection; punishment; regulations.

Cooperation, local; public works.***Corporate limits, works of improvement.***

Corporations.*

Corps of Engineers. (See also Chief of Engineers.)

Officers increased, etc. (Apr. 23, 1904, sec. 22;
Feb. 27, 1911, sec. 5.)

Court-martial. (See Military Laws.)

Craft, water.*

Creditors.*

Crimes committed on Mississippi River.*

Crimes.*

Customs, collectors of.*

D.

Damages.*

Dams.* (See pp. 2041 and 2249 of this index.)

Datum plane.*

Débris, mining.* (See pp. 1580 and 2041 of this index.)

Decay in works.*

Defacement of public structures.*

Defenses. (See also Fortifications.)

Injury.—It is a penal offense to injure or destroy harbor defenses or material thereof, or to violate any rule of the War Department for the protection of defenses. Penalty: Fine, imprisonment, or both, at the discretion of the U. S. court. (July 7, 1898.)

Material.—American material is to be preferred, but foreign material, when such is found preferable, may be purchased in limited quantities and shall be admitted free of duty. (Aug. 4, 1894; Mar. 2, 1895; June 6, 1896; Mar. 3, 1897; May 7, 1898; Mar. 3, 1899; May 25, 1900.)

Department of War.*

Deposits in navigable waters.*

Depths.*

Derelicts.* (See Wrecks.)

Destruction of public structures by private parties.*

Deterioration in works.*

Digging for gold.*

Dikes.*

Dirt, deposits of.*

Disbursement of funds.*

Disbursements.

No disbursing officer in the Army shall receive commissions or compensation for disbursements made. (June 23, 1866, sec. 3; Mar. 2, 1867, sec. 3.)

Bonds required from all persons making disbursements, except officers in the Regular Army. (June 23, 1866, sec. 3; Mar. 2, 1867, sec. 3.)

Frequent inquiries to be made by officers of the inspection department of the Army as to the necessity, economy, and propriety of all disbursements by disbursing officers of the Army, and their conformity to the law appropriating the money, and also to the law relating to the manner of keeping accounts and making disbursements. (Apr. 20, 1874.)

Disbursing officers.*

Substitutes authorized. (Mar. 4, 1909, sec. 8.)

Discharge measurements.*

Discontinuance of improvements.*

Displacement of tidewater.*

District attorneys, U. S.*

District engineers.*

District of Columbia. (See p. 2039 of this index.)

Districts, collection.*

Ditches, mining.*

Dock lines.*

Docks and ferries.*

Documenting of foreign-built dredges.*

Documents, public.*

Dolphins.* (See p. 2249 of this index.)

Dominion of Canada.*

Donations of land, etc.*

Draftsmen, skilled; employment of.*

Drawbridges. (See p. 2137 of this index.)

Drawings.*

Dredge boats.* (See p. 3337 of this index.)

Dues, tonnage.*

Dumpings.*

Duties, tonnage.*

E.

Easements.*

Edgings, deposit of.*

Eight-hour law.*

Emergency appropriations.*

Employees.*

Additional clerks and other employees necessary during Spanish-American War transferred to classified service. (Apr. 28, 1902, sec. 3.)

Extortion prohibited. (June 28, 1906.)

Compensation for injuries, etc. (May 30, 1903; Mar. 11, 1912.)

Attendance at conventions permitted under conditions, etc. (Aug. 24, 1912, sec. 10.)

Eight-hour law. Public contracts to provide for. Inspectors to report violations. (June 19, 1912.)

Punishment for violating law requiring specific appropriations for etc. (Aug. 23, 1912, sec. 5.)

Incapacited employees.—It is unlawful to establish, under appropriations for the executive, legislative, and judicial departments, a civil pension roll or an honorable service roll, or to exempt officers, clerks, or persons in the public service from existing laws concerning public employment. Annual leaves of absence of 30 days, exclusive of Sundays and legal holidays, however, may be granted. (Feb. 24, 1899; Mar. 3, 1901.)

Employment.*

Enforcement of laws, navigable waters.*

Engineer officers.* (See p. 2303 of this index and see Chief of Engineers above.)

Engineers, assistant.*

Engineers, boards of.*

Engineers, Chief of.*

Engineers, civil.*

Engineers, civilian.*

Engineers, Corps of.*

Composition of, reorganization of U. S. Army. (Feb. 2, 1901, sec. 11.)

Engineer School, Washington, D. C.* (See p. 2039 of this index.)

Engravings.*

Entry, ports of.*

Equipment, motor boats, etc.*

Estimate of funds required.*

Estimates.

To be submitted exactly as required by law.

(Aug. 23, 1912, sec. 9.)

Lump-sum appropriations exceeding \$250,000

to be accompanied by detailed statements of proposed use, etc. (Aug. 24, 1912, sec. 6.)

Examinations and surveys.* (See p. 22 of this index.)

Excavations in navigable waters.*

Executive documents.*

Expenditures, fiscal.*

Expenses.*

Experimental towboats.*

Explosives.

Detailed provisions for promoting safe transportation of. (May 30, 1908.)

F.

Fillings.*

Filth.*

Fines.*

Fiscal-year appropriations.*

Fisheries.*

Fishing or dredging in navigable waters.*

Fishways.*

Floating of logs, etc.*

Flood reservoirs.*

Flumes, mining.*

Fog signals.*

Foreign-built dredges.*

Foreign (insular) possessions.*

Forest reserves, etc.*

Forests.

Transfer of reserves from Interior Department to Department of Agriculture. Water rights for mining. Regulations. (Feb. 1, 1905, sec. 4.)

Fortifications.* (See also Defenses.) (See p. 1793 of this index.)

Fortifications may be erected in cases of emergency upon the written consent of the owner of the land upon which such work is to be placed temporarily. (Joint resolution approved Apr. 11, 1898.)

Freight statistics.*

Funds, surplus.*

G.

Garbage.*

Gauging.*

Gold mining.*

Government employees.*

Government funds.*

Government property.*

Gravel.*

Great Britain.*

Guaranties.*

H.

Harbor lines.* (See p. 2253 of this index.)

Harbors and rivers.* (See pp. 3 and 2041 of this index.)

Hiring of labor.*

Hire of private dredging plant.*

Hiring public property.*

Holidays. (See Regulations, Engineer Dept.)

Labor Day, the first Monday in September of each year, made a public holiday. (June 28, 1894.)

House of Representatives.*

Hyacinths.* (See p. 572 of this index.)

Hydraulics.*

Hydrology.*

I.

Improvements.*

Illustrations.*

Impaired works, restoration.*

Imperial Valley, Cal.*

Imposts on tonnage of shipping.*

Imprisonment.*

Improvements, river and harbor.*

Private parties may make improvements at own expenses, etc., subject to approval of Secretary of War and Chief of Engineers. (June 13, 1902, sec. 1.)

Indefinite appropriations.*

Indemnities.*

Index, Reports, Chief of Engineers.

"Raymond" Index called for. (June 13, 1902, sec. 13.)

Ordered brought up to date. (July 25, 1912, sec. 6.)

Indexes.*

Individuals, private.*

Injury to Government employees.*

Injury to public structures.*

Inland Waterways Commission.*

Inlets within shore lines, etc.*

Inner harbors.*

Inspectors.*

Insular possessions.*

Internal Improvement, Board of.*

International commissions.*

International Joint Commission.*

International Waterways Commission.*

Interoceanic canals.* (See p. 2357 of this index.)

Intracoastal waterways.*

Island (foreign) possessions.*

Isthmian Canal.* (See p. 2357 of this index.)

J.

Jetties.*

Jurisdiction, crimes, Mississippi River.*

Justice, Department of.*

K.

Klamath Indian Reservation.*

L.

Labor.* (See Public works.)

Eight hours shall constitute a day's work for all laborers, workmen, and mechanics employed by or on behalf of the U. S. (June 25, 1868.)

Limited to eight hours in any one calendar day for all laborers or mechanics employed by the Government, or by any contractor upon any public work of the U. S. (Aug. 1, 1892.)

Ladders, fish.*

Land.*

Land, deeds to.

Deeds to land in District of Columbia and Territories may be acknowledged before notaries of Philippines and Porto Rico. (Mar. 22, 1902.)

Lands, public.

Former grants to railroads canceled, with some exceptions, etc. (Feb. 25, 1909.)

Laws of Congress.*

Leases.*

Legal proceedings.*

Department of Justice shall conduct, where necessary to enforce laws for protection of public property, works, etc. (Mar. 3, 1899, sec. 17.)

The U. S. Attorney General or special counsel, etc., may conduct legal proceedings. (June 30, 1906.)

Legislation.*

Levees.*

Levels, water.*

Levying of tonnage duties.*

Liabilities of contractors.*

Licenses, revocable.*

Life, human; saving.*

Life-saving stations.*

Lighters.*

Lighthouse Board.*

Lighthouses.*

Lighthouse districts.*

Lights.*

Lime, depositing of.*

Locks.*

Logs, running.*

Lots of land.*

M.

Mall.

Record of, to be kept. Limitation of penalty privilege. (June 26, 1906.)

Maintenance of rivers and harbors.*

Marine commerce.*

Materials and plant.*

Mean low water.*

Mechanics, eight-hour law.*

Metals, precious.*

Mileage. (See Officers.)

Allowances to officers. (Mar. 2, 1901; June 12, 1906.)

Militia.

Defined. (Jan. 21, 1903.)

Mining.*

Moneys.*

Motor boats.*

Movement of vessels.*

Mud.*

Municipal corporations.*

Municipal limits.*

N.

National defense.

Penalties for disclosures. (Mar. 3, 1911.)

National Waterways Commission.*

Naval officers, retired.*

Navigable waters.*

Compilation of existing laws enacted from time to time by Congress for the maintenance, protection, and preservation of the navigable waters of the U. S., and draft of an act embodying such revision and enlargement of the aforesaid laws as the experience of the Corps of Engineers has shown to be advantageous to the public interest. (Annual reports of the Chief of Engineers, 1897, p. 4138.)

Bridges injuring channels or banks of rivers.

Removal of wrecks.

Bridges obstructing navigation.

Construction of piers, bridges, etc.

Depositing material in navigable waters.

Unlawful obstructions forbidden and penalties prescribed.

Method of enforcing laws forbidding obstructions to navigation.

Injuries to Government piers, etc.

Harbor lines.

Opening of drawbridges.

Regulations for canals.

The term "navigable waters" (Alaska) held to include all tidal waters up to the line of ordinary high tide, and all nontidal waters navigable in fact up to the line of ordinary high-water mark. (May 14, 1898.)

Public vessels may be detailed to provide for safety of life during regattas, etc. (Apr. 28, 1908.)

Bureau of Lighthouses in the Department of Commerce and Labor established. (June 17, 1910.)

Enforcement of rules. (June 13, 1902, sec. 6.)

Creation of any obstruction not affirmatively authorized by Congress prohibited. (Mar. 3, 1899, sec. 10.)

Navigation.*

Nicaraguan canal route. (See p. 2357 of this index.)

Nonnavigable waterways.*

Nontidal waters.*

Notices to alter bridges.* See p. 2137 of this index.)

O.

Obstructions. (See Navigable waters.)

Obstructions in navigable waters.* (See pp. 21, 2137 of this index.)

Occupancy of public structures.*

Occupancy of public works.

Temporary use of certain public works may be permitted. (Mar. 3, 1899, sec. 14.)

Ocean steamships.*

Offenders against laws for protection of navigable waters, etc.*

Office of the Chief of Engineers.* (See Chief of Engineers above, and p. 2039 of this index.)

Officers.

Detail to instruction schools. (Feb. 26, 1901.) (See Mileage.)

Mileage and transportation; leaves; sea travel, etc. (Mar. 2, 1901.)

Officers of the Army and Navy.* (See Military Laws of the United States.)

Officers of the Corps of Engineers.* (See Corps of Engineers above.)

Oysters.*

F.

Pamphlets.*

Panama.* (See p. 2357 of this index.)

Parcels of land.*

Parties, private.*

Pay, extra.

Instructor, military engineering. (Mar. 2, 1901.)

Officer in charge of public buildings and grounds, D. C. (Mar. 2, 1901.)

Payments.*

Penal laws.*

Penalties.*

Percentage and reimbursement basis of payment.*

Permanent appropriations.*

Permanent International Congresses of Navigation.*

Permits.*

Personal services.*

Persons, private.*

Philippines.

Bonds and funds for public works. (Feb. 6, 1905.)

Providing for administration, etc. (July 1, 1902.)

Photographs.*

Pierhead lines.*

Piers.*

Pipes, mining.*

Planes of reference.*

Plans.*

Plant.* (See p. 2337 of this index.)

Ports of entry.*

Precious metals, mining.*

Preservation and repairs.* (See p. 1797 of this index.)

Printing.*

Duplicating and filing devices to be transferred to Public Printer. (June 28, 1902, sec. 1.)

Illustrations. Special act required. (Mar. 3, 1903; Mar. 3, 1905, sec. 1.)

Cost of preparing documents chargeable to department originating matter; remainder of cost to be distributed. (Mar. 30, 1906.)

Documents to be printed in two or more editions to avoid unnecessary printing, etc. (Mar. 30, 1906.)

Estimates for documents required by departments to be submitted. (June 30, 1906, sec. 2.)

Printing of reports on examinations and surveys authorized, as congressional documents. (June 30, 1906; Aug. 5, 1909.)

Documents submitted in response to inquiries of Congress to be submitted with estimate of the probable cost of printing. (Mar. 1, 1907.)

Private persons.*

Proceedings, legal.*

Proceeds from various sources, etc.*

Process, swearing out, etc.*

Projects.* (See p. 22 of this index.)

If amount provided for completion of any project under continuing contract be less than the cost as estimated, proposals for bids shall be invited without further action by Congress. (Mar. 3, 1899, sec. 21.)

Property.*

Property returns.

Only certificates of loss are to be forwarded to the Treasury accounting officers, and the effect of such certificate shall be the same as if the facts set forth therein had been ascertained by the Treasury officials when accounting. The manner of making returns to the bureau or department concerned not affected by this act, except as provided above. The officer or agent shall, however, have an opportunity to relieve himself from liability. (Mar. 29, 1894.)

Proposals.*

Prosecutions.*

Prosecution of work.*

Protection of waters, etc.*

Protection of persons furnishing labor and materials.*

Protection of lands, etc.*

Publications.*

All work connected with distribution of publications to be done by the Public Printer. (See Printing above.) (Aug. 23, 1912, sec. 8.)

Public lands and buildings.

Reservations in Porto Rico authorized. (July 1, 1902.)

Public moneys. (See also Disbursements.)

Shall not be expended on any site or land for public works hereafter until the validity of the title thereto is established and the consent of the State legislature given to the purchase. Attorney General to examine titles to all lands or sites purchased by the U. S. (Sept. 11, 1841.)

Public property.*

Proceeds from, to be reported. (June 30, 1906, sec. 5.)

Public works.* (See also Repairs.)

Labor on, limited to eight hours per day for laborers, mechanics, and workmen. (June 25, 1868; Aug. 1, 1892.)

Material required for construction of public works and found on bars and islands, or adjacent to said works, may be taken under certain provisions. (July 5, 1884, sec. 6; Apr. 24, 1888.)

No public work to be deemed as entered upon until appropriations therefor shall have been actually made by Congress. (Aug. 11, 1888, sec. 14; Sept. 19, 1890, sec. 18.)

Title to land for public works to be established before any moneys are expended thereon. (Sept. 11, 1841.)

Payment for material and labor for.—Contractors on public works shall furnish penal bond to include security for labor and materials purchased. Action may be brought by the owner of such labor or materials, on this bond against the contractor, after fully setting forth the facts in the case to the department. The U. S. shall be at no expense. Security for costs in case of judgment for the defendant shall be required by the court. (Aug. 13, 1894.)

Public works, injury of.

✓Certain U. S. employees have power of arresting violators. (Mar. 3, 1899, sec. 17.)

Punishments.*

Purchases.*

Q.

Quarantine anchorages.*

Quarantine service.*

Quarantine stations.

Control vested in Secretary of Treasury. (June 19, 1906.)

R.

Radio communication.*

Rafts.*

Railroads.*

Reappropriations.*

Receipts.*

Reference planes.*

Refuse matter.*

Registration.*

Regulations and rules.*

Renting of public property.*

Repairs, preservation, etc.*

Repeal of laws, etc.*

Reports.* (See also pp. 1-22 of this index.)

No supplemental reports shall be rendered to Congress unless authorized. (June 13, 1902, sec. 2.)

Representatives, House of.*

Reservations, forest.*

Reservoirs.*

Resolutions, congressional.*

Restoration, repairs, etc.*

Retired officers of the Army and Navy.*

Revenue, amount collected, etc.*

Revenue officers.*

Revocable licenses.*

Rights of way.*

Rivers and harbors.*

Rivers and harbors, restoration of.

Allotments from emergency appropriation must be recommended by local engineer and the Chief of Engineers. \$10,000 maximum. Advertising for bids may be dispensed with. (June 13, 1902, sec. 1.)

Roads.

Provisions for construction of, Alaska. (May 14, 1906, sec. 2; Jan. 27, 1905.)

Rocks, depositing in waters, etc.*

Routes, transportation.*

Rubbish deposits.*

Running of logs, etc.*

S.

Sack rafts, etc.*

Salaries.

Annual compensation to be divided into 12 equal installments. (Apr. 28, 1904, sec. 4; June 30, 1906, sec. 6.)

Sales.*

Sawdust deposits.*

Seaboard transportation routes.*

Sea walls. (See p. 1797 of this index.)

Secretary of War.*

Security.*

Senate, United States.*

Service, voluntary.*

Shellfish.*

Shipping, levying tolls.*

Ships.*

Shore lines.*

Signals.*

Sites.* (See p. 1797 of this index.)

Slab deposits.*

Slack-water systems.*

Slag deposits.*

Slate deposits.*

Sludge deposits.*

Sluiceways.*

Specific appropriations.*

Speed of vessels.*

Statistics, commercial.*

Statutes.*

Stone.*

Storage reservoirs.*

Streams.*

Structures.*

Sunken craft.*

Sunken rocks.*

Supervision of New York Harbor.* (See p. 2111 of this index.)

Supplemental reports.*

Supplies.*

Sureties.*

Surface levels.*

Surplus funds.*

Surveys.* (See pp. 22, 2040, 2041 of this index.)

To locate natural oyster beds, etc., in waters of Maryland. (May 26, 1906.)

Survey marks.*

Suspension (abandonment) of improvements.*

Swearing out of processes, etc.*

T.

Taxation.

Repeal of war-revenue taxation of 1898, 1901. (Apr. 12, 1902.)

Taxes, tonnage.*

Telegraph act.*

Telephone, telegraph wire, etc.*

Telephones.

No expenditure for, in private residences. (Aug. 23, 1912, sec. 7.)

Terminal and transfer privileges.*

Tidal waters.*

Timber running.*

Tolls, levying.*

Tonnage.*
Towboats.*
Towing.*
Transfer and terminal facilities.*
Transfer of land, etc.*
Transportation of refuse matter.*
Transportation routes to seaboard.*
Trespasses.*
Tributaries.*
Tunnels.*
Tying-up of vessels.*

U.

Unexpended balances.*
United States officers. (See also Employees.)
 No disbursing officer in the Army shall receive
 commissions or compensation for disburse-
 ments made. (June 23, 1866, sec. 3; Mar. 2,
 1867, sec. 3.)
Unlawful obstructions.*
Unnavigable waters.*
Unserviceable land.*
Unworthy works.*
Useless lands.*
Use of public structures.*

V.

Vessels.*
 Procedures governing placing of liens. (June
 23, 1910.)
Violations of law.*
Voluntary service.*

W.

War Department.*
Warehouses.*
War, Secretary of.*
Waste matter.*
Water depths.*
Water hyacinths.*
Water level.*
Water power.*
Water-reserve lands.*
Waters, navigable.*
Waters, nonnavigable.*
Waterways.*
Weirs.*
Wharves.*
Wireless.
 Required on ocean or Great Lakes vessels.
 (July 23, 1912.)
Wireless communications.*
Works, public.
 List of crimes against the operations of the
 Government, or official duties, public justice,
 commerce, navigation, etc. (Mar. 4, 1909.)
Worn-out property.*
Worthless property.*
Wrecks.* (See p. 2116 of this index.)
 *See H. Doc. 1491, 62d Cong., 3d sess.
 *See H. Doc. 1491, 62d Cong., 3d sess.
 *See H. Doc. 1491, 62d Cong., 3d sess.
 *See H. Doc. 1491, 62d Cong., 3d sess.
 *See H. Doc. 1491, 62d Cong., 3d sess.
 *See H. Doc. 1491, 62d Cong., 3d sess.

* See H. Doc. 1491, 62d Cong., 3d sess.

SPECIAL SUBJECTS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

SECTION 9.—CLASSIFIED AND ALPHABETICAL LISTS OF THE FLOATING PLANT OF THE U. S. ENGINEER DEPARTMENT.¹

NOTE.—The floating plant or equipment operating under the direction of the Chief of Engineers, U. S. Army, ranges in character from seagoing suction dredges to fleets of rowboats. (See p. 2115 of this Index.)

The following is a summary of the more important tables of the floating equipment, each table of craft-names being arranged alphabetically.

For a complete list of the floating plant, see 10, 2514; 11, 2801; 12, 2902.

TABLE 1.—SEAGOING HOPPER DREDGES.

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|--------------------------|-------------------------|-------------|----------|---------|------------|------------------|------|------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| Atlantic..... | 2,670 | 288 0 | 47 6 | 25 0 | Steel..... | 9 | 51 | Wilmington, N. C. |
| Benysaard..... | 2,978 | 271 6 | 47 6 | 23 0 | ..do..... | 10 | 53 | New Orleans. |
| Burton..... | 1,510 | 177 0 | 38 0 | 19 0 | ..do..... | 5 | 23 | Cleveland. |
| Cape Fear..... | 480 | 131 3 | 29 0 | 12 0 | Wood..... | 4 | 26 | Wilmington, N. C. |
| Caucus..... | 1,980 | 200 0 | 41 0 | 23 2 | ..do..... | 7 | 28 | Montgomery. |
| Charleston..... | 800 | 122 6 | 30 0 | 12 0 | ..do..... | 6 | 21 | Mobile. |
| Chinook..... | 7,000 | 460 0 | 49 0 | 34 0 | Steel..... | 8 | 39 | Portland, Oreg. (2d). |
| Clatsop..... | 1,380 | 180 0 | 38 0 | 23 0 | ..do..... | 3 | 36 | Do. |
| Cumberland..... | 1,905 | 200 0 | 40 8 | 20 6 | ..do..... | 8 | 29 | Savannah. |
| Delaware..... | 4,200 | 315 0 | 52 0 | 22 6 | ..do..... | 9 | 50 | Philadelphia. |
| Galveston..... | 3,375 | 304 0 | 51 0 | 27 0 | ..do..... | 6 | 26 | Galveston. |
| Gedney..... | 1,500 | 157 0 | 36 6 | 16 0 | Wood..... | 4 | 19 | Newport. |
| Key West..... | 1,000 | 142 0 | 31 7 | 15 0 | ..do..... | 4 | 22 | Jacksonville. |
| Manhattan..... | 4,000 | 288 0 | 47 6 | 25 0 | Steel..... | 9 | 48 | Philadelphia. |
| Meade, Gen. G. G..... | 1,458 | 177 0 | 38 0 | 19 0 | ..do..... | 6 | 30 | Grand Rapids. |
| Michie, Col. P. S..... | 1,526 | 242 0 | 43 0 | 20 0 | ..do..... | 8 | 23 | Portland, Oreg. (1st). |
| Navesink..... | 3,150 | 290 0 | 47 6 | 28 0 | ..do..... | 9 | 54 | New York (2d). |
| New Orleans..... | 4,425 | 315 0 | 50 0 | 26 0 | ..do..... | 14 | 59 | New Orleans. |
| Raritan..... | 2,930 | 290 0 | 47 6 | 28 0 | ..do..... | 9 | 62 | New York (2d). |
| Sabine..... | 700 | 145 0 | 35 0 | 12 0 | Wood..... | 5 | 12 | Dallas. |
| Savannah..... | 1,461 | 177 0 | 38 0 | 19 0 | Steel..... | 6 | 28 | Savannah. |
| Sumter..... | 1,706 | 200 0 | 41 0 | 22 0 | Wood..... | 6 | 34 | Charleston. |
| Winyah Bay..... | 831 | 141 0 | 31 6 | 13 6 | ..do..... | 4 | 20 | Do. |

¹ In order to have a list including the plant under construction in 1912, the list printed above is of the plant as it existed early in 1913, giving a list for comparison with reports on the floating plant subsequent to 1912.

TABLE 2.—HYDRAULIC PIPE-LINE DREDGES.

| Name, number, or letter. | Displacement. | Dimensions. | | | Material. | Complement. | | District. |
|------------------------------|---------------|-------------|----------|---------|-----------------------------------|-------------|------|-------------------------|
| | | Length. | Breadth. | Depth. | | Officers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| Augusta..... | 101 | 74 0 | 28 0 | 4 6 | Steel..... | | 9 | Savannah. |
| Apo..... | 294 | 132 0 | 25 5 | 5 0 | W o o d steel and concrete. | 5 | 13 | Rock Island. |
| Bacon, Henry..... | 1,410 | 150 6 | 39 0 | 15 0 | Wood..... | 2 | 46 | Wilmington, N. C. |
| Barnard..... | 1,291 | 206 2 | 38 0 | 14 0 | Steel..... | | | Jacksonville. |
| Beta..... | 1,300 | 214 0 | 58 0 | 6 11 | do..... | 3 | 42 | St. Louis (M. R. C.). |
| Blackwater..... | 465 | 110 0 | 32 0 | 9 4 | Wood..... | 4 | 24 | Montgomery. |
| Cataract..... | 886 | 140 6 | 40 4 | 10 7 | do..... | 3 | 23 | Philadelphia. |
| De Witt Clinton..... | 400 | 95 0 | 27 6 | 8 6 | do..... | 8 | 32 | New York (1st). |
| Congaree ¹ | 250 | 101 10 | 32 0 | 6 0 | do..... | 2 | 13 | Charleston, S. C. |
| Dalecarlia..... | 233 | 80 0 | 26 0 | 7 0 | Wood..... | 1 | 13 | Washington, D. C. |
| Delta..... | 830 | 175 0 | 38 0 | 8 4 | Steel..... | 3 | 37 | St. Louis (M. R. C.). |
| Deluge..... | 170 | 80 0 | 21 0 | 4 2 | Wood..... | | | Pittsburgh. |
| Epsilon..... | 550 | 157 0 | 40 0 | 7 6 | Steel..... | 3 | 37 | St. Louis (M. R. C.). |
| Etna ² | 280 | 130 0 | 28 0 | 5 0 | Wood..... | 5 | 13 | Rock Island. |
| Flad, Henry..... | 860 | 192 0 | 44 0 | 7 0 | Steel..... | 3 | 40 | St. Louis (M. R. C.). |
| Florida ³ | 371 | 152 0 | 29 9 | 7 0 | do..... | 4 | 17 | Jacksonville. |
| Fort Chartres..... | 815 | 197 0 | 45 0 | 7 6 | do..... | 14 | 42 | St. Louis. |
| Fort Gage..... | 815 | 197 0 | 45 0 | 7 6 | do..... | 14 | 42 | Do. |
| Gamma..... | 581 | 138 0 | 38 0 | 7 10 | do..... | 3 | 33 | St. Louis (M. R. C.). |
| Geyser..... | 141 | 100 0 | 24 0 | 4 5 | Wood and steel. | 5 | 14 | Rock Island. |
| Gulfport..... | 886 | 150 0 | 40 0 | 11 6 | Steel..... | 11 | 31 | Mobile, Ala. |
| Hampton..... | 91 | 60 0 | 23 0 | 6 0 | Wood..... | 2 | 5 | Norfolk. |
| Harrod, B. M..... | 1,270 | 210 0 | 44 0 | 8 6 | Iron and steel. | 3 | 44 | St. Louis (M. R. C.). |
| Hecia..... | 217 | 120 0 | 26 0 | 5 0 | Wood..... | 5 | 14 | Rock Island. |
| Humphreys, Chas..... | 234 | 129 9 | 32 0 | 8 9 | do..... | 5 | 20 | Mobile. |
| Indiana..... | 417 | 125 0 | 34 0 | 6 10 | Steel..... | 1 | 27 | Cincinnati (1st). |
| Iota..... | 800 | 192 0 | 44 0 | 7 0 | do..... | | | St. Louis. |
| Jacksonville..... | 900 | 137 4 | 40 8 | 9 5 | Wood..... | 2 | 28 | Jacksonville. |
| Kappa..... | 860 | 192 0 | 44 0 | 7 0 | Steel..... | 3 | 40 | St. Louis (M. R. C.). |
| Ludlow, Gen..... | 400 | 162 1 | 36 9 | 4 0 | do..... | | | Grand Rapids. |
| Macon..... | 101 | 74 0 | 28 0 | 4 6 | do..... | | | Savannah. |
| Mallery, Maj. J. C..... | 666 | 130 0 | 32 0 | 9 0 | do..... | 8 | 31 | Jacksonville, Fla. |
| McGregor, Robert..... | 700 | 206 9 | 44 4 | 7 0 | do..... | 7 | 54 | Little Rock. |
| Mayon..... | 309 | 130 5 | 28 0 | 5 5 | do..... | 5 | 13 | Savannah. |
| Miller, Col. A. M..... | 710 | 138 6 | 37 0 | 13 0 | Wood..... | 5 | 55 | Galveston. |
| Morgan..... | 667 | 134 5 | 38 0 | 8 0 | Steel..... | 6 | 35 | Savannah. |
| Multnomah..... | 1,135 | 269 5 | 39 0 | 9 6 | do..... | 8 | 32 | Portland, Oreg. (2d). |
| Muscogee..... | 309 | 120 0 | 30 0 | 7 6 | Wood..... | 2 | 6 | Montgomery. |
| No. 1-O R ¹ | | 80 0 | 22 0 | 4 2 | do..... | | | Pittsburgh. |
| No. 6..... | 91 | 90 0 | 24 0 | 5 0 | Composite. | | | Mobile, Ala. |
| Orange..... | 547 | 115 0 | 36 0 | 9 6 | Wood..... | 2 | 20 | Dallas. |
| Oregon..... | 535 | 120 0 | 36 0 | 11 0 | do..... | 3 | 29 | Portland, Oreg. (1st). |
| Pascagoula..... | 771 | 150 0 | 40 0 | 10 6 | Steel..... | 10 | 30 | Mobile. |
| Pelee..... | 250 | 119 0 | 30 0 | 5 0 | Wood..... | 4 | 14 | Rock Island. |
| Pettus..... | 488 | 135 0 | 35 0 | 6 6 | do..... | 3 | 23 | Montgomery. |
| Portland..... | 131 | 100 0 | 22 0 | 5 0 | Steel..... | | 7 | Louisville. |
| Pump boat No. 1..... | 113 | 90 0 | 24 0 | 3 6 | Wood..... | | 5 | Chattanooga. |
| Ram..... | 419 | 125 0 | 30 0 | 7 0 | Steel..... | 6 | 20 | New Orleans (M. R. C.). |
| Sacramento..... | 984 | 150 0 | 40 0 | 11 6 | do..... | 11 | 31 | San Francisco (3d). |
| San Bernard..... | 440 | 83 0 | 32 0 | 7 6 | Wood..... | 8 | 32 | Galveston. |
| San Joaquin..... | 984 | 150 0 | 40 0 | 11 6 | Steel..... | 11 | 31 | San Francisco (3d). |
| San Pedro..... | 834 | 140 8 | 40 8 | 10 7 | do..... | 7 | 27 | Los Angeles. |
| Selma..... | 600 | 160 0 | 40 0 | 6 0 | do..... | 14 | 39 | St. Louis. |
| Shippingport..... | 131 | 100 0 | 22 0 | 5 0 | do..... | | 7 | Louisville. |
| Taal..... | 299 | 130 0 | 28 0 | 5 0 | W o o d steel and concrete. | 5 | 13 | Rock Island. |
| Taber, H. S..... | 700 | 206 9 | 44 4 | 7 0 | Steel..... | 7 | 54 | Little Rock. |
| Talbot, Capt. Andrew..... | 538 | 111 8 | 32 0 | 9 7 | Wood..... | 8 | 28 | New York (1st). |
| Thebes..... | 600 | 160 0 | 40 0 | 6 0 | Steel..... | 14 | 39 | St. Louis. |
| Tortoise..... | 198 | 102 0 | 24 0 | 5 3 | Wood..... | | 7 | Duluth. |
| Uncle Sam..... | 450 | 85 0 | 34 0 | 7 0 | do..... | 2 | 12 | Philadelphia. |
| Vesuvius ² | 244 | 114 10 | 30 0 | 5 0 | do..... | | 4 | Rock Island. |
| Wahalak..... | 886 | 150 0 | 40 0 | 11 6 | Steel..... | 11 | 29 | Mobile. |
| Wahkiakum..... | 1,135 | 269 5 | 39 0 | 9 6 | do..... | 8 | 32 | Portland, Oreg. (2d). |
| Warroad..... | 260 | 118 6 | 27 0 | 8 6 | Wood..... | 2 | 7 | St. Paul. |
| Waterway..... | 417 | 163 0 | 37 0 | 7 0 | Steel..... | 5 | 30 | Vicksburg. |
| Zeta..... | 650 | 157 0 | 40 0 | 7 6 | do..... | 3 | 40 | St. Louis (M. R. C.). |

¹ Rebuilding.² Double crew.³ Combination hydraulic and bucket dredge.

TABLE 3.—DIPPER DREDGES.

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|-----------------------------|-------------------------|----------------|----------------|----------------|-------------------------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | <i>Tons.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | | | | |
| Adams, Col. M. B. | 417 | 112 0 | 34 0 | 7 3 | Steel | 1 | 7 | Wheeling. |
| Addison | 177 | 75 0 | 30 0 | 7 2 | Wood | | 6 | Do. |
| Ajax | 124 | 73 0 | 26 0 | 6 0 | do. | 1 | 6 | Rock Island. |
| Algoma | 258 | 78 6 | 30 4 | 7 2 | do. | 1 | 7 | Milwaukee. |
| Apache | 217 | 80 0 | 30 0 | 8 0 | do. | 1 | 6 | Rock Island. |
| Appleton | 214 | 90 0 | 32 0 | 7 0 | do. | 1 | 5 | Milwaukee. |
| Asotin | 200 | 140 0 | 28 0 | 5 0 | do. | 3 | 15 | Portland, Oreg. (1st). |
| Attalla | 206 | 75 0 | 26 4 | 5 6 | do. | 2 | 6 | Montgomery. |
| Autauga | 123 | 75 0 | 26 4 | 5 6 | do. | 2 | 6 | Do. |
| Carrollton | 250 | 80 0 | 30 0 | 6 9 | do. | | 9 | Cincinnati (2d). |
| Champagne | 165 | 80 0 | 30 0 | 5 0 | do. | 1 | 9 | Portland, Oreg. (2d). |
| Cheraw | 620 | 155 0 | 28 0 | 7 1 | Steel | 2 | 12 | Charleston, S. C. |
| Cincinnati | 262.7 | 112 0 | 34 0 | 6 10 | Steel and iron. | | | Cincinnati (1st). |
| Davenport | 348 | 110 0 | 40 0 | 6 0 | Composite. | | 6 | Rock Island. |
| Farquhar, Col. | 250 | 76 0 | 24 0 | 6 0 | Wood | | | Grand Rapids. |
| Frankfort | 115 | 72 0 | 19 0 | 5 5 | do. | | 9 | Cincinnati (2d). |
| Frontenac | 172 | 76 0 | 26 0 | 6 7 | do. | 2 | 6 | Buffalo. |
| Green River | 298 | 112 0 | 31 0 | 4 0 | do. | 1 | 7 | Louisville. |
| Illinois | 280 | 90 0 | 34 0 | 8 0 | do. | 1 | 4 | Chicago. |
| Kentucky | 326 | 100 0 | 34 0 | 6 10 | do. | | 10 | Chattanooga. |
| Keokuk | 348 | 110 0 | 40 0 | 6 0 | Composite. | | 6 | Rock Island. |
| Kewaunee | 443 | 100 0 | 34 0 | 9 0 | do. | 1 | 16 | Milwaukee. |
| Kwasind | 187 | 80 0 | 28 0 | 6 6 | Wood | | 8 | Chattanooga. |
| Louisville | 128 | 67 0 | 28 0 | 6 0 | Iron | | 6 | Louisville. |
| Marlette | 263 | 115 6 | 34 0 | 6 6 | Steel | | | Cincinnati (1st). |
| Maumee | 549 | 100 0 | 36 0 | 11 0 | Wood | 2 | 11 | Cleveland. |
| Ohio | 270 | 112 0 | 31 6 | 6 8 | Iron | 1 | 13 | Cincinnati (1st). |
| Oswego | 235 | 94 0 | 31 6 | 6 1 | do. | | 10 | Do. |
| Otter Tail | 120 | 75 0 | 24 0 | 6 0 | Wood | 2 | 7 | St. Paul. |
| Phoenix | 186 | 80 0 | 30 0 | 8 0 | do. | 1 | 5 | Rock Island. |
| Sodus | 375 | 100 0 | 35 0 | 9 2 | do. | 2 | 8 | Buffalo. |
| St. Paul | 348 | 110 0 | 40 0 | 6 0 | Composite. | | 11 | Rock Island. |
| Tellico | 190 | 75 0 | 26 0 | 7 0 | do. | | 10 | Chattanooga. |
| Tennessee | 375 | 100 0 | 34 0 | 6 10 | do. | | 10 | Do. |
| Tusculum | 375 | 100 0 | 34 0 | 6 10 | do. | | 10 | Do. |
| Upatoi | 212 | 85 0 | 30 0 | 6 0 | Wood | 2 | 8 | Montgomery. |
| Vulcan | 240 | 80 0 | 30 0 | 8 0 | do. | 1 | 5 | Rock Island. |
| Wallowa | 175 | 125 0 | 25 6 | 5 0 | do. | 3 | 11 | Portland, Oreg. (1st). |
| Watauga | 400 | 100 0 | 34 0 | 7 10 | do. | | 10 | Chattanooga. |
| Wolf | 73 | 80 0 | 28 0 | 4 6 | do. | 2 | 5 | Memphis (M. R. C. 1st and 2d). |
| No. 1 | 187 | 79 10 | 30 0 | 7 4 | do. | | 5 | Chicago. |
| No. 1 | 200 | 80 0 | 30 0 | 7 0 | do. | | 5 | Nashville. |
| No. 1 | 303 | 85 0 | 32 0 | 7 0 | do. | 2 | 7 | Pittsburgh. |
| No. 1 | 115 | 65 0 | 27 0 | 6 6 | do. | | | Galveston. |
| No. 2 | 197 | 86 6 | 30 0 | 4 8 | do. | 2 | 7 | Pittsburgh. |
| No. 68 | 220 | 104 7 | 30 6 | 5 4 | do. | 1 | 7 | Little Rock. |
| No name | 159 | 65 0 | 26 2 | 6 5 | do. | 2 | 3 | Norfolk. |

TABLE 4.—BUCKET DREDGES.

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|--|-------------------------|-------------|----------|---------|-----------|------------------|------|-----------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| Ajax..... | 400 | 82 6 | 32 8 | 10 4 | Wood..... | 2 | 9 | Wilmington, N. C. |
| Alabama ¹ | 244 | 80 0 | 38 0 | 6 0 | do..... | | 7 | Chattanooga. |
| Albany..... | 75 | 70 0 | 30 0 | 4 9 | do..... | 1 | 6 | Montgomery. |
| Barataria..... | 302 | 102 0 | 36 0 | 6 1 | do..... | 3 | 16 | Miss. River (4th). |
| Buras..... | 341 | 110 0 | 40 0 | 7 3 | do..... | 4 | 8 | New Orleans (M. R. C. 4th). |
| Cascade..... | 90 | 60 0 | 30 0 | 5 0 | do..... | 1 | 7 | Portland, Oreg. (1st). |
| Casey..... | 163 | 86 0 | 28 0 | 6 5 | do..... | 1 | 4 | Louisville, Ky. |
| Cowlitz..... | 162 | 78 0 | 34 0 | 5 6 | do..... | 1 | 9 | Portland, Oreg. (2d). |
| Grossetete..... | 258 | 80 4 | 34 3 | 5 0 | do..... | 3 | 9 | New Orleans. |
| Hell Gate..... | 720 | 110 0 | 35 0 | 12 0 | do..... | | | Philadelphia. |
| Hercules..... | 670 | 100 0 | 38 0 | 11 4 | do..... | 1 | 11 | Wilmington, N. C. |
| Malta ¹ | 160 | 70 0 | 31 4 | 6 10 | do..... | | 9 | Cincinnati (2d). |
| Nolichucky..... | 252 | 85 0 | 30 0 | 6 10 | do..... | | | Chattanooga. |
| Omro..... | 150 | 100 0 | 30 0 | 6 0 | do..... | 1 | 4 | Milwaukee. |
| Oriole..... | 85 | 107 0 | 22 4 | 5 0 | do..... | 2 | 9 | St. Paul. |
| Oshkosh ¹ | 234 | 75 0 | 31 0 | 6 0 | do..... | 1 | 9 | Milwaukee. |
| Rosecrans ¹ | 176 | 111 0 | 22 0 | 5 0 | do..... | 1 | 5 | Wheeling. |
| Saginaw..... | 92 | 83 9 | 28 0 | 6 7 | do..... | | 4 | Grand Rapids. |
| Suppernong..... | 220 | 78 0 | 32 0 | 7 0 | do..... | 2 | 8 | Wilmington, N. C. |
| Tishomingo..... | 481 | 100 0 | 44 0 | 6 0 | do..... | | 10 | Chattanooga. |
| No. 1..... | 120 | 92 0 | 30 0 | 4 4 | do..... | 2 | 6 | Kansas City, Mo. |
| No. 1..... | 115 | 65 0 | 27 0 | 6 6 | do..... | | | Galveston. |
| No. 2 derrick boat..... | 149 | 70 0 | 22 0 | 6 10 | do..... | 1 | 11 | Charleston, S. C. |
| No. 6 Hudson River ² | 244 | 85 0 | 28 0 | 9 4 | do..... | 1 | 4 | New York (1st). |
| No. 21 Hudson River ² | 170 | 86 0 | 27 6 | 8 6 | do..... | 2 | 12 | Do. |

¹ Ladder dredge.² Gravel digging and screening plants.

TABLE 5.—SNAG BOATS.

| | | | | | | | | |
|-----------------------------|-------|--------|------|------|-----------------|---|----|-----------------------|
| Arkansas..... | 235 | 155 6 | 30 0 | 4 6 | Steel..... | 3 | 20 | Little Rock. |
| Black Warrior..... | 305 | 159 7 | 33 2 | 4 4 | Wood..... | 2 | 15 | Mobile. |
| Chattahoochee..... | 233 | 140 0 | 29 0 | 4 0 | do..... | 3 | 22 | Montgomery. |
| Choctawhatchee..... | 115 | 90 0 | 24 0 | 3 6 | do..... | 2 | 8 | Do. |
| Columbia..... | 137 | 137 4 | 27 0 | 4 0 | do..... | 2 | 20 | Vicksburg. |
| Conecuh..... | 37 | 60 0 | 20 0 | 3 0 | do..... | 1 | 8 | Montgomery. |
| Culberson, C. A..... | 200 | 106 0 | 28 0 | 5 0 | do..... | 4 | 12 | Dallas. |
| Delatour ¹ | 350 | 112 0 | 30 0 | 5 0 | do..... | 5 | 10 | New Orleans. |
| Demopolis..... | 96 | 82 3 | 25 6 | 4 9 | do..... | 2 | 11 | Mobile. |
| Escambia..... | 112 | 92 0 | 25 0 | 4 0 | do..... | 2 | 8 | Montgomery. |
| Escatawpa..... | 62 | 60 0 | 20 0 | 4 0 | do..... | 2 | 11 | Mobile. |
| Flint..... | 127 | 95 0 | 24 0 | 4 0 | do..... | 3 | 9 | Montgomery. |
| Florence, Thos. B..... | 107 | 109 6 | 20 0 | 4 0 | Iron and steel. | 3 | 9 | Vicksburg. |
| Geneva..... | 42 | 64 0 | 22 6 | 4 4 | Wood..... | 2 | 8 | Montgomery. |
| Guadalupe..... | 227 | 118 0 | 28 0 | 5 11 | do..... | 2 | 10 | Galveston. |
| Howell, C. W..... | 304 | 166 0 | 36 0 | 5 0 | Iron and steel. | 3 | 23 | Vicksburg. |
| Humphreys, Ben..... | 286 | 155 6 | 32 0 | 5 0 | do..... | 3 | 23 | Do. |
| Johnson, A. B..... | 58 | 84 0 | 22 0 | 3 0 | Wood..... | 1 | 11 | Little Rock. |
| Kentucky..... | 370 | 107 0 | 30 0 | 5 6 | do..... | 4 | 12 | Cincinnati (2d). |
| Kissimmee..... | 65 | 60 0 | 18 0 | 4 0 | do..... | 2 | 5 | Jacksonville. |
| Macomb, J. N..... | 1,160 | 177 6 | 62 0 | 8 0 | Steel..... | 6 | 36 | St. Louis. |
| Mammoth Cave..... | 284 | 141 0 | 32 8 | 5 0 | do..... | 3 | 15 | Louisville. |
| Mandan..... | 150 | 156 0 | 24 0 | 4 7 | do..... | 3 | 14 | Kansas City. |
| Mathloma..... | 177 | 140 0 | 34 0 | 5 0 | Wood..... | 3 | 11 | Portland, Oreg. (2d). |
| McCalla, R. C..... | 133 | 119 6 | 28 3 | 5 0 | do..... | 4 | 20 | Mobile. |
| McPherson, James B..... | 340 | 194 10 | 36 0 | 5 7 | Steel..... | 5 | 18 | Kansas City. |
| Missouri..... | 510 | 187 0 | 52 0 | 7 0 | do..... | 6 | 36 | Do. |
| Navasota..... | 140 | 90 0 | 25 0 | 5 0 | Wood..... | 2 | 12 | Dallas. |
| Oconee..... | 126 | 110 0 | 38 0 | 4 4 | do..... | 3 | 11 | Savannah. |

¹ Snag boat and bucket dredge.

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|-----------------------------|-------------------------|----------------|----------------|----------------|-------------------------------|------------------|-------|------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | <i>Tons.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | | | | |
| Pearl..... | 128 | 96 6 | 26 0 | 5 0 | Wood..... | 3 | 11 | Mobile. |
| Pedee..... | 317 | 131 8 | 26 0 | 5 3 | Steel..... | 2 | 12 | Charleston, S. C. |
| Quapaw..... | 240 | 147 6 | 30 0 | 4 4 | do..... | 3 | 19 | Little Rock. |
| Ransdell, Jos. E..... | 286 | 155 6 | 32 0 | 5 0 | Iron and steel..... | 3 | 23 | Vicksburg. |
| Rattler..... | 182 | 70 0 | 30 0 | 7 0 | Wood..... | ..... | ..... | Philadelphia. |
| Reese, C. B..... | 340 | 195 9 | 36 0 | 5 3 | Iron and steel..... | 3 | 27 | Little Rock. |
| Riverside..... | 57 | 84 0 | 22 0 | 3 0 | Wood..... | 1 | 11 | Do. |
| Roanoke..... | 232 | 115 0 | 24 0 | 5 10 | do..... | 3 | 5 | Norfolk. |
| Selzer..... | 240 | 136 6 | 34 11 | 4 8 | do..... | 3 | 29 | San Francisco (3d). |
| Skagit..... | 205 | 115 0 | 31 0 | 5 9 | do..... | 3 | 8 | Seattle. |
| Swan..... | 264 | 159 0 | 31 4 | 4 6 | Steel..... | 3 | 11 | Pittsburgh. |
| Tipton, David..... | 265 | 164 0 | 34 0 | 5 0 | Wood..... | 7 | 19 | Rock Island. |
| Tombigbee..... | 151 | 119 0 | 28 0 | 5 4 | do..... | 3 | 14 | Mobile. |
| Trent..... | 120 | 70 0 | 20 0 | 5 0 | do..... | 2 | 8 | Wilmington, N. C. |
| Trinity..... | 190 | 123 5 | 30 0 | 3 0 | do..... | 4 | 12 | Dallas. |
| Tugalo..... | 336 | 129 3 | 34 0 | 5 6 | Steel and wood..... | 3 | 12 | Savannah. |
| Turtle, Capt..... | 75 | 65 0 | 30 0 | 4 6 | do..... | ..... | 10 | Wheeling. |
| Twining, Wm. J..... | 370 | 155 0 | 30 0 | 4 0 | do..... | 4 | 15 | Montgomery. |
| Umatilla..... | 300 | 159 9 | 34 4 | 5 1 | Wood..... | 3 | 14 | Portland, Oreg. (1st). |
| Vienua..... | 152 | 117 6 | 26 0 | 4 6 | do..... | 3 | 12 | Mobile. |
| Waco..... | 200 | 118 8 | 30 2 | 5 0 | do..... | 4 | 12 | Dallas. |
| Wateres..... | 317 | 131 8 | 26 0 | 5 3 | Steel..... | 3 | 12 | Charleston, S. C. |
| Woodruff, E. A..... | 863 | 226 0 | 48 0 | 7 6 | Iron, steel, and wood..... | 6 | 34 | Cincinnati (1st). |
| Wright, Gen. H. G..... | 130 | 89 0 | 23 6 | 5 6 | Wood..... | 2 | 7 | Wilmington, N. C. |
| Wright, H. G..... | 1,100 | 187 0 | 62 0 | 8 0 | Steel..... | 6 | 35 | St. Louis. |
| York..... | 110 | 72 0 | 22 0 | 6 0 | Wood..... | ..... | ..... | Washington, D. C. |
| No. 1..... | 64 | 90 0 | 24 0 | 2 6 | do..... | 1 | 15 | Nashville. |
| No. 1..... | 35 | 54 0 | 18 0 | 4 0 | do..... | 2 | 4 | Savannah. |
| No. 2, derrick barge..... | 65 | 50 0 | 22 0 | 7 0 | do..... | ..... | ..... | Galveston. |
| No. 1, derrick barge..... | 95 | 60 0 | 20 0 | 6 0 | do..... | ..... | ..... | Charleston. |

1 Snag boat and bucket dredge.

2 Snag boat and rake dredge.

TABLE 6.—DERRICK BOATS.

| | | | | | | | | |
|--------------------|-----|-------|------|------|----------------------|-------|-------|-----------------------------------|
| A..... | 110 | 80 0 | 28 0 | 4 0 | Wood..... | 1 | 6 | Charleston. |
| Black..... | 35 | 45 0 | 20 0 | 3 9 | do..... | 1 | 7 | Wilmington, N. C. |
| C..... | 29 | 46 0 | 32 0 | 3 6 | do..... | ..... | ..... | Mobile. |
| Contentnia..... | 32 | 40 0 | 20 0 | 4 0 | do..... | 1 | 6 | Wilmington, N. C. |
| D. B. No. 4..... | 140 | 70 0 | 26 1 | 2 8 | do..... | 1 | 8 | Galveston. |
| Mary Ann..... | 161 | 115 0 | 27 0 | 3 8 | do..... | ..... | ..... | Pittsburgh. |
| Mingo..... | 116 | 94 0 | 32 0 | 5 0 | Steel..... | ..... | 5 | Cincinnati (1st). |
| Rattler..... | 240 | 70 0 | 30 0 | 7 0 | Wood..... | 2 | 11 | Philadelphia. |
| Sapelo..... | 160 | 85 4 | 39 8 | 5 5 | do..... | 1 | 11 | Savannah. |
| Tallahatta..... | 81 | 50 0 | 40 0 | 5 0 | do..... | ..... | ..... | Mobile. |
| 6..... | 185 | 102 6 | 32 0 | 7 10 | do..... | ..... | ..... | Duluth. |
| 7..... | 185 | 102 6 | 32 0 | 7 10 | do..... | ..... | ..... | Do. |
| 8..... | 80 | 80 0 | 30 0 | 4 0 | Wood..... | ..... | 2 | Chattanooga. |
| 9..... | 40 | 70 0 | 20 0 | 5 7 | do..... | ..... | ..... | Duluth. |
| 8..... | 104 | 80 0 | 30 0 | 4 9 | do..... | ..... | 4 | Chattanooga. |
| 1017..... | 74 | 90 0 | 32 0 | 5 0 | Crossed wood..... | ..... | 5 | Memphis (M. R. C. 1st and 2d). |
| No. 1..... | 107 | 70 0 | 32 0 | 5 0 | Wood..... | ..... | ..... | Cincinnati (1st). |
| No. 1..... | 50 | 34 3 | 13 2 | 3 0 | do..... | ..... | ..... | Chicago. |
| No. 1..... | 115 | 65 0 | 27 0 | 5 6 | do..... | 1 | 14 | Galveston. |
| No. 1..... | 81 | 66 6 | 29 6 | 5 10 | do..... | ..... | 2 | Milwaukee. |
| No. 1..... | 142 | 100 0 | 30 0 | 4 9 | do..... | 1 | 1 | New Orleans. |
| No. 1..... | 78 | 63 0 | 24 0 | 5 0 | do..... | ..... | ..... | Do. |
| No. 1..... | 84 | 74 0 | 26 0 | 5 0 | do..... | 2 | 3 | Buffalo. |
| No. 1..... | 51 | 65 0 | 20 5 | 3 10 | do..... | ..... | ..... | Portland, Oreg. (1st). |
| No. 1..... | 42 | 51 0 | 22 6 | 2 10 | do..... | ..... | ..... | Portland, Oreg. (2d). |
| No. 1..... | 42 | 60 0 | 20 0 | 6 0 | do..... | ..... | ..... | Savannah. |
| No. 1..... | 75 | 68 0 | 20 0 | 3 1 | do..... | ..... | ..... | St. Louis. |
| No. 1..... | 105 | 95 0 | 32 0 | 2 6 | do..... | 1 | 16 | Vicksburg. |
| No. 1, It..... | 47 | 50 0 | 22 0 | 4 2 | do..... | ..... | ..... | Pittsburgh. |
| No. 1, G. & B..... | 76 | 70 0 | 26 0 | 4 0 | do..... | ..... | 2 | Louisville. |

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|--------------------------|-------------------------|-------------|----------|--------|-----------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| No. 1, O. R. | 87 ^a | 71 0 | 37 0 | 4 0 | Wood | | | Pittsburgh. |
| No. 1, O. R. | 131 | 70 0 | 32 0 | 5 0 | Steel | | 2 | Louisville. |
| No. 2 | 107 | 70 0 | 32 0 | 5 0 | Wood | | | Cincinnati (1st). |
| No. 2 | 65 | 64 0 | 22 0 | 7 0 | do. | | 10 | Galveston. |
| No. 2 ¹ | 122 | 74 0 | 36 0 | 6 0 | do. | | | Manila. |
| No. 2 | 131 | 84 2 | 27 4 | 6 8 | do. | | 2 | Milwaukee. |
| No. 2 | 106 | 76 0 | 26 0 | 6 3 | do. | 2 | 3 | Buffalo. |
| No. 2 | 65 | 59 0 | 22 0 | 5 8 | do. | | | New Orleans. |
| No. 2 | 70 | 70 0 | 26 0 | 3 8 | do. | | | Pittsburgh. |
| No. 2 | 84 | 70 0 | 30 0 | 4 0 | do. | 1 | 9 | Portland, Oreg. (1st). |
| No. 2 | 42 | 51 0 | 22 6 | 2 10 | do. | | | Portland, Oreg. (2d). |
| No. 2 | 75 | 68 0 | 20 0 | 3 1 | do. | | | St. Louis. |
| No. 2 | 54 | 65 0 | 24 0 | 3 0 | do. | 2 | 18 | Vicksburg. |
| No. 2, U. S. E. D. | 113 | 74 9 | 34 11 | 4 1 | do. | | 1 | Wheeling. |
| Wheeling. | | | | | | | | |
| No. 2, G. & B. | 76 | 70 0 | 26 0 | 4 0 | do. | | 5 | Louisville. |
| No. 2, O. R. | 131 | 70 0 | 32 0 | 5 0 | Steel | | 2 | Do. |
| No. 3 | 74 | 80 0 | 24 0 | 4 6 | Wood | | 4 | Chattanooga. |
| No. 3 | 236 | 50 0 | 42 0 | 12 0 | Steel | | | Detroit. |
| No. 3 | 90 | 67 0 | 30 0 | 4 0 | Wood | | 3 | Little Rock. |
| No. 3 | 128 | 100 0 | 30 0 | 4 9 | do. | 1 | 1 | New Orleans. |
| No. 3 | 45 | 54 0 | 22 0 | 3 8 | do. | | 9 | Galveston. |
| No. 3 | 60 | 75 0 | 30 0 | 5 0 | do. | | 5 | Memphis (M. R. C. 1st and 2d). |
| No. 3 | 44 | 80 0 | 20 0 | 4 9 | do. | | | Milwaukee. |
| No. 3 | 144 | 80 0 | 30 0 | 4 7 | do. | | 2 | Nashville. |
| No. 3 | 90 | 70 0 | 26 7 | 4 0 | do. | | | Pittsburgh. |
| No. 3 | 42 | 51 0 | 22 6 | 2 10 | do. | | | Portland, Oreg. (2d). |
| No. 3, U. S. E. D. | 185 | 75 0 | 35 0 | 4 7 | do. | | 1 | Wheeling. |
| Wheeling. | | | | | | | | |
| No. 3, G. & B. | 76 | 70 0 | 26 0 | 4 0 | do. | | 6 | Louisville. |
| No. 4 | 49 | 80 0 | 30 0 | 3 0 | do. | | | Chattanooga. |
| No. 4 | 91 | 80 0 | 30 0 | 4 0 | do. | | | Do. |
| No. 4 | 9 | 29 6 | 10 0 | 3 10 | do. | | | Los Angeles. |
| No. 4 | 44 | 80 0 | 20 0 | 4 9 | do. | | | Milwaukee. |
| No. 4 | 98 | 70 0 | 32 0 | 4 7 | do. | | 2 | Nashville. |
| No. 4 | 65 | 65 0 | 30 0 | 4 4 | do. | | 1 | Cincinnati (2d). |
| No. 4 | 42 | 51 0 | 22 6 | 2 10 | do. | | | Portland, Oreg. (2d). |
| No. 5, L. P. C. | 57 | 72 0 | 22 0 | 4 0 | do. | | 2 | Louisville. |
| No. 5 | 250 | 100 0 | 34 0 | 6 10 | do. | | 3 | Chattanooga. |
| No. 5 | 19 | 40 0 | 18 0 | 3 6 | do. | | | Los Angeles. |
| No. 5 | 98 | 70 0 | 32 0 | 4 7 | do. | | | Nashville. |
| No. 5 | 166 | 75 6 | 28 6 | 7 0 | do. | | | Manila. |
| No. 5 | 50 | 38 0 | 18 0 | 6 0 | do. | | | Philadelphia. |
| No. 5 | 65 | 65 0 | 30 0 | 4 10 | Steel | | 1 | Cincinnati (2d). |
| No. 6 | 85 | 80 0 | 30 0 | 4 0 | Wood | | | Chattanooga. |
| No. 7 | 85 | 80 0 | 30 0 | 3 6 | do. | | 2 | Do. |
| No. 7, L. K. | 95 | 70 0 | 22 0 | 4 10 | do. | | | Wheeling. |
| No. 10 | 140 | 80 0 | 30 0 | 4 0 | do. | | 4 | Chattanooga. |
| No. 11 | 90 | 80 0 | 30 0 | 4 0 | do. | | | Do. |
| No. 12 | 90 | 80 0 | 30 0 | 4 0 | do. | | | Do. |
| No. 13 | 91.5 | 80 0 | 30 0 | 4 0 | do. | | 3 | Do. |
| No. 14 | 90 | 80 0 | 30 0 | 4 0 | do. | | | Do. |
| No. 16, Hudson River. | 170 | 80 0 | 26 6 | 6 0 | do. | 2 | 2 | New York (1st). |
| No. 19, Hudson River. | 170 | 80 9 | 27 4 | 7 6 | do. | 2 | 2 | Do. |
| No. 20, Hudson River. | 145 | 81 0 | 27 6 | 8 6 | do. | 2 | 2 | Do. |
| No. 24, U. S. E. D. | 161 | 75 0 | 35 0 | 4 10 | do. | 1 | 2 | Wheeling. |
| Wheeling. | | | | | | | | |
| No. 29, U. S. E. D. | 41 | 62 0 | 24 0 | 3 8 | do. | | | Do. |
| Kanawha. | | | | | | | | |
| No. 116 | 85 | 69 0 | 29 0 | 4 0 | do. | 1 | 20 | Vicksburg. |
| No. 297 | 42 | 100 0 | 20 0 | 4 6 | do. | 1 | 4 | Rock Island. |
| No. 319 | 65 | 70 0 | 26 0 | 4 0 | do. | 1 | 4 | Do. |
| No. 596 | 170 | 120 0 | 30 0 | 6 0 | do. | 2 | 6 | Vicksburg (3d M. R. C.). |
| No. 1309 | 100 | 86 0 | 35 0 | 5 0 | do. | 2 | 6 | Do. |
| Hudson | 200 | 71 0 | 24 0 | 7 0 | do. | | | New York (1st). |
| No name | 43 | 42 11 | 15 11 | 3 9 | do. | | 3 | Norfolk. |
| No name | 132 | 80 0 | 36 0 | 5 0 | do. | 1 | 1 | St. Louis (M. R. C.). |
| No name | | 76 0 | 22 0 | 6 5 | do. | | | Detroit. |
| Wolf, L. C. | 114 | 60 6 | 32 6 | 4 7 | do. | 1 | 2 | Wheeling. |

^a Condemned and destroyed 1914.

TABLE 7.—PILE DRIVERS.

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|-----------------------------|-------------------------|-------------|----------|---------|------------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| No. 1, G. R. | 24 | 40 0 | 20 0 | 3 0 | Wood | | | Grand Rapids. |
| No. 1. | 57 | 76 0 | 19 0 | 4 4 | do. | 2 | 4 | Kansas City. |
| No. 1-B. | 57 | 76 0 | 19 0 | 4 4 | do. | 2 | 4 | Do. |
| No. 1. | 111 | 66 4 | 21 4 | 6 6 | do. | | 2 | Milwaukee. |
| No. 1. | 12 | 81 0 | 22 0 | 4 0 | do. | | | Montgomery. |
| No. 1. | 71 | 55 0 | 25 0 | 4 0 | do. | | | New Orleans. |
| No. 1. | 68 | 50 0 | 26 6 | 4 0 | do. | | | Pittsburgh. |
| No. 1. | 36 | 60 0 | 22 0 | 3 6 | do. | | 3 | Portland, Oreg. (2d). |
| No. 1. | 20 | 45 3 | 17 0 | 3 6 | do. | | | Savannah. |
| No. 1. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | St. Louis. |
| No. 1, O. R. | 88 | 70 0 | 22 0 | 4 5 | do. | | 10 | Louisville. |
| No. 2, O. R. | 88 | 70 0 | 22 0 | 4 5 | do. | | 10 | Do. |
| No. 2. | 118 | 60 0 | 25 4 | 6 6 | do. | | 2 | Milwaukee. |
| No. 2. | 14 | 40 0 | 18 0 | 3 0 | do. | | | Montgomery. |
| No. 2 ¹ . | 127 | 75 6 | 30 0 | 5 0 | do. | | | New Orleans. |
| No. 2. | 66 | 50 0 | 26 4 | 4 7 | do. | | 7 | Pittsburgh. |
| No. 2. | 82 | 70 0 | 24 0 | 4 0 | do. | | 5 | Portland, Oreg. (2d). |
| No. 2. | 63 | 76 0 | 19 0 | 4 4 | do. | 2 | 8 | Kansas City, Mo. |
| No. 3. | 63 | 76 0 | 19 0 | 4 4 | do. | 2 | 8 | Do. |
| No. 3. | 89 | 70 0 | 22 0 | 4 5 | do. | | 10 | Louisville. |
| No. 3. | 8.8 | 30 0 | 16 0 | 2 0 | do. | | | Montgomery. |
| No. 3. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | St. Louis. |
| No. 4. | 56 | 57 0 | 24 0 | 3 6 | do. | | 6 | Duluth. |
| No. 4. | 17.5 | 40 0 | 18 0 | 3 0 | do. | | 8 | Montgomery. |
| No. 4. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | St. Louis (M. R. C.). |
| No. 4, Hudson River. | 50 | 50 0 | 21 0 | 3 1 | do. | 1 | 5 | New York (1st). |
| No. 4. | 63 | 76 0 | 19 0 | 4 4 | do. | 2 | 8 | Kansas City, Mo. |
| No. V-S. | 49 | 65 0 | 19 0 | 4 6 | do. | 2 | 4 | Kansas City. |
| No. 5. | 63 | 76 0 | 19 0 | 4 4 | do. | 2 | 8 | Kansas City, Mo. |
| No. 5. | 12 | 40 0 | 18 0 | 3 0 | do. | | 8 | Montgomery. |
| No. 5. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | St. Louis. |
| No. 5, Hudson River. | 55 | 50 0 | 21 7 | 3 2 | do. | 1 | 5 | New York (1st). |
| No. 6. | 50 | 50 0 | 28 0 | 3 10 | do. | | | Cincinnati (2d). |
| No. 6. | 63 | 76 0 | 19 0 | 4 4 | do. | 2 | 8 | Kansas City, Mo. |
| No. 6. | 57 | 70 0 | 20 0 | 3 0 | do. | | 6 | Memphis (M. R. C. 1st and 2d). |
| No. VII-Y. | 57 | 76 0 | 19 0 | 4 4 | do. | 4 | 4 | Kansas City. |
| No. 9. | 57 | 70 0 | 20 0 | 3 0 | do. | | 6 | Memphis (M. R. C. 1st and 2d). |
| No. 11. | 30 | 80 0 | 22 0 | 4 2 | do. | | | Montgomery. |
| No. 13. | 54 | 68 0 | 20 0 | 3 6 | do. | 1 | 4 | St. Louis (M. R. C.). |
| No. 15. | 57 | 76 0 | 19 0 | 4 4 | do. | 4 | 4 | Kansas City. |
| No. 17. | 10 | 40 0 | 18 0 | 3 0 | do. | | | Montgomery. |
| No. 25. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | St. Louis. |
| No. 26. | 17.5 | 40 0 | 18 0 | 3 0 | do. | | | Montgomery. |
| No. 26. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | St. Louis. |
| No. 28. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | Do. |
| No. 29. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | Do. |
| No. 30. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | Do. |
| No. 31. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | Do. |
| No. 32. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | Do. |
| No. 33. | 47 | 66 0 | 20 0 | 4 6 | do. | | 5 | Rock Island. |
| No. 33. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | St. Louis. |
| No. 34. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | Do. |
| No. 35. | 75 | 68 0 | 20 0 | 3 1 | do. | | 8 | Do. |
| No. 101. | 106 | 88 0 | 25 0 | 2 4 | Steel | 2 | 6 | Do. |
| No. 102. | 106 | 88 0 | 25 0 | 2 4 | do. | 2 | 6 | Do. |
| No. 103. | 106 | 88 0 | 25 0 | 2 4 | do. | 2 | 6 | Do. |
| No. 104. | 106 | 88 0 | 25 0 | 2 4 | do. | 2 | 6 | Do. |
| No. 104. | | 65 0 | 18 0 | 3 0 | do. | | | Rock Island. |
| No. 508. | 58 | 66 0 | 22 0 | 4 3 | Composite. | | | Do. |
| No. 551. | 84 | 100 0 | 25 0 | 5 0 | Wood | 2 | 8 | Kansas City, Mo. |
| No. 971. | 56 | 76 0 | 25 0 | 3 10 | do. | 1 | 4 | St. Louis (M. R. C.). |
| No. 981. | 56 | 76 0 | 25 0 | 3 10 | do. | 1 | 4 | Do. |
| No. 982. | 56 | 76 0 | 25 0 | 3 10 | do. | 1 | 4 | Do. |
| No. 983. | 56 | 76 0 | 25 0 | 3 10 | do. | 1 | 4 | Do. |
| No name. | | 43 0 | 20 0 | 3 9 | do. | | | New York (1st). |
| Lilliput. | 82 | 60 0 | 24 0 | 5 1 | do. | | | Wilmington, N. C. |
| Tackle. | 58 | 64 0 | 28 0 | 3 6 | do. | | | San Francisco (3d). |

¹ Pile driver and derrick.

TABLE 8.—GRADERS.

| Name, number, or letter. | Displacement. | Dimensions. | | | Material. | Complement. | | District. |
|----------------------------|---------------|-------------------------|------------------------|-----------------------|-------------|-------------|------|------------------------------------|
| | | Length. | Breadth. | Depth. | | Officers. | Men. | |
| No. 1..... | Tons. 280 | <i>Ft. in.</i> 124 0 | <i>Ft. in.</i> 30 0 | <i>Ft. in.</i> 7 7 | Wood..... | | 20 | New Orleans (M. R. C. 4th). |
| No. 2..... | 150 | 110 0 | 30 0 | 5 0 | do..... | | 11 | Memphis (M. R. C. 1st and 2d). |
| No. 2..... | 280 | 124 0 | 30 0 | 7 7 | do..... | | 20 | New Orleans (M. R. C. 1st and 2d). |
| No. 101 ¹ | 120 | 88 0 | 25 0 | 2 4 | Steel..... | 2 | 9 | St. Louis. |
| No. 102 ¹ | 120 | 88 0 | 25 0 | 2 4 | do..... | 2 | 9 | Do. |
| No. 1011..... | 229 | 120 0 | 30 0 | 6 0 | Wood..... | 3 | 18 | Vicksburg (3d M. R. C.). |
| No. 1012..... | 229 | 120 0 | 30 6 | 6 0 | do..... | 3 | 18 | Do. |
| No. 1022..... | 180 | 110 0 | 30 0 | 6 0 | Crescoted.. | | 11 | Memphis (1st and 2d M. R. C.). |
| No. 1205..... | 190 | 120 11 | 30 2 | 7 0 | Steel..... | | 11 | Do. |
| No. 9313..... | 115 | 100 4 | 27 3 | 4 0 | Wood..... | | 11 | Do. |
| IV-EP..... | | 70 0 | 19 10 | 5 0 | do..... | | | Do. Kansas City. |

¹ Combined grader and derrick boat.

TABLE 9.—DRILL BOATS.

| | | | | | | | | |
|-----------------------------------|-----|-------|------|-----|------------|---|----|------------------------|
| Newton, Gen. John.. | 750 | 127 0 | 58 0 | 9 6 | Wood..... | | | Philadelphia. |
| No. 1..... | 50 | 65 0 | 20 0 | 3 8 | do..... | | | Portland, Oreg. (1st). |
| No. 1, Columbia River | 100 | 100 0 | 26 6 | 4 6 | do..... | | | Seattle. |
| No. 1, U. S. E. D. Hudson River. | 30 | 42 0 | 20 6 | 3 2 | do..... | | | New York (1st). |
| No. 2..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Chattanooga. |
| No. 2..... | 50 | 65 0 | 20 0 | 3 8 | do..... | | | Portland, Oreg. (1st). |
| No. 2, Columbia River | 100 | 100 0 | 26 6 | 4 6 | do..... | | | Seattle. |
| No. 3..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Chattanooga. |
| No. 3..... | 50 | 65 0 | 20 0 | 3 8 | do..... | | | Portland, Oreg. (1st). |
| No. 3, Columbia River | 100 | 100 0 | 26 6 | 4 6 | do..... | | | Seattle. |
| No. 4..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Chattanooga. |
| No. 5..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Do. |
| No. 6..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Do. |
| No. 6..... | 77 | 80 0 | 20 0 | 4 0 | do..... | | | Rock Island. |
| No. 7..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Chattanooga. |
| No. 8..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Do. |
| No. 9..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Do. |
| No. 10..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Do. |
| No. 10..... | 10 | 40 0 | 14 0 | 2 8 | do..... | | 4 | Louisville. |
| No. 11..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Chattanooga. |
| No. 11..... | 10 | 40 0 | 14 0 | 2 8 | do..... | | 5 | Louisville. |
| No. 12..... | 45 | 25 0 | 6 0 | 1 0 | do..... | | | Chattanooga. |
| No. 12..... | 10 | 40 0 | 14 0 | 2 8 | do..... | | 4 | Louisville. |
| No. 15..... | 10 | 40 0 | 14 0 | 2 8 | do..... | | 4 | Do. |
| No. 16..... | 10 | 40 0 | 14 0 | 2 8 | do..... | | 4 | Do. |
| No. 16..... | 60 | 68 0 | 26 0 | 5 0 | do..... | | | Montgomery. |
| No. 39, U. S. E. D. Hudson River. | 200 | 71 0 | 24 0 | 7 0 | do..... | 1 | 12 | New York (1st). |
| No. 103..... | | 81 0 | 18 0 | 4 0 | do..... | | | Rock Island. |
| No. 426..... | 272 | 132 0 | 32 0 | 6 0 | Steel..... | | 16 | Do. |

TABLE 10.—MANEUVER BOATS.

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|----------------------------------|-------------------------|-------------|----------|---------|------------|------------------|------|-------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| No. 1..... | 15 | 45 10 | 16 0 | 3 4 | Wood..... | | | Dallas. |
| No. 1..... | 36 | 50 0 | 20 0 | 3 4 | do..... | | | Cincinnati (2d). |
| No. 1..... | 71 | 74 10 | 22 0 | 4 7 | do..... | | 5 | Louisville. |
| No. 1..... | 57 | 60 0 | 22 0 | 3 5 | do..... | | | Charleston. |
| No. 1, A. R. | 41 | 56 0 | 18 0 | 3 0 | do..... | | | Pittsburgh. |
| No. 2..... | 22 | 44 1 | 20 0 | 3 7 | do..... | | | Dallas. |
| No. 2..... | 71 | 74 10 | 22 0 | 4 7 | do..... | | 5 | Louisville. |
| No. 2, O. R. | 70 | 60 0 | 22 0 | 4 0 | do..... | | | Pittsburgh. |
| No. 3..... | 50 | 60 0 | 26 0 | 3 4 | do..... | | | Cincinnati (2d). |
| No. 3, O. R. | 54 | 60 0 | 20 0 | 4 0 | do..... | | | Pittsburgh. |
| No. 4, O. R. | 58 | 60 0 | 22 0 | 3 8 | do..... | | | Do. |
| No. 5, O. R. | 65 | 60 0 | 22 0 | 3 8 | do..... | | | Do. |
| No. 6, O. R. | 41 | 56 0 | 18 0 | 3 0 | do..... | | | Do. |
| No. 8, O. R. | 65 | 60 0 | 22 0 | 3 8 | do..... | | | Do. |
| No. 10, U. S. E. D. Wheeling. | 60 | 60 0 | 22 0 | 3 8 | do..... | | | Wheeling. |
| No. 11, U. S. E. D. Wheeling. | 60 | 60 0 | 22 0 | 3 8 | do..... | | | Do. |
| No. 22, U. S. E. D. Wheeling. | 60 | 60 0 | 22 0 | 3 8½ | do..... | | | Do. |
| No. 23, U. S. E. D. Wheeling. | 60 | 60 0 | 22 0 | 3 8½ | do..... | | | Do. |
| No. 38..... | 65 | 65 0 | 30 0 | 5 2 | do..... | | | Cincinnati (2d). |
| No. 39..... | 50 | 60 0 | 26 0 | 3 4 | do..... | | | Do. |
| No. 45..... | 76 | 65 0 | 30 0 | 4 10 | Steel..... | | | Do. |
| No. 46..... | 55 | 60 0 | 26 0 | 3 6 | do..... | | | Do. |
| No. 47..... | 55 | 60 0 | 26 0 | 3 6 | do..... | | | Do. |
| No name..... | 71 | 75 0 | 22 0 | 3 3 | Wood..... | | | Cincinnati (1st). |
| No. 9113..... | 36 | 60 0 | 25 0 | 4 0 | do..... | | | Viicksburg. |
| No. 9122..... | 75 | 80 0 | 30 0 | 4 0 | do..... | | | Do. |
| No. 9127..... | 50 | 60 0 | 25 0 | 4 0 | do..... | | | Do. |

¹ Authorized after June 30, 1914.

TABLE 11.—TUG AND SURVEY BOATS, SCREW (STEAM).

| | | | | | | | | |
|-----------------------|------|-------|-------|------|------------|---|---|---------------------------------------|
| Adams, H. M..... | 95 | 78 4 | 18 9 | 7 6 | Wood..... | 2 | 2 | Portland, Oreg. (2d). |
| Alexander, Gen..... | 110 | 77 6 | 18 4 | 8 0 | do..... | | | San Francisco (2d). |
| Angler..... | 95 | 91 3 | 17 2 | 10 0 | do..... | | | Savannah. |
| Arago..... | 90 | 89 6 | 18 0 | 9 0 | do..... | 2 | 7 | Portland, Oreg. (2d). |
| Ariadne..... | 8 | 45 6 | 9 0 | 4 0 | do..... | | | Milwaukee. |
| Boaz..... | 55 | 65 0 | 16 3 | 7 0 | Iron..... | 2 | 3 | Viicksburg (M. R. C. 3d). |
| Brewerton..... | 60 | 69 7 | 15 9 | 8 11 | Wood..... | 2 | 2 | Buffalo. |
| Camden..... | 170 | 80 0 | 20 0 | 9 0 | Steel..... | 2 | 5 | Philadelphia. |
| Casey, T. L..... | 90 | 70 0 | 15 0 | 8 0 | do..... | 2 | 2 | Buffalo. |
| Castle..... | 165 | 95 0 | 20 2 | 10 6 | do..... | 2 | 6 | Washington, D. C. |
| Caswell, Richard..... | 200 | 84 9 | 18 6 | 9 4 | do..... | 2 | 7 | Wilmington, N. C. |
| Cerebus..... | 226 | 109 3 | 23 0 | 12 6 | do..... | 4 | 5 | New York (super. of N. Y. Harbor). |
| Chickasaw..... | 155 | 109 0 | 18 8 | 9 9 | do..... | 2 | 6 | Mobile. |
| Chipeta..... | 44 | 76 8 | 14 1 | 8 4 | Wood..... | | | Norfolk, Va. |
| Circle..... | 38 | 53 6 | 14 3 | 6 6 | do..... | 2 | 1 | Duluth. |
| Coquet..... | 100 | 58 0 | 13 6 | 7 0 | do..... | 2 | 6 | Wilmington, N. C. |
| Cora..... | 220 | 140 0 | 23 7 | 13 6 | do..... | 2 | 9 | Newport. |
| Cynthia..... | 135 | 74 7 | 17 10 | 7 10 | do..... | 2 | 6 | Wilmington, N. C. |
| Dearborn..... | 9 | 50 0 | 8 9 | 4 9 | Steel..... | | | Chicago. |
| Donovan, C..... | 180 | 95 0 | 19 2 | 10 0 | do..... | 2 | 4 | New Orleans. |
| Engineer..... | 298 | 108 0 | 20 0 | 11 0 | do..... | | | Manila. |
| Engineer, N. Y..... | 197 | 100 3 | 21 2 | 10 8 | do..... | 2 | 6 | New York (2d). |
| Essayons..... | 130 | 85 0 | 21 0 | 11 6 | do..... | 2 | 3 | Duluth. |
| Gem..... | 10.9 | 45 2 | 9 3 | 4 6 | Wood..... | | | Savannah. |

| Name, number, or letter. | Displacement. | Dimensions. | | | Material. | Complement. | | District. |
|------------------------------|------------------|-------------|----------|---------|------------|-------------|------|--|
| | | Length. | Breadth. | Depth. | | Officers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| Gibbon..... | 124 | 61 9 | 19 0 | 8 8 | Wood..... | 2 | 11 | Savannah. |
| Gillmore, Gen..... | 47 | 61 6 | 15 0 | 4 10 | do..... | 2 | 1 | Grand Rapids. |
| Gladwin..... | (¹) | 118 5 | 18 4 | 9 9 | do..... | 1 | 8 | Detroit. |
| Gwendolen..... | 8 | 30 0 | 8 0 | 4 6 | do..... | 1 | 1 | Buffalo. |
| Hancock..... | 120 | 99 10 | 17 6 | 7 6 | do..... | 2 | 7 | Detroit (Lake Survey). |
| Harding, Horace..... | 215 | 90 6 | 23 1 | 10 6 | do..... | 2 | 0 | Mobile. |
| Harwood, Col..... | 107 | 80 0 | 17 8 | 9 6 | do..... | 1 | 3 | Boston. |
| Helen..... | 33 | 56 0 | 12 0 | 5 9 | do..... | | | Galveston. |
| Hillsboro..... | 86 | 114 0 | 14 6 | 6 4 | do..... | 2 | 4 | Jacksonville. |
| Humphreys, Gen. A.A..... | 50 | 73 8 | 16 6 | 7 1 | do..... | 2 | 5 | Philadelphia. |
| Industry..... | 110 | 71 8 | 16 0 | 7 10 | do..... | 14 | 4 | Milwaukee. |
| Lamont..... | 216 | 108 8 | 22 11 | 12 6 | Steel..... | 4 | 5 | New York (super. of N. Y. Harbor). |
| Lusk, Col. J. L..... | 295 | 123 11 | 19 4 | 11 10 | Wood..... | 2 | 12 | Detroit (Lake Survey). |
| Manchac..... | 113 | 78 0 | 17 0 | 7 0 | do..... | 2 | 5 | New Orleans (M. R. C. 4th). |
| Manisees..... | 225 | 106 0 | 22 0 | 9 0 | do..... | 4 | 5 | New York (2d). |
| Manitowoc..... | 200 | 100 0 | 21 6 | 10 7 | Steel..... | 4 | 6 | Milwaukee. |
| Marengo..... | 137 | 82 0 | 19 4 | 8 8 | do..... | 2 | 5 | New Orleans (M. R. C. 4th). |
| McGregor..... | 79 | 87 6 | 14 3 | 7 1 | Wood..... | 3 | 4 | Norfolk. |
| Mendall, G. H..... | 150 | 101 0 | 21 2 | 10 0 | do..... | 2 | 7 | Portland, Oreg. (2d). |
| Mercur..... | 60 | 83 0 | 13 3 | 7 0 | Steel..... | 2 | 3 | Wilmington, N. C. |
| Morganza..... | 180 | 94 0 | 20 4 | 10 3 | do..... | 2 | 5 | New Orleans (M. R. C. 4th). |
| Nimrod..... | 245 | 106 11 | 22 8 | 10 8 | Wood..... | 4 | 5 | New York (super. of N. Y. Harbor). |
| Nipinock..... | 4 | 32 6 | 6 6 | 4 0 | do..... | 1 | 1 | New York (1st). |
| Noble, Alfred..... | 83 | 76 6 | 15 6 | 7 0 | Steel..... | 1 | 3 | Detroit. |
| Parker..... | 98 | 69 9 | 16 4 | 7 2 | Wood..... | 2 | 2 | Vicksburg (M. R. C. 3d, super. of N. Y. Harbor). |
| Philadelphia..... | 55 | 67 0 | 16 0 | 7 6 | Steel..... | 2 | 5 | Philadelphia. |
| Picket..... | 32 | 52 5 | 11 11 | 6 3 | Wood..... | 1 | 3 | New Orleans. |
| Pontonier..... | 50 | 80 0 | 18 0 | 3 6 | Steel..... | 2 | 2 | Washington Barracks, D. C. |
| Post, J. C..... | 95 | 78 0 | 18 9 | 7 6 | Wood..... | 2 | 2 | Portland, Oreg. (2d). |
| Quest..... | 46 | 65 0 | 15 0 | 8 0 | do..... | 2 | 3 | Cleveland. |
| Reese, Gen..... | 29 | 48 0 | 12 0 | 5 0 | do..... | 1 | 3 | New Orleans. |
| Rumsey, James..... | 127 | 120 0 | 22 0 | 4 3 | Steel..... | 1 | 7 | Wheeling. |
| San Pedro ² | 113 | 92 10 | 20 10 | 10 6 | Iron..... | | | Manila. |
| Sapper..... | 100 | 76 4 | 16 10 | 9 6 | Wood..... | 1 | 3 | Detroit. |
| Scout..... | 195 | 106 1 | 20 10 | 10 8 | Steel..... | 4 | 5 | New York (super. of N. Y. Harbor). |
| Search..... | 200 | 158 6 | 18 0 | 10 0 | do..... | 2 | 11 | Detroit (Lake Survey). |
| Sentinel..... | 170 | 95 0 | 20 0 | 10 6 | do..... | 3 | 6 | Baltimore. |
| Spear..... | 160 | 87 0 | 19 8 | 11 0 | Wood..... | 2 | 4 | Cleveland. |
| Surveyor..... | 176 | 98 0 | 20 1 | 8 5 | do..... | 2 | 12 | Detroit (Lake Survey). |
| Talfor, Capt..... | 130 | 80 0 | 16 2 | 8 0 | do..... | 2 | 5 | Galveston. |
| Thayer, Col..... | 34 | 54 4 | 15 3 | 6 0 | do..... | 1 | 3 | New York (1st). |
| Tickfaw..... | 217 | 94 0 | 20 4 | 10 0 | Steel..... | 2 | 5 | New Orleans (4th M. R. C.). |
| Tonty..... | 120 | 96 0 | 16 0 | 5 6 | do..... | 2 | 5 | New Orleans. |
| Totten, Gen..... | 85 | 53 0 | 16 2 | 6 11 | Wood..... | 1 | 4 | New York (1st). |
| Tunica..... | 205 | 90 0 | 20 4 | 9 8 | Steel..... | 2 | 5 | New Orleans (M. R. C. 4th). |
| Tuscaloosa..... | 212 | 92 0 | 23 0 | 8 0 | Wood..... | 2 | 6 | Mobile. |
| Uacha..... | 43 | 62 0 | 12 0 | 7 5 | Iron..... | 2 | 3 | New Orleans. |
| Vidette..... | 124 | 110 0 | 14 9 | 7 7 | Wood..... | 2 | 5 | Duluth. |
| Vidette..... | 200 | 105 0 | 21 0 | 10 0 | Steel..... | 1 | 8 | Philadelphia. |
| Vigilant..... | 208 | 114 5 | 22 8 | 12 0 | do..... | 1 | 7 | New York (super. of N. Y. Harbor). |
| Visitor..... | 145 | 95 6 | 18 0 | 6 4 | do..... | 2 | 5 | Cleveland. |
| Warren, Gen..... | 75 | 72 2 | 17 0 | 5 0 | Wood..... | | | Washington, D. C. |
| West Neabish..... | 47 | 59 5 | 15 1 | 6 6 | do..... | 1 | 2 | Detroit. |
| Whitewater..... | 61 | 83 0 | 19 0 | 9 0 | Iron..... | 2 | 3 | Vicksburg (M. R. C. 3d). |
| Wilson..... | 100 | 96 0 | 19 6 | 11 0 | Steel..... | 3 | 9 | Seattle. |
| No. 1, U. S. L. S..... | 56 | 70 0 | 13 6 | 6 6 | Wood..... | 2 | 4 | Detroit (Lake Survey). |
| No. 2, U. S. L. S..... | 48 | 70 5 | 14 6 | 7 6 | do..... | 2 | 6 | Do. |

¹ Double crew.

² Sold to Quartermaster Corps, 1913.

TABLE 12.—TOW AND SURVEY BOATS, PADDLE (STEAM).

| Name, number, or letter, | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|-----------------------------|-------------------------|----------------|----------------|----------------|--------------------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | <i>Ft. in.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | | | | |
| Ada..... | 25 | 68 0 | 11 0 | 3 0 | Wood..... | 2 | 4 | Rock Island. |
| Alabama..... | 219 | 134 5 | 25 6 | 4 4 | do..... | 4 | 14 | Montgomery. |
| Alert..... | 135 | 115 0 | 19 6 | 3 10 | do..... | 2 | 9 | Rock Island. |
| Allen, A. D..... | 150 | 137 10 | 23 6 | 4 0 | do..... | 2 | 6 | Little Rock. |
| Arethusa..... | 92 | 110 0 | 22 0 | 4 4 | do..... | 2 | 5 | Kansas City. |
| Augustin, Lt..... | 191 | 136 0 | 25 6 | 5 0 | Steel..... | 2 | 7 | Do. |
| Aux Vasses..... | 50 | 70 0 | 18 0 | 3 6 | Wood..... | 1 | 4 | St. Louis. |
| Boone, Daniel..... | 86 | 117 6 | 22 7 | 4 0 | do..... | 2 | 7 | Kansas City, Mo. |
| Boose, Henry..... | 100 | 100 0 | 19 6 | 3 10 | do..... | 2 | 8 | Rock Island. |
| Brazos..... | 15 | 54 6 | 13 6 | 2 10 | do..... | | | Galveston. |
| Cahokia..... | 90 | 81 0 | 18 0 | 3 3 | do..... | 1 | 4 | St. Louis. |
| Cherokee..... | 278 | 147 2 | 27 4 | 4 8 | Steel..... | 2 | 7 | Louisville. |
| Chilowee..... | 104 | 100 0 | 19 0 | 3 6 | Wood..... | 1 | 5 | Chattanooga. |
| Chisca..... | 450 | 185 6 | 30 3 | 5 0 | do..... | 4 | 13 | Memphis (M. R. C. 1st and 2d). |
| Choctaw..... | 560 | 171 6 | 36 0 | 5 6 | Steel..... | 2 | 12 | St. Louis (M. R. C.). |
| Cinque Hommes..... | 90 | 81 0 | 18 0 | 3 3 | Wood..... | 1 | 4 | Do. |
| Coal Bluff..... | 230 | 128 0 | 25 0 | 4 6 | do..... | 2 | 9 | Rock Island. |
| Colbert..... | 185 | 158 0 | 25 6 | 4 6 | do..... | 1 | 9 | Chattanooga. |
| Columbus..... | 231 | 154 0 | 28 0 | 4 0 | do..... | 3 | 21 | Montgomery. |
| Control..... | 232 | 157 0 | 26 6 | 4 8 | do..... | 4 | 10 | Vicksburg (M. R. C. 3d). |
| Coppee, H. St. L..... | 350 | 166 0 | 30 0 | 6 0 | Steel..... | 8 | 18 | Do. |
| Craighill, Gen..... | 198 | 133 9 | 28 0 | 4 3 | do..... | 2 | 5 | Wheeling. |
| Cumberland..... | 189 | 132 0 | 27 0 | 4 0 | Wood..... | 1 | 5 | Nashville. |
| E. A. W..... | 16 | 30 0 | 9 6 | 2 6 | Steel..... | | | Cincinnati (1st). |
| Ellenor..... | 213 | 125 0 | 25 0 | 4 0 | Wood..... | 2 | 12 | Rock Island. |
| Ellen..... | 200 | 124 0 | 26 6 | 4 5 | do..... | 1 | 7 | Do. |
| Elsie..... | 40 | 67 0 | 13 0 | 3 0 | Steel..... | 2 | 5 | Do. |
| Emerald..... | 28 | 77 2 | 12 0 | 3 3 | Wood..... | 1 | 3 | Louisville. |
| Emily..... | 25 | 67 0 | 12 0 | 3 0 | do..... | 2 | 3 | Rock Island. |
| Ewens, John..... | 162 | 136 6 | 21 0 | 4 10 | Steel..... | 3 | 12 | St. Louis (M. R. C.). |
| Fox..... | 128 | 107 8 | 18 4 | 5 0 | Wood..... | 3 | 4 | Milwaukee. |
| Fox..... | 19 | 66 6 | 12 3 | 3 0 | do..... | 2 | 3 | Chicago. |
| Fury..... | 110 | 113 0 | 22 0 | 3 10 | do..... | 2 | 7 | Rock Island. |
| Grace..... | 38 | 79 0 | 17 0 | 3 11 | do..... | 2 | 3 | Do. |
| Graham..... | 138 | 134 2 | 21 0 | 3 0 | do..... | 3 | 7 | Memphis (M. R. C. 1st and 2d). |
| Gregory..... | 240 | 131 0 | 22 0 | 4 2 | do..... | 2 | 6 | Cincinnati (2d). |
| Gurney, Lt..... | 191 | 136 0 | 25 6 | 5 0 | Steel..... | 2 | 7 | Kansas City. |
| Guyandot..... | 229 | 157 11 | 31 7 | 4 3 | Steel and iron. | 1 | 8 | Cincinnati (1st). |
| Henry..... | 34 | 87 0 | 18 8 | 3 2 | Wood..... | 1 | 4 | Nashville. |
| Hider, Arthur..... | 350 | 163 0 | 30 0 | 6 0 | Steel..... | 8 | 18 | Vicksburg (M. R. C. 3d). |
| Hiwassee..... | 104 | 100 0 | 19 0 | 3 6 | Wood..... | 1 | 5 | Chattanooga. |
| Hyacinth..... | 75 | 102 6 | 18 0 | 2 6 | do..... | 2 | 6 | New Orleans. |
| Iroquois..... | 176.8 | 130 6 | 38 0 | 4 5 | Steel..... | 3 | 9 | Cincinnati (1st). |
| Isle de Bois..... | 50 | 70 0 | 18 0 | 3 3 | Wood..... | 1 | 4 | St. Louis. |
| Isaquena..... | 441 | 145 6 | 30 0 | 6 0 | Steel..... | 8 | 18 | Vicksburg (M. R. C. 3d). |
| Itasca..... | 80 | 94 0 | 15 0 | 5 0 | Iron..... | 2 | 2 | Memphis (M. R. C. 1st and 2d). |
| Joachim..... | 90 | 81 0 | 18 0 | 3 3 | Wood..... | 1 | 4 | St. Louis. |
| John..... | 34 | 87 0 | 18 8 | 3 2 | do..... | 1 | 4 | Nashville. |
| Jupiter..... | 120 | 99 0 | 20 0 | 4 6 | Steel..... | | | St. Louis (M. R. C.). |
| Kaskaskia..... | 150 | 100 0 | 24 0 | 4 3 | do..... | 1 | 4 | Do. |
| Keith, George G..... | 128 | 128 0 | 22 7 | 4 0 | Wood..... | 2 | 7 | Kansas City, Mo. |
| King, Col. W. R..... | 37 | 78 7 | 15 1 | 3 0 | do..... | 1 | 4 | Chattanooga. |
| King, Wm. R..... | 716 | 190 0 | 41 0 | 5 0 | Steel..... | 6 | 26 | St. Louis. |
| Lafourche..... | 300 | 136 0 | 27 10 | 5 6 | do..... | 3 | 9 | New Orleans (M. R. C. 4th). |
| Leota..... | 167 | 137 0 | 23 0 | 4 6 | Wood..... | 2 | 4 | Montgomery. |
| Leota..... | 500 | 171 6 | 36 0 | 5 6 | Steel..... | 2 | 12 | St. Louis (M. R. C.). |
| Lewis, Lt..... | 191 | 136 0 | 25 6 | 5 0 | do..... | 2 | 7 | Kansas City. |
| Loma..... | 31 | 96 0 | 16 1 | 4 7 | Wood..... | 2 | 4 | Wheeling. |
| Lookout..... | 180 | 135 0 | 26 0 | 4 4 | do..... | 1 | 7 | Chattanooga. |

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|--------------------------|-------------------------|----------------|----------------|----------------|--------------------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | <i>Tons.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | | | | |
| Louise..... | 25 | 61 0 | 12 0 | 3 2 | Steel..... | 2 | 3 | Rock Island. |
| Lucia..... | 25 | 68 0 | 12 8 | 3 0 | Wood..... | 1 | 4 | Do. |
| Mac..... | 35 | 73 0 | 16 0 | 2 3 | do..... | 2 | 3 | Do. |
| Marion..... | 54 | 80 0 | 18 0 | 3 0 | do..... | 2 | 4 | Do. |
| Mars..... | 83 | 80 0 | 17 0 | 3 9 | Steel..... | 1 | 6 | St. Louis (M. R. C.). |
| McPherson..... | 113 | 115 0 | 20 6 | 3 6 | Wood..... | 1 | 9 | Chattanooga. |
| Mercury..... | 83 | 80 0 | 17 6 | 3 9 | Steel..... | 1 | 6 | St. Louis (M. R. C.). |
| Meramec..... | 150 | 100 0 | 24 0 | 4 3 | do..... | 1 | 4 | Do. |
| Merrill..... | 163 | 115 0 | 22 0 | 3 0 | Wood..... | 1 | 7 | Cincinnati (2d). |
| Miami..... | 229 | 157 11 | 31 7 | 4 3 | Steel and iron. | 1 | 8 | Cincinnati (1st). |
| Minnetonka..... | 490 | 204 2 | 29 6 | 5 4 | Wood..... | 4 | 13 | Memphis (M. R. C. 1st and 2d). |
| Mississippi..... | 540 | 174 0 | 32 0 | 6 0 | Steel..... | 4 | 36 | St. Louis (M. R. C.). |
| Newton, Gen. J..... | 560 | 175 0 | 24 0 | 7 6 | do..... | 3 | 9 | New Orleans (M. R. C. 4th). |
| Nokomis..... | 500 | 171 6 | 36 0 | 5 6 | do..... | 6 | 23 | St. Louis (M. R. C.). |
| Nolty, Augustus J..... | 150 | 136 0 | 24 0 | 5 0 | do..... | 3 | 10 | Memphis (M. R. C. 1st and 2d). |
| Nugent..... | 191 | 141 3 | 24 6 | 4 3 | Wood..... | 3 | 10 | Mobile. |
| Osage..... | 39 | 68 8 | 15 1 | 3 2 | do..... | 2 | 2 | Kansas City. |
| Pearl..... | 40 | 85 1 | 18 0 | 4 0 | do..... | 2 | 4 | Chicago. |
| Plaquemine..... | 300 | 136 0 | 28 0 | 5 6 | Steel..... | 3 | 9 | New Orleans (M. R. C. 4th). |
| Rees, W. M..... | 150 | 136 0 | 24 0 | 5 0 | do..... | 3 | 10 | Memphis (M. R. C. 1st and 2d). |
| Roberts, T. P..... | 208 | 133 2 | 22 10 | 5 0 | Wood..... | 2 | 7 | Pittsburgh. |
| Ruth..... | 40 | 75 0 | 17 0 | 2 3 | do..... | 2 | 4 | Rock Island. |
| Sachem..... | 500 | 171 6 | 36 0 | 5 6 | Steel..... | 2 | 12 | St. Louis (M. R. C.). |
| Salvisi..... | 150 | 100 0 | 24 0 | 4 3 | do..... | 1 | 4 | Do. |
| Saturn..... | 120 | 99 0 | 20 0 | 4 6 | do..... | 1 | 10 | St. Louis (M. R. C.). |
| Scioto..... | 229 | 157 11 | 31 7 | 4 3 | Steel and iron. | 1 | 10 | Cincinnati (1st). |
| Search..... | 80 | 120 6 | 22 3 | 4 0 | Wood..... | 3 | 19 | St. Louis (M. R. C.). |
| Shawnee..... | 83 | 117 0 | 25 4 | 3 6 | do..... | 2 | 5 | Louisville. |
| Simpson, Gen. J. H..... | 525 | 170 0 | 32 0 | 5 0 | do..... | 6 | 23 | St. Louis. |
| Slackwater..... | 242 | 137 8 | 26 10 | 4 4 | do..... | 2 | 21 | Pittsburgh. |
| Teche..... | 90 | 100 0 | 20 4 | 5 0 | Steel..... | 3 | 9 | New Orleans (M. R. C. 4th). |
| Tensas..... | 78 | 93 6 | 20 4 | 4 6 | do..... | 2 | 5 | Do. |
| Tom Ray..... | 30 | 60 3 | 14 0 | 2 6 | Wood..... | 1 | 3 | Nashville. |
| Vega..... | 112 | 104 0 | 17 4 | 4 0 | do..... | 1 | 7 | Cincinnati (2d). |
| Venus..... | 83 | 93 0 | 17 0 | 3 9 | Steel..... | 1 | 6 | St. Louis (M. R. C.). |
| Vulcan..... | 83 | 93 0 | 17 0 | 3 9 | do..... | 1 | 6 | Do. |
| Wave Rock..... | 28 | 56 0 | 12 0 | 2 6 | Wood..... | 4 | 2 | Louisville. |
| Wolf..... | 114 | 89 0 | 19 0 | 4 6 | do..... | 3 | 2 | Milwaukee. |
| Wynoka..... | 560 | 171 6 | 36 0 | 5 6 | Steel..... | 2 | 12 | St. Louis (M. R. C.). |

TABLE 13.—STEAM LIGHTERS.

| | | | | | | | | |
|----------------|-----|-------|------|-----|-----------|---|---|-------------|
| Executive..... | 236 | 86 3 | 20 0 | 8 5 | Wood..... | 1 | 3 | Boston. |
| Fanuco..... | 287 | 107 0 | 28 0 | 8 9 | do..... | 2 | 6 | New London. |

TABLE 14.—GASOLINE LAUNCHES (SCREW).

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|-----------------------------|-------------------------|----------------|----------------|----------------|------------|------------------|------|--------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | <i>Tons.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | | | | |
| Albatross..... | 0.7 | 31 6 | 7 0 | 2 10 | Wood..... | | | Pittsburgh. |
| Alberita..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Amelia..... | 5 | 35 0 | 8 0 | 3 6 | do..... | | | Savannah. |
| Amite..... | 1.21 | 20 11 | 3 11 | 1 6 | do..... | | | New Orleans. |
| Ana..... | | 18 3 | 4 6 | 1 4 | do..... | | | Washington, D. C. |
| Arc..... | 1 | 16 0 | 4 5 | 2 0 | do..... | | | Duluth. |
| Ariel..... | 6 | 31 6 | 7 3 | 4 7 | do..... | | 1 | Cleveland. |
| Arrow..... | 2 | 31 0 | 7 0 | 4 0 | do..... | | 2 | Montgomery. |
| Auxvasse..... | 1 | 30 0 | 4 6 | 2 0 | do..... | | 1 | Kansas City, Mo. |
| Bar..... | 2 | 26 6 | 6 11 | 3 7 | do..... | 1 | 1 | Galveston. |
| Bass..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Bastrop..... | 16 | 46 6 | 11 6 | 5 0 | do..... | 1 | 1 | Galveston. |
| Beatrice..... | | 30 0 | 6 6 | 3 2 | do..... | | | New Orleans (M. R. C. 4th). |
| Beaumont..... | 32 | 58 2 | 13 7 | 8 5 | do..... | 1 | 2 | Dallas. |
| Beetle..... | | 26 0 | 5 1 | 1 5 | do..... | | | Rock Island. |
| Bell..... | | 16 4 | 4 4 | 1 8 | do..... | | | Washington, D. C. |
| Bertha S..... | 4.7 | 33 0 | 6 6 | 2 4 | do..... | | 1 | Grand Rapids. |
| Biloxi..... | 25 | 40 0 | 11 7 | 4 7 | do..... | 2 | 1 | Mobile. |
| Birch..... | 1.5 | 28 0 | 6 6 | 2 6 | Steel..... | | | St. Louis. |
| Bittern..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Black Rock..... | 1 | 25 0 | 7 3 | 4 3 | do..... | | 1 | Buffalo. |
| Boeuf..... | | 14 0 | 4 5 | 2 8 | Wood..... | | | New Orleans. |
| Bolivar..... | .9 | 25 0 | 5 0 | 1 11 | do..... | 1 | 1 | St. Louis (M. R. C.). |
| Bonne Femme..... | | 24 8 | 5 6 | 2 5 | Steel..... | | | Kansas City. |
| Bull Calf..... | 1 | 23 0 | 6 0 | 3 4 | Wood..... | | 1 | St. Paul. |
| Bully..... | 1 | 20 7 | 6 0 | 2 8 | do..... | 1 | 1 | Galveston. |
| Burton No. 1..... | .9 | 18 2 | 4 2 | 2 3 | do..... | | | Cleveland. |
| Caddo..... | 2.5 | 30 0 | 8 0 | 3 0 | do..... | | | Dallas. |
| Calumet..... | 2 | 22 0 | 5 0 | 1 4 | do..... | | | Chicago. |
| Catoma..... | 2 | 25 0 | 7 3 | 2 0 | do..... | | | Montgomery. |
| C. B. C..... | 2 | 20 4 | 6 0 | 3 0 | do..... | 1 | 1 | Galveston. |
| Cerritos..... | | 36 6 | 9 6 | 4 9 | do..... | | 1 | Los Angeles. |
| Charlton..... | 1 | 24 0 | 5 0 | 1 10 | do..... | | 1 | Kansas City, Mo. |
| Chica..... | .35 | 19 6 | 5 5 | 2 7 | do..... | | | Jacksonville. |
| Chico..... | .6 | 20 0 | 5 0 | 2 2 | Steel..... | | | Cincinnati (1st). |
| Chicot..... | 4.2 | 35 5 | 6 6 | 3 0 | do..... | | | Vicksburg (3d M. R. C.). |
| Chippewa..... | | 35 0 | 6 0 | 2 6 | Wood..... | | 1 | Rock Island. |
| Chord..... | 2 | 22 6 | 5 5 | 2 7 | do..... | | 1 | Duluth. |
| Clermont..... | .9 | 25 11 | 6 0 | 3 0 | do..... | | | Cincinnati (1st). |
| Clinch..... | 3.3 | 35 0 | 8 0 | 3 9 | do..... | | 1 | Chattanooga. |
| Clyde..... | 9 | 42 0 | 9 3 | 2 7 | do..... | | | San Francisco (1st). |
| Cobra..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Cockspur..... | 1.4 | 20 0 | 6 0 | 2 9 | do..... | | | Savannah. |
| Colonel..... | 31 | 66 8 | 12 6 | 5 6 | do..... | 2 | 2 | Galveston. |
| Columbia..... | 2.2 | 31 7 | 6 0 | 1 11 | do..... | | 1 | Charleston. |
| Comet..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Commodore..... | 1 | 23 4 | 6 0 | 3 2 | do..... | | | Galveston. |
| Coot..... | 1.5 | 21 0 | 4 7 | 2 0 | do..... | | | Montgomery. |
| Coot..... | | 20 0 | 5 9 | 1 8 | do..... | | | Rock Island. |
| Corvi..... | 2 | 18 0 | 4 10 | 2 4 | do..... | | 1 | Jacksonville. |
| Cosine..... | 4 | 25 0 | 6 6 | 2 6 | do..... | | | Savannah. |
| Coyote..... | 2 | 28 0 | 5 6 | 3 0 | do..... | | | Portland, Oreg. (1st). |
| Crane..... | | 20 0 | 5 9 | 1 8 | do..... | | | Rock Island. |
| Curlew..... | | 20 0 | 5 9 | 1 8 | do..... | | | Do. |
| Curve..... | 2 | 22 6 | 5 5 | 2 7 | do..... | | 1 | Duluth. |
| D'Armit..... | 4.3 | 35 0 | 8 3 | 4 6 | do..... | | | Jacksonville. |
| Dahlia..... | | 26 0 | 5 3 | 1 3 | Steel..... | | 1 | Cincinnati (1st). |
| Daisy..... | | 26 0 | 5 3 | 1 3 | do..... | | 1 | Do. |
| Dakota..... | 2 | 28 0 | 5 2 | 1 3 | Wood..... | | | Rock Island. |
| Dauphin..... | 58 | 80 4 | 17 1 | 4 6 | do..... | 3 | 3 | Mobile. |
| Davey..... | | 24 8 | 5 3 | 1 8 | do..... | | | Rock Island. |
| Dawho..... | 25 | 60 0 | 13 0 | 8 0 | do..... | 2 | 1 | Charleston. |
| Delafield..... | 8 | 39 6 | 9 6 | 6 6 | do..... | | 1 | New York (1st). |
| Delaware..... | 2 | 20 2 | 6 8 | 3 2 | do..... | | | Philadelphia. |
| De Soto..... | 14 | 57 6 | 10 7 | 5 1 | do..... | 2 | 3 | Jacksonville. |
| Dolly..... | 2.5 | 25 2 | 5 10 | 2 6 | do..... | | | Portland, Oreg. (2d). |
| Dolly..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Dolphin..... | 4 | 28 0 | 4 6 | 2 4 | Steel..... | 1 | 1 | Do. |
| Don..... | 9 | 41 9 | 9 7 | 3 6 | Wood..... | 1 | 1 | Detroit. |
| Dorothy..... | 1.5 | 22 2 | 6 11 | 1 4 | do..... | | | Philadelphia. |

| Name, number, or letter. | Displacement. | Dimensions. | | | Material. | Complement. | | District. |
|--------------------------|---------------|-------------|----------|---------|---------------------|-------------|------|------------------------|
| | | Length. | Breadth. | Depth. | | Officers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| Du Brie..... | 1.9 | 28 6 | 5 0 | 3 8 | Wood..... | | 1 | Louisville. |
| Echo River..... | ■ | 39 9 | 7 5 | 3 2 | do..... | | 1 | Do. |
| Ellis..... | 7.5 | 33 0 | 9 2 | 3 1 | do..... | | 1 | New London. |
| Engineer..... | 10 | 37 6 | 7 8 | 3 0 | do..... | | | Grand Rapids. |
| Engineer..... | ■ | 30 0 | 6 6 | 2 8 | do..... | | 1 | Washington Bar- |
| | | | | | | | | racks, D. C. |
| Engineer, U. S..... | 6.3 | 30 0 | 6 5 | 2 2 | do..... | | 1 | Newport. |
| Enif..... | 7 | 30 0 | 7 6 | 4 6 | do..... | | 1 | Jacksonville. |
| Enquirer..... | | 30 4 | 7 0 | 3 0 | do..... | | | Kansas City. |
| Etowah..... | 2 | 25 6 | 6 6 | 2 10 | do..... | | | Montgomery. |
| Eudora..... | 1 | 20 0 | 5 0 | 1 6 | Galvanized iron. | | 1 | Nashville. |
| Eufaula..... | .8 | 27 6 | 7 3 | 2 4 | Wood..... | | | Montgomery. |
| Eureka..... | 1.8 | 30 2 | 7 8 | 3 2 | do..... | | 1 | Dallas. |
| Eureka..... | 3 | 25 0 | 8 6 | 3 3 | do..... | | | Portland, Oreg. (2d). |
| Faber..... | 10 | 42 0 | 10 0 | 4 0 | do..... | | 3 | Wilmington, N. C. |
| Firefly..... | | 26 0 | 5 1 | 1 5 | do..... | | | Rock Island. |
| Folly..... | | 26 0 | 5 3 | 1 3 | do..... | | | Do. |
| Fox..... | | 26 0 | 5 3 | 1 3 | do..... | | | Do. |
| Frances..... | 7 | 43 0 | 7 10 | 3 0 | do..... | | 2 | Wilmington, N. C. |
| Freak..... | 2.5 | 27 0 | 8 0 | 3 0 | do..... | | 1 | Jacksonville. |
| Fuchsia..... | | 26 0 | 5 3 | 1 3 | Steel..... | | 1 | Cincinnati (1st). |
| "G"..... | 1.5 | 25 7 | 8 2 | 3 6 | Wood..... | | 1 | Galveston. |
| Galena..... | | 35 0 | 6 0 | 2 6 | Steel..... | | 1 | Cincinnati (1st). |
| Ganawanda..... | 4 | 32 0 | 5 6 | 2 6 | Wood..... | | 1 | New York (1st). |
| Gannet..... | 20 | 72 0 | 12 6 | 5 2 | do..... | | 1 | Wilmington, Del. |
| Gar..... | | 26 0 | 5 3 | 1 3 | do..... | | 3 | Rock Island. |
| Gazelle..... | 73 | 66 5 | 18 2 | 10 7 | do..... | | 1 | Newport. |
| Gladwin No. 1..... | | 20 0 | 4 7 | 2 3 | do..... | (1) | (1) | Detroit. |
| Gladwin No. 2..... | | 15 4 | 4 5 | 1 9 | do..... | (1) | (1) | Do. |
| Gnat..... | | 26 0 | 5 1 | 1 5 | do..... | | | Rock Island. |
| Grey Cloud..... | 2 | 58 0 | 5 2 | 1 3 | do..... | | 1 | Do. |
| Gull..... | | 20 0 | 5 9 | 1 8 | do..... | | | Do. |
| Hancock No. 1..... | 1.5 | 15 6 | 4 6 | 2 0 | do..... | | | Detroit (Lake Sur- |
| | | | | | | | | vey). |
| Harpeth..... | 1.75 | 26 0 | 6 0 | 2 2 | Steel..... | | | Nashville. |
| Helen..... | 33 | 56 0 | 12 4 | 5 9 | Wood..... | | 1 | Galveston. |
| Heron..... | 11 | 36 0 | 9 6 | 4 5 | do..... | | 1 | Milwaukee. |
| Hiawatha..... | | 35 0 | 6 0 | 2 6 | do..... | | | Rock Island. |
| Hill..... | 6.9 | 31 5 | 7 7 | 2 6 | do..... | | 1 | Galveston. |
| Hinda..... | 1.8 | 28 0 | 7 6 | 4 3 1/2 | do..... | | 2 | Wilmington, Del. |
| Holly..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Hornet..... | | 26 0 | 5 3 | 1 3 | do..... | | | Do. |
| Hydrog..... | 1 | 24 10 | 5 7 | 1 6 | do..... | | | St. Louis (M. R. C.). |
| Ingalls, Gen..... | 8 | 43 0 | 8 4 | 4 9 | do..... | | 2 | New York (2d). |
| Inc..... | 1 | 22 0 | 6 8 | 2 6 | do..... | | 1 | Dallas. |
| Inspector..... | 6 | 31 0 | 6 6 | 4 6 | do..... | | 1 | Cleveland. |
| Inspector..... | 26 | 50 3 | 8 9 | 4 8 | Steel..... | | 2 | Detroit (Lake Sur- |
| | | | | | | | | vey). |
| Jefferson..... | 2 | 30 7 | 7 0 | 5 6 | Wood..... | | | Dallas. |
| Jennie..... | 5 | 30 0 | 8 0 | 3 2 | do..... | | | Portland, Oreg. (1st). |
| Jolly..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Jordan..... | 8.5 | 32 4 | 9 8 | 3 2 | do..... | | 1 | Mobile. |
| Juanita..... | 1 | 22 0 | 6 0 | 2 2 | do..... | | 1 | Dallas. |
| Katherine..... | 2 | 30 5 | 7 11 | 3 11 | do..... | | | New London. |
| Kingfisher..... | 10 | 41 1 | 11 0 | 4 0 | do..... | | 2 | Milwaukee. |
| Krey, John..... | 7 | 35 5 | 8 0 | 5 0 | do..... | | | Wilmington, N. C. |
| Lad..... | | 23 0 | 6 6 | 2 0 | do..... | | | Detroit. |
| Lamine..... | .5 | 20 0 | 4 9 | 1 11 | do..... | | 1 | Kansas City, Mo. |
| Lark..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Laura..... | 6 | 40 9 | 6 7 | 4 2 | Steel..... | | 2 | Louisville. |
| Leach, Col..... | 5.32 | 36 4 | 10 6 | 4 3 | Wood..... | | | Washington, D. C. |
| Leaf..... | 4.5 | 32 0 | 7 6 | 4 0 | do..... | | 1 | Mobile. |
| Liberty..... | 2 | 26 0 | 7 0 | 2 10 | do..... | | 1 | Dallas. |
| Little Blue..... | 1 | 24 0 | 5 0 | 1 10 | do..... | | 1 | Kansas City, Mo. |
| Locust..... | | 26 0 | 5 1 | 1 5 | do..... | | | Rock Island. |
| Long, J. C..... | 12 | 42 0 | 8 5 | 3 7 | Steel..... | | 2 | Cincinnati (1st). |
| Long Point..... | 11 | 38 0 | 9 6 | 4 0 | Wood..... | | 2 | Norfolk. |
| Lookout..... | 3 | 30 0 | 6 6 | 3 9 | do..... | | | New York (super. of |
| | | | | | | | | N. Y. Harbor). |
| Loon..... | | 26 0 | 6 0 | 1 6 | do..... | | | Rock Island. |
| Louise..... | 13 | 40 0 | 10 0 | 5 0 | do..... | | 1 | Charleston. |
| Ludington..... | 1.47 | 22 4 | 5 0 | 2 4 | do..... | | | Grand Rapids. |
| Lunette..... | 3 | 20 0 | 5 6 | 3 6 | do..... | | 1 | Jacksonville. |
| Luzon..... | 12 | 53 0 | 9 4 | 4 9 | do..... | | 1 | Pittsburgh. |
| Mal..... | .95 | 18 0 | 5 10 | 2 5 | do..... | | | Jacksonville. |
| Mallard..... | 8 | 35 0 | 9 0 | 4 2 | do..... | | 1 | Milwaukee. |
| Madge..... | 4 | 25 0 | 6 0 | 3 0 | do..... | | | Rock Island. |
| Maguire, Capt..... | 49 | 67 0 | 17 7 | 4 2 | do..... | | 2 | Jacksonville. |

| Name, number, or letter. | Displacement. | Dimensions. | | | Material. | Comple- | | District. |
|--------------------------|---------------|-------------|----------|---------|-----------|----------------|------|--------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| Mamie K. | 2 | 25 0 | 6 0 | 2 7 | Wood | 1 | | Mobile. |
| Mansker | .5 | 20 0 | 5 0 | 2 0 | do. | | 1 | Nashville. |
| Margaretta. | 3 | 21 0 | 5 6 | 2 6 | do. | | | Portland, Oreg. (1st). |
| Marie. | | 29 0 | 8 0 | 4 0 | do. | | | New York (1st). |
| M. C. | | 16 0 | 4 0 | 1 10 | do. | | | Chicago. |
| Meyler, Capt. J. J. | 44 | 70 6 | 15 0 | 7 8 | do. | 2 | 3 | Jacksonville. |
| Mignon. | .5 | 18 4 | 5 2 | 2 1 | Steel | | | Cincinnati (1st). |
| Millville | 1 | 22 6 | 6 6 | 2 6 | Wood. | | 1 | Norfolk. |
| Minnehaha. | | 35 0 | 6 0 | 2 6 | do. | | | Rock Island. |
| Minneiska | | 35 0 | 6 0 | 2 6 | do. | | 1 | Do. |
| Mohawk | 5.5 | 35 0 | 8 6 | 3 9 | do. | | | Portland, Oreg. (2d). |
| Molly. | | 26 0 | 5 3 | 1 3 | do. | | | Rock Island. |
| Moniteau. | 1 | 24 0 | 5 0 | 1 10 | do. | | | Kansas City, Mo. |
| Monomoy. | 65 | 82 9 | 15 6 | 9 6 | do. | 2 | 3 | Newport. |
| Monroe. | 4 | 40 0 | 8 6 | 4 0 | do. | | 2 | Wheeling. |
| Moreau. | | 20 0 | 5 1 | 2 1 | Steel | | | Kansas City. |
| Mosquito. | | 26 0 | 5 1 | 1 5 | Wood. | | | Rock Island. |
| Moth. | | 26 0 | 5 1 | 1 5 | do. | | | Do. |
| M. R. C-1. | | 19 6 | 4 10 | 1 3 | do. | | 1 | St. Louis (M. R. C.). |
| M. R. C-2. | | 19 6 | 4 10 | 1 3 | do. | | | Do. |
| Mulberry. | 2.62 | 35 0 | 6 10 | 3 10 | do. | 1 | 1 | Mobile. |
| Munden. | 1 | 22 6 | 6 6 | 2 6 | do. | | 1 | Norfolk. |
| Murrelet. | 2.5 | 24 0 | 6 5 | 5 6 | do. | | | Portland, Oreg. (1st). |
| Muskkrat. | 1 | 19 3 | 5 2 | 1 7½ | do. | | 1 | St. Paul. |
| Myra. | 10 | 40 0 | 7 4 | 3 6 | do. | | | Rock Island. |
| Nancy. | 7.75 | 30 0 | 6 5 | 2 0 | do. | | 2 | Wilmington, N. C. |
| Nanina. | 5 | 42 4 | 7 5 | 3 11 | do. | | 2 | Wheeling. |
| Neches. | 1.1 | 26 0 | 6 0 | 2 4 | Steel | | 1 | Dallas. |
| Nell. | 1.5 | 25 0 | 5 6 | 2 3 | Wood. | | | Cincinnati (1st). |
| Nemadji. | 20 | 60 9 | 12 0 | 6 2 | do. | 2 | 1 | Duluth. |
| Neptune. | 3.3 | 32 0 | 5 4 | 3 6 | do. | | 1 | New Orleans (4th M. R. C.). |
| New Castle. | 1.5 | 23 0 | 7 0 | 2 8 | do. | | | Philadelphia. |
| Nola. | 8.5 | 35 0 | 7 5 | 4 6 | do. | | 1 | Honolulu. |
| Norka. | 22 | 62 0 | 14 0 | 6 1 | do. | 1 | 1 | Portland, Me. |
| Norva. | 6.5 | 36 10 | 10 6 | 4 3 | do. | 2 | | Norfolk. |
| Obion. | .9 | 25 0 | 5 0 | 1 11 | do. | 1 | 1 | St. Louis (M. R. C.). |
| Ocia. | 2 | 30 0 | 5 0 | 3 0 | do. | | | Portland, Oreg. (1st). |
| Olive. | 5 | 34 0 | 8 0 | 3 2 | do. | | 1 | Wilmington, N. C. |
| Ontario. | | 27 0 | 6 3 | 4 0 | do. | | 1 | Buffalo. |
| Oostenaula. | .2 | 25 0 | 6 0 | 3 2 | do. | | | Montgomery. |
| Opelika. | 37 | 60 6 | 12 6 | 5 3 | do. | 2 | 1 | Memphis (M. R. C. 1st and 2d). |
| Orcas. | 45 | 70 6 | 14 0 | 3 7 | do. | 2 | 2 | Seattle. |
| Otter. | 2 | 28 0 | 5 2 | 1 3 | do. | | 1 | Rock Island. |
| Quachita. | 17 | 65 6 | 10 5 | 4 0 | Steel | 2 | 2 | Vicksburg. |
| Palouse. | 2 | 32 0 | 4 4 | 2 8 | Wood. | | | Portland, Oreg. (1st). |
| Pansy. | | 26 0 | 5 3 | 1 3 | do. | | 1 | Rock Island. |
| Pathfinder. | 10 | 38 0 | 9 6 | 6 5 | do. | | 2 | Baltimore. |
| Papoose. | 6 | 30 3 | 8 0 | 4 0 | do. | | | Portland, Oreg. (2d). |
| Paquippe. | 65 | 82 9 | 15 6 | 9 6 | do. | 2 | 3 | Norfolk. |
| Pearl. | 5 | 40 0 | 7 6 | 4 0 | do. | | 2 | Cincinnati (2d). |
| Pedrito. | 2.2 | 30 0 | 7 0 | 3 4 | do. | | 1 | Los Angeles. |
| Peony. | | 26 0 | 5 3 | 1 3 | do. | | 1 | Rock Island. |
| Pequot. | 2.5 | 28 3 | 7 4 | 4 6 | do. | | 1 | New London. |
| Perch. | | 26 0 | 5 3 | 1 3 | do. | | | Rock Island. |
| Phoenix, John | 1.4 | 28 0 | 5 0 | 2 3 | do. | | 1 | Louisville. |
| Pink. | | 26 0 | 5 3 | 1 3 | do. | | 1 | Rock Island. |
| Pioneer. | 6 | 35 0 | 8 6 | 4 0 | do. | | 1 | Cincinnati (2d). |
| Pipin. | 2 | 28 0 | 5 2 | 1 3 | do. | | 1 | Rock Island. |
| Plébe. | 19 | 56 0 | 9 0 | 5 0 | do. | 1 | 1 | Boston. |
| Plover. | | 20 0 | 5 9 | 1 8 | do. | | | Rock Island. |
| Polly. | | 26 0 | 5 3 | 1 3 | Steel | | | Do. |
| Polly. | 2 | 16 0 | 4 6 | 2 6 | do. | | 1 | Wilmington, N. C. |
| Powhatan. | 6.4 | 40 2 | 9 9 | 4 3 | do. | | | Norfolk. |
| Primary. | 1.3 | 11 5 | 5 0 | 2 0 | Wood. | | | Montgomery. |
| Pulaski. | 2 | 22 0 | 7 0 | 3 0 | do. | | | Savannah. |
| Quincy. | | 35 0 | 6 0 | 2 6 | do. | | | Rock Island. |
| Racket. | 1 | 22 6 | 4 7 | 1 7 | do. | | 1 | Kansas City, Mo. |
| Reles. | 5.3 | 30 0 | 7 6 | 3 1 | Steel | | | Washington, D. C. |
| Rio Vista. | 45.5 | 60 0 | 16 0 | 7 0 | Wood. | | 2 | San Francisco (3d). |
| Robert J. | 1 | 24 0 | 4 6 | 2 0 | do. | | 1 | Wilmington, N. C. |
| Rock Island Rapids. | 4 | 22 0 | 4 0 | 2 0 | Steel | | | Rock Island. |
| Rocks. | 5 | 26 0 | 7 3 | 4 0 | Wood. | | | Wilmington, N. C. |
| Rose. | | 26 0 | 6 0 | 1 8 | do. | | | Rock Island. |
| Salem. | 6.5 | 35 0 | 9 0 | 3 3 | Steel | 1 | | Portland, Oreg. (2d). |
| Sally. | | 26 0 | 5 3 | 1 3 | do. | | | Rock Island. |
| Salvador. | 13.8 | 41 0 | 9 6 | 4 0 | do. | | | New Orleans. |
| Santa Rosa. | 04 | 70 0 | 16 0 | 8 0 | do. | 1 | 4 | Montgomery. |
| Scojaquada. | 65 | 82 9 | 15 6 | 9 6 | Wood. | 2 | 3 | Buffalo. |
| Schuykill. | 16 | 54 0 | 12 0 | 5 3 | Steel. | 2 | 1 | Philadelphia. |

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|---------------------------------------|-------------------------|----------------|----------------|----------------|------------|------------------|------|-----------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | <i>Tons.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | | | | |
| Schuyler..... | 1.2 | 25 0 | 5 8 | 1 10 | Steel..... | | | New York (2d). |
| Scorpion..... | 1.5 | 23 0 | 7 0 | 4 0 | do..... | | | Philadelphia. |
| Scorpion..... | | 28 0 | 4 6 | 2 4 | Wood..... | | 1 | Rock Island. |
| Seminole..... | 8 | 36 4 | 10 6 | 5 10 | do..... | | 1 | Chicago. |
| Seneca..... | 7.3 | 40 0 | 8 0 | 2 9 | do..... | | | Savannah. |
| Sergeant Burke..... | 5 | 35 0 | 8 6 | 3 6 | do..... | | 1 | Wheeling. |
| Sextant..... | 2 | 27 0 | 6 0 | 4 0 | Steel..... | | 1 | Dallas. |
| Shad..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Shearwater..... | 4 | 40 0 | 8 0 | 6 0 | Wood..... | | 4 | Montgomery. |
| Sioux..... | 1 | 24 0 | 5 0 | 1 10 | do..... | | 1 | Kansas City, Mo. |
| Sisters, The..... | .5 | 25 0 | 4 4 | 3 0 | do..... | | | Cincinnati (1st). |
| Snapshot..... | 1 | 18 0 | 6 0 | 3 6 | do..... | 1 | 1 | Galveston. |
| Sirius..... | 5 | 32 0 | 8 0 | 3 0 | do..... | | 1 | Jacksonville. |
| Snipe..... | | 20 0 | 6 4 | 2 0 | do..... | | | Rock Island. |
| Sparrow..... | | 20 0 | 5 10 | 1 7 | do..... | | | Do. |
| Spray..... | 12.5 | 45 6 | 11 0 | 7 6 | do..... | | | Savannah. |
| Spry..... | 1 | 20 0 | 6 0 | 3 6 | do..... | 1 | 1 | Galveston. |
| Spry..... | 2 | 18 6 | 5 4 | 3 8 | do..... | | 1 | Wilmington, N. C. |
| Stadia..... | 5 | 30 3 | 6 5 | 2 9 | do..... | | | New Orleans. |
| Starvation..... | 1 | 22 6 | 6 6 | 2 6 | do..... | | 1 | Norfolk. |
| Stewart..... | 1.5 | 28 0 | 6 6 | 2 6 | Steel..... | | | St. Louis. |
| Sulphur..... | 2.5 | 30 0 | 8 0 | 3 0 | Wood..... | | 1 | Dallas. |
| Swallow..... | | 20 0 | 5 10 | 1 7 | do..... | | | Rock Island. |
| Swift..... | | 20 0 | 5 10 | 1 7 | do..... | | | Do. |
| Tarpon..... | 2 | 28 6 | 7 0 | 3 1 | do..... | 1 | 1 | Galveston. |
| Thom, Gen. Geo..... | 24 | 73 0 | 12 5 | 4 6 | do..... | | | Wilmington. |
| Tilly..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Tocoi..... | .24 | 16 10 | 4 1 | 1 9 | Steel..... | | | Jacksonville. |
| Trenton..... | 4.5 | 28 0 | 8 0 | 3 8 | Wood..... | | | Philadelphia. |
| Trimbelle..... | | 35 0 | 6 0 | 2 6 | do..... | | 1 | Wilmington, N. C. |
| Trout..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Vamos..... | 5 | 31 0 | 7 0 | 2 2 | do..... | | | Do. |
| Vermilion..... | 1.75 | 20 1 | 4 11 | 2 4 | do..... | | | New Orleans. |
| Vernon..... | 1 | 15 0 | 4 0 | 2 3 | do..... | | | Montgomery. |
| Victoria..... | 3 | 27 0 | 7 0 | 3 4 | do..... | 1 | 1 | Galveston. |
| Vigilant..... | 22 | 63 5 | 12 0 | 7 6 | do..... | 1 | 1 | Portland, Oreg. (2d). |
| Violet..... | | 26 0 | 5 3 | 1 3 | do..... | | 1 | Wilmington, N. C. |
| Violetta..... | 8 | 31 0 | 11 4 | 4 4 | do..... | | 1 | Jacksonville. |
| Viper..... | | 28 0 | 4 6 | 2 6 | do..... | | | Rock Island. |
| "W"..... | | 16 4 | 4 8 | 0 10 | do..... | | | New York (1st). |
| Wacouta..... | 2 | 26 0 | 5 3 | 1 3 | do..... | | 1 | Rock Island. |
| Wah-ta-wah..... | 36 | 80 0 | 15 0 | 5 2 | do..... | 2 | 2 | New York (1st). |
| Wakenda..... | 1 | 24 0 | 5 0 | 1 10 | do..... | | 1 | Kansas City, Mo. |
| Waumandee..... | | 30 6 | 5 9 | 3 0 | do..... | | 1 | Wilmington, N. C. |
| Wasp..... | | 22 0 | 5 0 | 0 8 | do..... | | | Rock Island. |
| Wekiva..... | .5 | 18 0 | 5 6 | 2 1 | do..... | | 1 | Jacksonville. |
| Welaka..... | .5 | 20 0 | 5 6 | 2 2 | do..... | | 1 | Do. |
| Wild Horse..... | 1 | 24 0 | 5 0 | 1 10 | do..... | | 1 | Kansas City, Mo. |
| Wolf..... | 18 | 36 8 | 10 0 | 3 6 | do..... | 1 | 1 | Mobile. |
| Wren..... | | 26 0 | 5 3 | 1 3 | do..... | | | Rock Island. |
| Yawl..... | | 26 0 | 5 3 | 1 3 | do..... | | | Do. |
| Zumbro..... | | 35 0 | 6 0 | 2 6 | do..... | | 1 | Wilmington, N. C. |
| No. 1..... | 1 | 25 0 | 5 6 | 4 0 | do..... | | | Detroit. |
| No. 1..... | | 14 0 | 4 0 | 2 6 | do..... | | | Wilmington, Del. |
| No. 1, Inspector..... | 3 | 25 0 | 4 6 | 2 6 | Steel..... | | | Little Rock. |
| No. 2..... | 2 | 20 0 | 5 3 | 3 0 | do..... | | 1 | Chattanooga. |
| No. 3..... | 3 | 22 0 | 6 3 | 3 2 | Wood..... | | 1 | Do. |
| No. 3, U. S. L. S..... | 2.6 | 22 3 | 6 3 | 3 2 | do..... | | | Detroit (Lake Sur- vey). |
| No. 4..... | 6 | 23 0 | 6 6 | 3 6 | do..... | | 1 | Chattanooga. |
| No. 4, M. R. C..... | .81 | 20 0 | 4 10 | 1 3 | do..... | | 1 | St. Louis (M. R. C.). |
| No. 4, U. S. L. S..... | 10 | 38 6 | 4 6 | 4 2 | do..... | | | Detroit (Lake Sur- vey). |
| No. 5..... | | 19 2 | 4 3 | 2 7 | do..... | | | Chattanooga. |
| No. 5, U. S. L. S..... | 10 | 36 1 | 9 0 | 4 0 | do..... | | | Detroit (Lake Sur- vey). |
| No. 6..... | 4 | 23 0 | 6 0 | 4 6 | do..... | | 1 | Chattanooga. |
| No. 6, U. S. L. S..... | 10 | 36 0 | 9 0 | 4 0 | do..... | | | Detroit (Lake Sur- vey). |
| No. 7..... | 3 | 27 6 | 4 0 | 3 8 | do..... | | 1 | Chattanooga. |
| No. 8, U. S. L. S..... | 2.4 | 23 3 | 6 6 | 3 3 | do..... | | | Detroit (Lake Sur- vey). |
| No. 26..... | 90 | 80 0 | 37 0 | 4 0 | do..... | | | Mobile. |
| No. 32..... | | 28 0 | 4 6 | 2 4 | do..... | | | Rock Island. |
| No. 33, U. S. E. D., Wheeling..... | .67 | 22 0 | 5 10 | 1 10 | do..... | | | Wheeling. |
| No. 34, U. S. E. D., Wheeling..... | .67 | 22 0 | 5 10 | 1 10 | do..... | | | Do. |
| No name..... | | 28 0 | 6 6 | 3 0 | Steel..... | | | St. Louis. |
| No name..... | | 28 0 | 6 6 | 3 0 | do..... | | | Do. |

TABLE 15.—GASOLINE TOWBOATS (PADDLE).

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|-----------------------------|-------------------------|-------------|----------|---------|------------|------------------|------|-------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| Comet..... | 21 | 69 0 | 16 0 | 2 4 | Wood..... | 2 | | Cincinnati (1st). |
| Coosa..... | 123 | 95 0 | 18 0 | 4 9 | do..... | 6 | | Montgomery. |
| Gasconade..... | 11 | 59 2 | 12 6 | 2 6 | do..... | 3 | | Kansas City. |
| Glenville..... | 30 | 53 6 | 9 0 | 3 0 | Steel..... | | | Wheeling. |
| Katherine..... | 55 | 86 4 | 22 0 | 3 0 | Wood..... | 2 | 14 | Kansas City. |
| Leona..... | 10 | 46 0 | 10 0 | 3 0 | do..... | | 2 | Rock Island. |
| Niota..... | 25 | 70 0 | 13 9 | 3 0 | do..... | | 8 | Chattanooga. |
| Richland..... | 78.7 | 103 6 | 20 6 | 4 7 | do..... | | | Charleston, S. C. |
| Sylph..... | 38 | 84 6 | 16 5 | 2 9 | do..... | 1 | 2 | Mobile. |
| White Oak..... | 75 | 104 0 | 18 0 | 3 6 | do..... | | 7 | Chattanooga. |
| No. 1..... | 52 | 96 0 | 15 0 | 2 8 | do..... | | 2 | Nashville. |

TABLE 16.—QUARTER BOATS.

| A..... | 40 | 72 0 | 20 0 | 2 6 | Wood..... | 11 | | Kansas City. |
|-------------------|------|-------|------|-----|-----------|----|-----|-----------------------------|
| A..... | 34 | 45 0 | 24 0 | 5 0 | do..... | 6 | 28 | Mobile. |
| B..... | 46 | 72 0 | 20 0 | 2 6 | do..... | | 20 | Kansas City. |
| B..... | 34 | 60 0 | 20 0 | 3 4 | do..... | 3 | 21 | Mobile. |
| Baton Rouge..... | 198 | 140 0 | 30 4 | 4 0 | do..... | 10 | 180 | New Orleans (M. R. C. 4th). |
| Bayou Goula..... | 198 | 140 0 | 30 4 | 4 0 | do..... | 10 | 180 | Do. |
| Bayou Sara..... | 198 | 140 0 | 30 4 | 4 0 | do..... | 10 | 180 | Do. |
| Beaufort..... | 15 | 50 0 | 18 3 | 2 8 | do..... | | 11 | Wilmington, N. C. |
| Chester..... | 90 | 60 0 | 25 0 | 5 8 | do..... | 3 | 15 | Philadelphia. |
| Coinjock..... | 72.7 | 80 0 | 22 0 | 4 3 | do..... | 5 | 21 | Norfolk. |
| C-1..... | 37 | 70 0 | 20 0 | 3 7 | do..... | | 28 | Grand Rapids. |
| No. 2..... | 30 | 65 0 | 14 0 | 2 6 | do..... | | 10 | Nashville. |
| No. 3..... | 16 | 60 0 | 14 0 | 2 6 | do..... | | 12 | Do. |
| D..... | 83 | 75 0 | 25 0 | 5 9 | do..... | 5 | 20 | Mobile. |
| Hay Lake..... | 106 | 70 0 | 22 0 | 4 4 | do..... | | | Detroit. |
| Intercoastal..... | | 65 6 | 22 6 | 4 5 | do..... | | | New Orleans. |
| Lake Borgne..... | 68 | 80 0 | 22 0 | 4 4 | do..... | 3 | 16 | New Orleans (M. R. C. 4th). |
| Margaret..... | 30 | 100 0 | 26 0 | 4 3 | do..... | | | Chicago. |
| N..... | 65 | 75 6 | 22 6 | 5 2 | do..... | | 21 | Mobile. |
| Natchez..... | 198 | 140 0 | 30 0 | 4 0 | do..... | 10 | 180 | New Orleans (M. R. C. 4th). |
| New Orleans..... | 237 | 166 0 | 30 0 | 4 3 | do..... | 10 | 180 | New Orleans. |
| O..... | 65 | 75 6 | 22 6 | 5 2 | do..... | | 20 | Mobile. |
| Observer..... | 25 | 50 0 | 20 0 | 5 0 | do..... | | 1 | Philadelphia. |
| Oiga..... | 68 | 80 0 | 22 0 | 4 4 | do..... | 4 | 8 | New Orleans (M. R. C. 4th). |
| Port Arthur..... | 84 | 60 0 | 28 0 | 6 0 | do..... | | 36 | Dallas. |
| Port Hudson..... | 68 | 80 0 | 22 0 | 4 4 | do..... | 2 | 6 | New Orleans (M. R. C. 4th). |
| Pungo..... | 72.7 | 80 0 | 22 0 | 4 3 | do..... | 5 | 21 | Norfolk. |
| Skidaway..... | 27 | 51 6 | 11 0 | 4 0 | do..... | | | Savannah. |
| St. Joseph..... | 198 | 140 0 | 30 4 | 4 0 | do..... | 10 | 180 | New Orleans (M. R. C. 4th). |
| Sunshine..... | 12 | 47 6 | 11 6 | 3 0 | do..... | | 8 | Wilmington, N. C. |
| Thronateeska..... | 96 | 75 0 | 26 0 | 4 7 | do..... | | 24 | Montgomery. |
| Torres..... | 68 | 80 0 | 22 0 | 4 4 | do..... | 2 | 6 | New Orleans (M. R. C. 4th). |
| Z..... | 72 | 90 0 | 20 0 | 4 0 | do..... | 11 | 36 | Kansas City, Mo. |
| No. 1..... | 27 | 40 8 | 14 3 | 5 0 | do..... | | | New Orleans. |
| No. 1..... | 64 | 80 2 | 19 1 | 4 2 | do..... | | 11 | Norfolk. |
| No. 1..... | 28 | 65 0 | 14 0 | 2 6 | do..... | | 10 | Nashville. |
| No. 1..... | 20 | 60 0 | 16 0 | 3 0 | do..... | | 4 | Chattanooga. |
| No. 1..... | 80 | 60 8 | 23 7 | 7 6 | do..... | | 42 | Galveston. |
| No. 1..... | 110 | 100 0 | 20 0 | 5 0 | do..... | 10 | 52 | Kansas City. |
| No. 1..... | 104 | 100 0 | 20 0 | 4 0 | do..... | | 69 | Little Rock. |
| No. 1..... | 23 | 50 0 | 20 0 | 3 7 | do..... | | 27 | Montgomery. |

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|--------------------------|-------------------------|--------------|--------------|-------------|-----------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| No. 1. | Tons. 44 | Ft. in. 85 0 | Ft. in. 22 0 | Ft. in. 3 6 | Wood | | | Pittsburgh. |
| No. 1. | 120 | 90 0 | 26 0 | 4 0 | do. | | 11 | Portland, Oreg. (2d). |
| No. 1. | 130 | 135 0 | 30 0 | 3 11 | do. | 17 | 116 | St. Louis. |
| No. 1, eches River. | 27 | 60 0 | 16 0 | 4 0 | do. | | 10 | Dallas. |
| No. 1, Trinity River. | 24 | 60 0 | 22 0 | 3 0 | do. | | 36 | Do. |
| No. 2. | 5 | 26 6 | 10 0 | 2 8 | do. | | 8 | Charleston. |
| No. 2. | 40 | 85 0 | 18 0 | 3 0 | do. | | 48 | Chattanooga. |
| No. 2. | 110 | 100 0 | 20 0 | 5 0 | do. | 10 | 52 | Kansas City. |
| No. 2. | 25 | 70 0 | 18 3 | 3 6 | do. | | 18 | Milwaukee. |
| No. 2. | 23 | 50 0 | 20 0 | 3 7 | do. | | 27 | Montgomery. |
| No. 2. | 29.8 | 76 0 | 16 0 | 3 0 | do. | | | Pittsburgh. |
| No. 2. | 130 | 135 0 | 30 0 | 3 11 | do. | 17 | 116 | St. Louis. |
| No. 2. | 36 | 48 0 | 16 0 | 3 6 | do. | | | St. Paul. |
| No. 2. | 34 | 68 0 | 18 0 | 3 0 | do. | 1 | 20 | Vicksburg. |
| No. 2, Cypress Bayou. | 35 | 66 6 | 22 0 | 3 6 | do. | | 40 | Dallas. |
| No. 2, Ohio. | 138 | 125 6 | 30 0 | 4 6 | do. | | 44 | Louisville. |
| No. 2, Ohio. | 88 | 110 0 | 22 0 | 3 6 | do. | | 44 | Do. |
| No. 3. | 2 | 22 0 | 8 4 | 1 9 | do. | | 9 | Charleston. |
| No. 3. | 24 | 65 0 | 16 0 | 3 0 | do. | | 2 | Chattanooga. |
| No. 3. | 11 | 50 0 | 16 0 | 3 0 | do. | | | Chicago. |
| No. 3. | 110 | 100 0 | 20 0 | 5 0 | do. | 10 | 52 | Kansas City. |
| No. 3. | 88 | 110 0 | 22 0 | 3 6 | do. | | 52 | Louisville. |
| No. 3. | 26 | 60 0 | 16 0 | 2 0 | do. | | 8 | Montgomery. |
| No. 3. | 115 | 135 0 | 26 0 | 3 6 | do. | 17 | 116 | St. Louis. |
| No. 3. | 39 | 52 0 | 16 0 | 3 5 | do. | | | St. Paul. |
| No. 3. | 84 | 68 0 | 18 0 | 3 0 | do. | 1 | 20 | Vicksburg. |
| No. 3, Hudson River. | 17 | 40 5 | 15 6 | 2 4 | do. | 3 | 9 | New York (1st). |
| No. 3, Red River. | 25 | 62 0 | 18 0 | 2 10 | do. | 1 | 18 | Dallas. |
| No. 3, Wabash. | 53 | 102 4 | 22 0 | 3 0 | do. | | 16 | St. Louis (M. R. C.). |
| No. 4. | 72 | 90 0 | 20 0 | 5 0 | do. | 1 | 41 | Kansas City, Mo. |
| No. 4. | 15 | 51 0 | 13 0 | 4 0 | do. | | | Savannah. |
| No. 4. | 16 | 53 0 | 16 0 | 2 9 | do. | | 11 | Wilmingon, N. C. |
| No. 4. | 88 | 110 0 | 22 0 | 3 6 | do. | | 16 | Louisville. |
| No. 4. | 48 | 70 0 | 21 6 | 3 0 | do. | | 50 | Montgomery. |
| No. 4. | 115 | 135 0 | 26 0 | 3 6 | do. | 17 | 116 | St. Louis (M. R. C.). |
| No. 4, Trinity River. | 35 | 66 6 | 22 0 | 3 6 | do. | | 40 | Dallas. |
| No. 5. | 25 | 64 0 | 16 0 | 3 0 | do. | | 15 | Chattanooga. |
| No. 5. | 20 | 41 0 | 16 0 | 3 10 | do. | | | Savannah. |
| No. 5. | 72 | 90 0 | 20 0 | 5 0 | do. | 1 | 41 | Kansas City, Mo. |
| No. 5. | 115 | 135 0 | 26 0 | 3 6 | do. | 17 | 116 | St. Louis (M. R. C.). |
| No. 5. | 34 | 68 3 | 18 0 | 3 5 | do. | 1 | 20 | Vicksburg. |
| No. 5, Ohio. | 169 | 124 6 | 25 0 | 4 2 | do. | | 5 | Louisville. |
| No. 5, Trinity River. | 6.5 | 30 0 | 16 0 | 2 9 | do. | | 10 | Dallas. |
| No. 6. | 20 | 65 0 | 16 0 | 3 0 | do. | | 24 | Chattanooga. |
| No. 6. | 84 | 100 0 | 20 0 | 5 0 | do. | 10 | 58 | Kansas City, Mo. |
| No. 6. | 130 | 135 0 | 30 0 | 3 11 | do. | 17 | 116 | St. Louis. |
| No. 6, Trinity River. | 6.5 | 30 0 | 16 0 | 2 9 | do. | | 10 | Dallas. |
| No. 7. | 44 | 106 0 | 21 0 | 3 0 | do. | | 8 | Chattanooga. |
| No. 7. | 84 | 100 0 | 20 0 | 5 0 | do. | 10 | 58 | Kansas City, Mo. |
| No. 7. | 130 | 135 0 | 30 0 | 3 11 | do. | 17 | 116 | St. Louis. |
| No. 7, Trinity River. | 6.5 | 30 0 | 16 0 | 2 9 | do. | | 10 | Dallas. |
| No. 8. | 27 | 67 0 | 16 0 | 3 0 | do. | | 4 | Chattanooga. |
| No. 8. | 84 | 100 0 | 20 0 | 5 0 | do. | 10 | 58 | Kansas City, Mo. |
| No. 8. | 125 | 135 0 | 25 0 | 8 0 | do. | | | Memphis (M. R. C. 1st and 2d). |
| No. 8. | 130 | 135 0 | 30 0 | 3 11 | do. | 17 | 116 | St. Louis. |
| No. 8, Hudson River. | 225 | 90 0 | 29 0 | 9 0 | do. | 18 | 90 | New York (1st). |
| No. 8, Trinity River. | 6.5 | 30 0 | 16 0 | 2 9 | do. | | | Dallas. |
| No. 9. | 56 | 104 0 | 20 0 | 3 6 | do. | | 15 | Chattanooga. |
| No. 9. | 130 | 135 0 | 30 0 | 3 11 | do. | 17 | 116 | St. Louis. |
| No. 9. | 34 | 68 0 | 18 0 | 4 0 | do. | 1 | 20 | Vicksburg. |
| No. 10. | 45 | 105 0 | 21 0 | 3 9 | do. | | 36 | Chattanooga. |
| No. 10. | 22 | 75 0 | 14 0 | 1 9 | do. | | | Cincinnati (2d). |
| No. 10. | 130 | 135 0 | 30 0 | 3 11 | do. | 17 | 116 | St. Louis. |
| No. 10. | 34 | 68 0 | 18 0 | 3 0 | do. | 1 | 20 | Vicksburg. |
| No. 11. | 56 | 100 0 | 20 0 | 4 0 | do. | | 3 | Chattanooga. |
| No. 11. | 40 | 90 0 | 18 0 | 3 6 | do. | | | Cincinnati (2d). |
| No. 11. | 125 | 135 0 | 25 0 | 8 0 | do. | | 128 | Memphis (M. R. C. 1st and 2d). |
| No. 11. | 46 | 75 0 | 20 0 | 3 0 | do. | | 30 | Rock Island. |
| No. 11. | 34 | 68 0 | 18 0 | 3 0 | do. | 1 | 20 | Vicksburg. |
| No. 12. | 43 | 80 0 | 20 0 | 4 0 | do. | | | Chattanooga. |
| No. 12. | 25 | 78 0 | 11 0 | 4 0 | do. | | | Cincinnati (2d). |
| No. 12. | 125 | 135 0 | 25 0 | 8 0 | do. | | | Memphis (M. R. C. 1st and 2d). |
| No. 14. | 55 | 100 0 | 24 0 | 4 0 | do. | | 15 | Chattanooga. |
| No. 14. | 35 | 70 0 | 16 0 | 4 0 | do. | | 30 | Rock Island. |
| No. 15. | 56 | 100 0 | 20 0 | 3 3 | do. | | 25 | Chattanooga. |
| No. 17. | 52 | 70 0 | 24 0 | 3 0 | do. | | 84 | Rock Island. |

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|-----------------------------|-------------------------|-------------|----------|---------|------------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | Tons. | Ft. in. | Ft. in. | Ft. in. | | | | |
| No. 17 (office)..... | 89 | 85 0 | 23 0 | 3 0 | Wood..... | | | Vicksburg (M. R. C. 3d). |
| No. 19..... | 113 | 100 0 | 24 0 | 4 0 | do..... | | | Chattanooga. |
| No. 20..... | 93 | 100 0 | 24 0 | 4 0 | do..... | | | Do. |
| No. 21..... | 93 | 100 0 | 24 0 | 4 0 | do..... | | | Do. |
| No. 25..... | 125 | 135 0 | 25 0 | 8 0 | do..... | 3 | 60 | Memphis (M. R. C. 1st and 2d). |
| No. 25..... | 120 | 80 0 | 23 0 | 5 0 | do..... | | 28 | Montgomery. |
| No. 26..... | 125 | 135 0 | 25 0 | 8 0 | do..... | | | Memphis (M. R. C. 1st and 2d). |
| No. 27..... | 43 | 90 6 | 18 6 | 3 0 | do..... | | 2 | Do. |
| No. 28..... | 30 | 65 0 | 20 0 | 3 9 | do..... | | | Wheeling. |
| No. 29, Amelia..... | 43 | 90 6 | 18 6 | 3 0 | do..... | 11 | 2 | Memphis (M. R. C. 1st and 2d). |
| No. 44..... | 40 | 50 0 | 22 0 | 3 6 | Steel..... | | | Cincinnati (2d). |
| No. 45..... | 32 | 74 0 | 16 0 | 3 0 | Wood..... | | 12 | Rock Island. |
| No. 47..... | 46 | 75 0 | 20 0 | 3 0 | do..... | | 35 | Do. |
| No. 52 (office)..... | 32 | 58 0 | 18 0 | 3 6 | do..... | | 18 | Do. |
| No. 65..... | 20 | 40 0 | 16 0 | 2 0 | do..... | | 6 | Do. |
| No. 71..... | 46 | 75 0 | 20 0 | 3 6 | do..... | | 6 | Do. |
| No. 75..... | 46 | 75 0 | 20 0 | 3 6 | do..... | | 35 | Do. |
| No. 86..... | 87 | 100 0 | 28 0 | 5 0 | do..... | 3 | | Vicksburg (M. R. C. 3d). |
| No. 87..... | 87 | 100 0 | 28 0 | 5 0 | do..... | 8 | 80 | Do. |
| No. 88..... | 107 | 120 0 | 28 0 | 6 0 | do..... | | 12 | Do. |
| No. 91..... | 15 | 50 0 | 12 0 | 3 0 | do..... | | 12 | Rock Island. |
| No. 92..... | 40 | 81 0 | 16 0 | 3 0 | do..... | | 20 | Do. |
| No. 118..... | 43 | 70 0 | 20 0 | 3 0 | do..... | | 48 | Do. |
| No. 120..... | 14 | 40 0 | 14 0 | 2 0 | do..... | | 3 | Do. |
| No. 121..... | 26 | 52 0 | 16 0 | 2 6 | do..... | | 12 | Do. |
| No. 122..... | 26 | 52 0 | 16 0 | 2 6 | do..... | | 12 | Do. |
| No. 123..... | 26 | 52 0 | 16 0 | 2 6 | do..... | | 12 | Do. |
| No. 131..... | 186 | 131 0 | 30 0 | 5 0 | do..... | | 131 | Vicksburg (M. R. C. 3d). |
| No. 155..... | 107 | 120 0 | 28 0 | 6 0 | do..... | 8 | 90 | Do. |
| No. 156..... | 107 | 120 0 | 28 0 | 6 0 | do..... | | 12 | Do. |
| No. 157..... | 107 | 120 0 | 28 0 | 6 0 | do..... | 8 | 94 | Do. |
| No. 158 (store)..... | 107 | 120 0 | 28 0 | 6 0 | do..... | | | Do. |
| No. 159..... | 107 | 120 0 | 28 0 | 6 0 | do..... | | | Do. |
| No. 183..... | 62 | 100 0 | 20 0 | 3 0 | do..... | | 56 | Rock Island. |
| No. 184..... | 33 | 60 0 | 18 0 | 3 0 | do..... | | 18 | Do. |
| No. 202..... | 43 | 70 0 | 20 0 | 3 0 | do..... | | 35 | Do. |
| No. 208..... | 130 | 120 0 | 30 0 | 6 0 | do..... | | 120 | Memphis (M. R. C. 1st and 2d). |
| No. 221..... | 130 | 120 0 | 30 0 | 6 0 | do..... | | 120 | Do. |
| No. 231..... | 62 | 100 0 | 20 0 | 4 3 | do..... | | 56 | Rock Island. |
| No. 232..... | 62 | 100 0 | 20 0 | 4 3 | do..... | | 20 | Do. |
| No. 237..... | 46 | 68 0 | 22 0 | 3 0 | do..... | | 24 | Do. |
| No. 262..... | 45 | 66 0 | 22 0 | 3 0 | do..... | | 18 | Do. |
| No. 301..... | 46 | 75 0 | 20 0 | 4 0 | do..... | | 35 | Do. |
| No. 342..... | 50 | 80 0 | 20 0 | 3 0 | do..... | | 20 | Do. |
| No. 343..... | 43 | 70 0 | 20 0 | 3 0 | do..... | | 46 | Do. |
| No. 344..... | 43 | 70 0 | 20 0 | 3 0 | do..... | | 30 | Do. |
| No. 345..... | 43 | 70 0 | 20 0 | 3 0 | do..... | | 30 | Do. |
| No. 346..... | 50 | 80 0 | 20 0 | 3 0 | do..... | | 20 | Do. |
| No. 347..... | 50 | 80 0 | 20 0 | 3 0 | do..... | | 20 | Do. |
| No. 348..... | 50 | 80 0 | 20 0 | 3 0 | do..... | | 20 | Do. |
| No. 367..... | 50 | 78 0 | 26 0 | 3 0 | do..... | | 60 | Do. |
| No. 411..... | 60 | 76 0 | 26 0 | 4 0 | do..... | | 50 | Do. |
| No. 412..... | 51 | 82 0 | 20 0 | 3 0 | do..... | | 46 | Do. |
| No. 414..... | 43 | 70 0 | 20 0 | 3 0 | do..... | | 30 | Do. |
| No. 492..... | 50 | 71 0 | 18 0 | 3 6 | do..... | | 30 | Do. |
| No. 504..... | 40 | 75 0 | 20 0 | 3 0 | do..... | | 30 | Do. |
| No. 505..... | 40 | 75 0 | 20 0 | 3 0 | do..... | | 30 | Do. |
| No. 512..... | 42 | 80 0 | 18 0 | 3 6 | do..... | | 20 | Do. |
| No. 513..... | 42 | 80 0 | 18 0 | 3 6 | do..... | | 20 | Do. |
| No. 514..... | 42 | 80 0 | 18 0 | 3 6 | do..... | | 20 | Do. |
| No. 0901..... | 30 | 68 0 | 18 0 | 4 0 | do..... | 5 | 14 | Memphis (M. R. C. 1st and 2d). |
| No. 1010..... | 177 | 135 0 | 34 0 | 5 0 | do..... | 8 | 127 | Vicksburg (M. R. C. 3d). |
| No. 1020..... | 156 | 140 0 | 30 0 | 4 0 | do..... | | 156 | Memphis (M. R. C. 1st and 2d). |
| No. 1021..... | 156 | 140 0 | 30 0 | 4 0 | do..... | | 156 | Do. |
| No. 1107..... | 177 | 140 0 | 34 0 | 5 0 | do..... | | 129 | Vicksburg (M. R. C. 3d). |
| No. 1108..... | 177 | 140 0 | 34 0 | 5 0 | do..... | | 129 | Do. |
| No. 1201..... | 177 | 140 0 | 34 0 | 5 0 | do..... | | 129 | Do. |
| No. 1202..... | 177 | 140 0 | 34 0 | 5 0 | do..... | | 129 | Do. |

| Name, number, or letter. | Dis- place- ment. | Dimensions. | | | Material. | Comple- ment. | | District. |
|---------------------------------------|-------------------------|----------------|----------------|----------------|------------|------------------|------|-----------------------------------|
| | | Length. | Breadth. | Depth. | | Offi- cers. | Men. | |
| | <i>Tons.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | <i>Ft. in.</i> | | | | |
| No. 1301..... | 77 | 100 0 | 26 0 | 4 0 | Wood..... | 3 | 33 | Memphis (M. R. C. 1st and 2d). |
| No. 1307..... | 177 | 140 0 | 34 0 | 5 0 | ...do..... | 10 | 144 | Vicksburg (M. R. C 3d). |
| No. 1308..... | 177 | 110 0 | 34 0 | 5 0 | ...do..... | 10 | 144 | Do. |
| No. 1402..... | 190 | 160 0 | 36 6 | 4 0 | ...do..... | 2 | 255 | Memphis (M. R. C. 1st and 2d). |
| U. S. E. D., Hudson River, No. 1. | 30 | 42 0 | 20 6 | 3 2 | ...do..... | 3 | 20 | New York (1st). |
| U. S. E. D., Hudson River, No. 41. | 129 | 86 9 | 26 4 | 8 9 | ...do..... | 9 | 36 | Do. |
| U. S. E. D., Hudson River, No. 44. | 80 | 62 0 | 22 0 | 4 3 | ...do..... | 2 | 33 | Do. |

TABLE 17.—CONCRETE MIXING PLANTS.

| | | | | | | | | |
|----------------------|-----|------|------|-----|------------|---|----|-----------------|
| No. 7, Hudson River. | 244 | 85 0 | 28 0 | 9 4 | Wood..... | 1 | 15 | New York (1st). |
| No. 13, Hudson River | 100 | 80 0 | 26 0 | 3 8 | ...do..... | 2 | 13 | Do. |
| No. 17, Hudson River | 150 | 90 0 | 27 0 | 7 0 | ...do..... | 6 | 9 | Do. |
| No. 18, Hudson River | 150 | 84 0 | 27 6 | 8 6 | ...do..... | 6 | 7 | Do. |

PART V.

THE PANAMA CANAL REPORTS.

COMMISSIONS.

SECTION A.—LIST OF THE ISTHMIAN CANAL COMMISSIONS, COMBINED WITH A BRIEF TABLE OR SUMMARY OF THE MORE IMPORTANT TOPICS OF THEIR REPORTS, ARRANGED CHRONOLOGICALLY.

SUBJECTS.

SECTION B.—ALPHABETICAL ARRANGEMENT OF THE PRINCIPAL TOPICS OF THE REPORTS.

PLATES.

THE PANAMA CANAL.
ORGANIZATION CHARTS, 1907, 1909, 1914.

GUIDE TO THE USE OF PART V.

What is contained in this part.—An index in a brief form to the important engineering matter, etc., connected with the engineering project of constructing a waterway across the Central American Isthmus, from 1492 to 1914.

What engineering reports are indexed.—These are as follows:

1. Isthmian Canal Commission No. 1, 1899–1901, 1 volume and plates.
2. Isthmian Canal Commission No. 2, 1904, 1 volume.
3. Isthmian Canal Commission No. 3, 1905–1906, 2 volumes.
4. Board of Consulting Engineers, 1906, 1 volume and plates.
5. Isthmian Canal Commission No. 4, 1907–1913, 7 volumes and 4 sets of plates.
6. The Panama Canal (Isthmian Canal Commission and), 1914, 1 volume and plates.

The subjects of these reports.—On the pages immediately following this there is a list of the more important subjects of these reports so arranged that a brief inspection or examination of the list of subjects affords a general understanding of what has been involved in the work of constructing an artificial waterway across the Central American Isthmus.

This list of subjects is arranged chronologically. It shows also the personnel of the various commissions, and names important heads of departments. Reference is made to the paging of the reports on each subject in such a way that their length or scope is indicated. The list of subjects is arranged also to show something of the various plans of organization leading up to the completion of The Panama Canal.

Alphabetical arrangement.—With the exception of the matter referred to in the preceding paragraph, all the matter of Part V is arranged in the customary alphabetical form. Illustration: Details concerning appropriations will be found referred to under "Appropriations"; concerning dams, under "Dams"; and concerning terminals, under "Terminals."

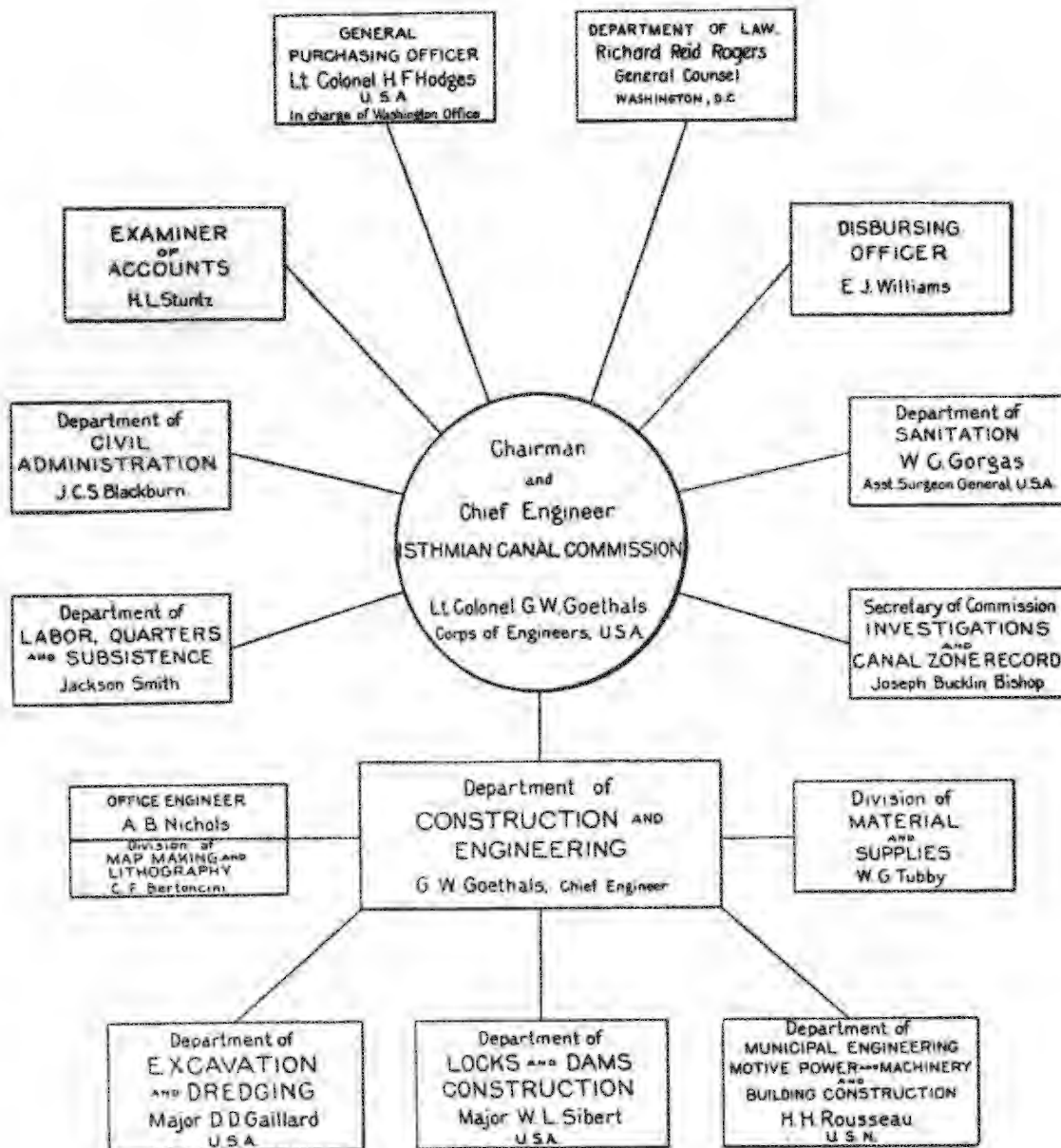
Page references.—These are of the same character as in other parts of this index, with the exception of the addition of the letter P, which refers to the special reports on the Isthmian or Panama Canal project. Illustration: **P-06**, 436, pl. 5, means the report of the Isthmian Canal Commission for 1906, page 436, plate 5.

To distinguish the report of the Board of Consulting Engineers of 1906 from the other reports for that year, a star (*) is added to a reference to that report. Illustration: **P-06***, 377, means the report of the Board of Consulting Engineers, 1906, page 377.

Abstracts.—Brief abstracts have been provided of important reports. Illustration: Under "Projects" are brief but informative details concerning projects for waterways across the Isthmus. Under "Appropriations" is a table of appropriations for the work. Under "Atlantic Division" is a brief outline of the operations on that division.

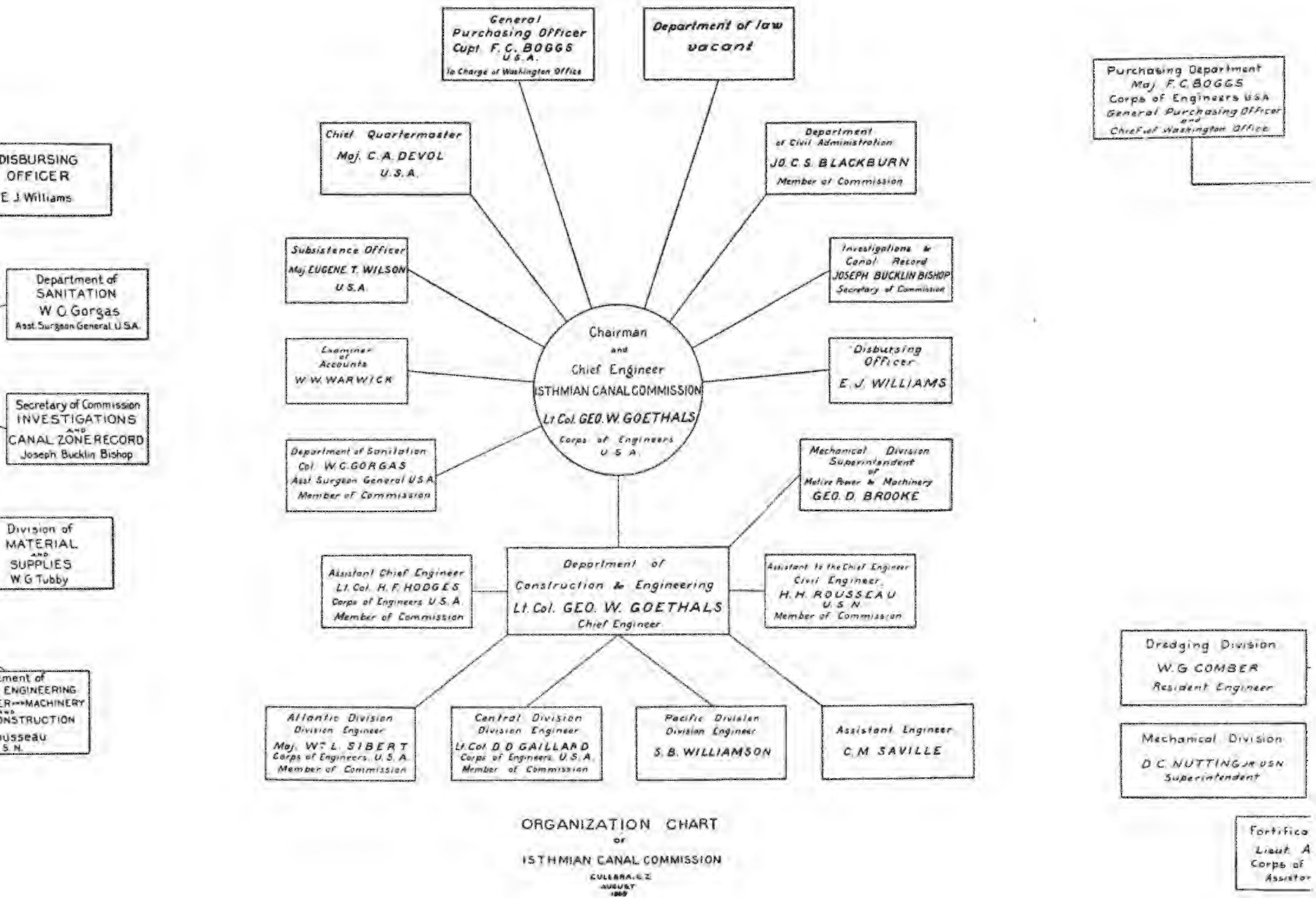
Cross references.—Copious cross references have been provided. Illustration: "Dams" refers to "Locks," "Gates," etc., and to related subjects in the list of important subjects in Section A.

Names of places.—But few names of places have been listed alphabetically, because Part V is intended mainly to index engineering matter. Illustration: Under "Dams" have been collected the more important engineering facts connected with dams, rather than under "Gatun," "Miraflores," "Pedro Miguel," or "Bohio." There are subheads under "Dams" referring to each of these places, however, and each important reference usually names the place connected with the engineering fact indexed. This plan brings related engineering facts under one head usually, rather than under several scattered headings, and makes Part V more compact than would otherwise be the case.

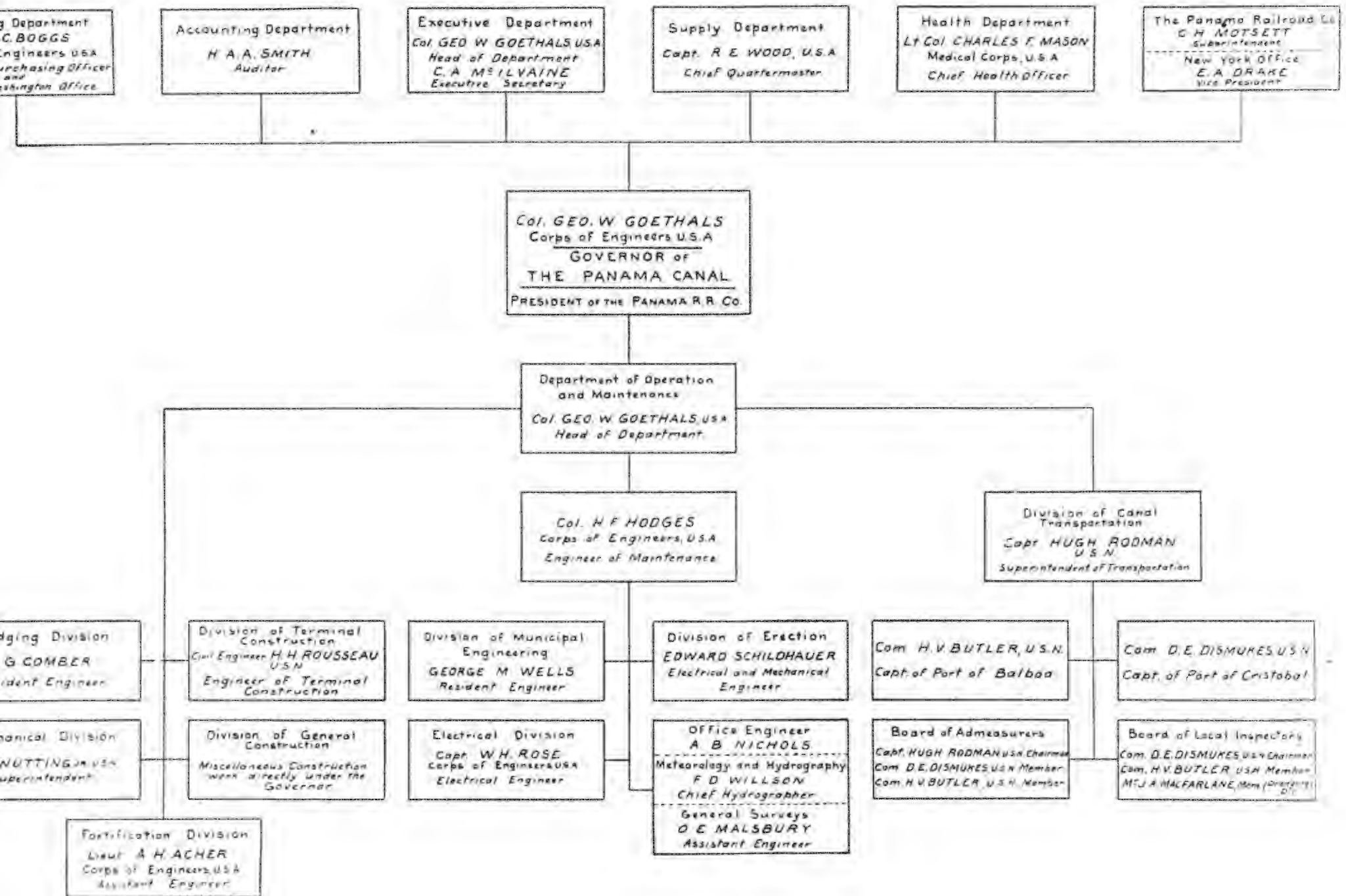


ORGANIZATION CHART
OF
ISTHMIAN CANAL COMMISSION.

CULEBRA, C.Z.
OCTOBER
1907.



GENERAL ORGANIZATION, JULY 1, 1914.



THE PANAMA CANAL REPORTS.

SECTION A—COMMISSIONS.

Table of subjects in the reports indexed in Part V.

1899-1901.

| No. | Pages of this Index. | Reports. | 1899-1901 |
|-----|----------------------------|---|--|
| | | | Paging of the Isthmian reports. |
| 1 | 2484 | Isthmian Canal Commission. (No. 1) ¹ | 1-688 |
| 2 | 2549 | Canal projects—1492-1901..... | 18-43 |
| 3 | 2557 | Dimensions and prices..... | 44-48 |
| 4 | 2407 | Routes..... | 49-55 |
| 5 | 2408 | Panama route..... | 56-70 |
| 6 | 2408 | Nicaragua route..... | 71-111 |
| 7 | 2406 | Earthquakes, climate, health, etc..... | 112-114 |
| 8 | 2554 | Rights and franchises..... | 115-160 |
| 9 | 2427 | Value of possible canal..... | 161-166 |
| 10 | 2453 | Military value of possible canal..... | 167-168 |
| 11 | 2538 | Upkeep, etc..... | 169-170 |
| 12 | 2564 | Conclusions of I. C. C. No. 1 (Nicaragua route favored)..... | 171-175 |
| 13 | 2557, 2585 | Locks..... | 179-196 |
| 14 | 2556 | History, Panama Canal Co., 1880-1894..... | 197-214 |
| 15 | 2556 | Documents, New Panama Canal Co..... | 215-218 |
| 16 | 2407 | Hydrography, Panama route..... | 219-246 |
| 17 | 2406 | Waste weirs and discharges, Bohio Lake..... | 247-252 |
| 18 | 2559 | Alternate line, Gatun-Bohio. (See Surveys, p. 2598 of this Index)..... | 253-254 |
| 19 | 2609 | Time of transit, by proposed routes..... | 255-272 |
| 20 | 2406 | Discharge, canalized San Juan R..... | 273-280 |
| 21 | 2406 | Hydrography, Nicaragua..... | 281-348 |
| 22 | 2408 | Surveys, San Juan R.-Indio R..... | 349-352 |
| 23 | 2610 | Treaties, contracts, etc..... | 358-509 |
| 24 | 2427 | Industrial and commercial value of canal..... | 515-671 |
| 25 | 2563 | Supplementary R. ² —Comparison of Panama and Nicaragua routes. Sale of Panama rights proposed by French company. Panama route recommended, where previously Nicaragua route had been the choice..... | 673-681 |

¹ Members: Rear Admiral J. G. Walker, U. S. N., president; Samuel Pasco; Alfred Noble; George S. Morison; Col. Peter C. Hains, Corps of Engineers, U. S. A.; Wm. H. Burr; Lt. Col. O. H. Ernst, Corps of Engineers, U. S. A.; Lewis M. Haupt; and Emory R. Johnson. R. dated Nov. 16, 1901. Transmitted to President Roosevelt by Secretary of State John Hay, Nov. 30, 1901, and by President to Congress on Dec. 4, 1901. Au. act Mar. 3, 1899. Admiral Walker appointed June 10, 1899.

² S. Doc. 123, 57th Cong., 1st sess.

Table of subjects in the reports indexed in Part V.

1904.

| No. | Pages of this Index. | Reports. | 1904 |
|-----|----------------------|---|------------------------|
| | | | Paging of the reports. |
| 26 | 2485 | Isthmian Canal Commission (No. 2) ¹ | 1-95 |
| 27 | 2450 | Customs, etc. | 17-22 |
| 28 | 2594 | Act authorizing canal construction. | 23-25 |
| 29 | 2610 | Treaty with Panama (Republic). | 25-31 |
| 30 | 2619 | Laws establishing government. | 31, 65-70 |
| 31 | 2486 | Instructions from the President. | 31-35 |
| 32 | 2619 | Transfer of property to U. S. | 35-36 |
| 33 | 2485 | Organization. | 36-38, 43-44 |
| 34 | 2485 | Visit of Isthmian Canal Commission No. 2 to Isthmus. | 38-40 |
| 35 | 2481 | Harbor, Cristobal. | 40 |
| 36 | 2599 | Proposed dam at Gatun, or Tiger Hill. | 41 |
| 37 | 2599 | Bohio Dam. | 41-42 |
| 38 | 2583 | Control of Chagres. | 42-43 |
| 39 | 2617 | Waterworks and sewers, Panama and Colon. | 44-48 |
| 40 | 2461 | Engineering and construction ² | 48-49 |
| 41 | 2585 | Sanitation. | 49-53 |
| 42 | 2369 | Accounting system. | 53-54 |
| 43 | 2508 | Material, supplies, and machines. | 54-57 |
| 44 | 2542 | Panama R. R. | 57-65 |
| 45 | 2493 | Municipalities and legislation. | 68-70 |
| 46 | 2471 | Expenditures and estimates. | 71-74 |
| 47 | 2369 | Treasurer's R. | 75-76 |
| 48 | 2619 | Governor of Zone ³ | 77-95 |
| 49 | 2619 | Transfer of Zone ² | 78-79 |
| 50 | 2619 | Geography. | 79-80 |
| 51 | 2480 | Harbors. | 80-81 |
| 52 | 2524 | Municipalities. | 81-82 |
| 53 | 2619 | Industrial and social conditions. | 82 |
| 54 | 2619 | Zone government. | 82-83 |
| 55 | 2619 | Postal affairs. | 83-84 |
| 56 | 2619 | Public order. | 84-85 |
| 57 | 2619 | Justice and judiciary. | 85-86 |
| 58 | 2619 | Jails. | 86 |
| 59 | 2585 | Health and sanitation. | 86-91 |
| 60 | 2619 | Lands and buildings. | 91-93 |
| 61 | 2619 | Public works. | 93-94 |
| 62 | 2619 | Telegraphs and telephones. | 94 |
| 63 | 2581 | Receipts and disbursements. | 94-95 |

¹ Members: Rear Admiral J. G. Walker, U. S. N., chairman; Maj. Gen. Geo. W. Davis, U. S. A.; Wm. B. Parsons; W. H. Burr; B. M. Harrod; C. E. Grunsky; and F. J. Hecker. Commission an. act June 28, 1902. R. for period, May, 1904, the date of creation of I. C. C. No. 2, to Nov. 30, 1904.

² Head of engineering staff immediately after transfer from the French company (New Panama Canal Company), Maj. W. M. Black, Corps of Engineers, U. S. A. Maj. Black (Chief of Engineers, U. S. A., 1916) preceded Mr. Wallace. P-04, 35, 78, 79.

³ Maj. Gen. G. W. Davis, member of I. C. C. No. 2. Appointed governor, etc., May 8, 1904. R. dated Nov. 1, 1904.

Table of subjects in the reports indexed in Part V.

1905-1906.

| No. | Pages of this Index. | Reports. | Paging of the reports. | |
|-----|----------------------------|---|---------------------------|---------|
| | | | 1905 | 1906 |
| 64 | 2528 | Isthmian Canal Commission (No. 3) ¹ | 1-340 | 1-153 |
| 65 | 2528 | Organization and reorganization..... | 5 | 15, 151 |
| 66 | 2585 | Health and sanitation..... | 6 | 2 |
| 67 | 2460 | Employees, care of, and obtaining..... | 7-8 | 3-6 |
| 68 | 2487 | Labor (including transportation, etc.)..... | 9-10 | 5 |
| 69 | 2508 | Material and supplies..... | 15-16 | 11 |
| 70 | 2547 | Plant, production of..... | 16-17 | ..... |
| 71 | 2572 | Ships, purchases..... | 17 | ..... |
| 72 | 2600 | Telegraphs and cables..... | 18 | ..... |
| 73 | 2542 | Panama R. R..... | 18 | 10 |
| 74 | 2521 | Monetary system..... | 20 | 12 |
| 75 | 2395 | Auditing, etc..... | 20 | ..... |
| 76 | 2620 | Finances (fiscal matters)..... | 21 | 12, 118 |
| 77 | 2620 | Governor of zone (R.) ² | 28-107 | 17-45 |
| 78 | 2546 | Relations with Panama (Republic)..... | 29 | 18 |
| 79 | 2618 | Yellow fever..... | ..... | ..... |
| 80 | 2483 | Immigration, restriction of..... | 34 | 19 |
| 81 | 2507 | Malaria..... | ..... | ..... |
| 82 | 2450 | Harbor regulations..... | 35 | 21 |
| 83 | 2403 | Bubonic plague..... | ..... | ..... |
| 84 | 2526 | Pipe line, oil..... | 38 | 22 |
| 85 | 2585 | Sanitation of the Isthmus..... | ..... | ..... |
| 86 | 2585 | Sanitation, near-by countries..... | 39 | 22 |
| 87 | 2616 | Water supply (drinking)..... | 41 | ..... |
| 88 | 2590 | Sewers..... | 42 | ..... |
| 89 | 2546 | Faving..... | 44 | ..... |
| 90 | 2573 | Living quarters..... | 46 | ..... |
| 91 | 2475 | Food supply..... | 47 | ..... |
| 92 | 2620 | Delimitation of zone..... | 48 | ..... |
| 93 | 2441 | Consuls..... | 48 | ..... |
| 94 | 2430 | Commissaries..... | 49 | ..... |
| 95 | 2450 | Currency agreement..... | 50 | ..... |
| 96 | 2583 | Roads..... | 50 | ..... |
| 97 | 2483 | Care of insane, etc..... | 52 | ..... |
| 98 | 2525 | Nurses, religion..... | 52 | 26 |
| 99 | 2526 | Office buildings..... | 53 | ..... |
| 100 | 2471 | Expropriation..... | 54 | ..... |
| 101 | 2460 | Employees..... | 58 | ..... |
| 102 | 2582 | Religious work..... | 58 | 27 |
| 103 | 2470 | Executive office..... | 59 | 27 |
| 104 | 2481 | Health department..... | 59 | 24, 29 |
| 105 | 2585 | Sanitation..... | 60 | 23, 28 |
| 106 | 2481 | Hospitals..... | 61 | 30 |
| 107 | 2573 | Quarantine..... | 61 | 30 |
| 108 | 2481 | Laboratory..... | 62 | 32 |
| 109 | 2582 | Revenues..... | 63 | 33 |
| 110 | 2450 | Customs..... | 64 | ..... |
| 111 | 2484 | Internal revenue..... | 64 | 32 |
| 112 | 2548 | Postal service..... | 65 | ..... |
| 113 | 2589 | Public schools..... | 66 | 34 |
| 114 | 2462 | Estates..... | 66 | 33 |
| 115 | 2489 | Lands..... | 67 | 41 |
| 116 | 2492 | Legal department..... | 67 | 41 |
| 117 | 2447 | Courts, etc..... | 69 | 36 |
| 118 | 2475 | Fire department..... | ..... | 43 |
| 119 | 2548 | Police..... | 71 | 35 |
| 120 | 2616 | Water commissioner, office of..... | ..... | ..... |
| 121 | 2524 | Municipalities..... | ..... | 24, 37 |

¹ Members: T. P. Shonts, chairman, to Mar. 4, 1907; C. E. Magoon, to Sept. 25, 1907; Rear Admiral M. T. Endicott, U. S. N., Col. P. C. Hains, Col. O. H. Ernst, U. S. A., B. M. Harrod, to Mar. 16, 1907. I. C. C. No. 3 appointed by President Roosevelt Apr. 3, 1905. I. C. C. No. 2 rendered its last R. Dec. 1, 1904. The last R. of the Chief Engineer was rendered Feb. 1, 1905. R. of I. C. C. No. 3, dated Dec. 6, 1905, for year ending Dec. 1, 1905. R. dated Dec. 6, 1906, for year ending Dec. 1, 1906.

² Chas. E. Magoon, head of department of government and sanitation and governor of Canal Zone. Appointed Apr. 1, 1905. R. dated Nov. 16, 1905, to cover year ending Oct. 31, 1905. R. dated Oct. 1, 1906, to cover from Nov. 1, 1905, to Sept. 30, 1906.

Table of subjects in the reports indexed in Part V.

1905-1906.

| No. | Pages of this Index. | Reports. | Paging of the reports. | |
|-----|----------------------|--|------------------------|--------------|
| | | | 1905 | 1906 |
| 122 | 2589 | Schools..... | | 39 |
| 123 | 2395 | Audits and disbursements..... | 72 | |
| 124 | 2470 | Estimates, etc..... | 72 | |
| 125 | 2419 | Chief Engineer (R.)..... | 108-123 | 82-117 |
| 126 | 2487 | Labor and quarters..... | 109 | 114 |
| 127 | 2524 | Municipal engineering..... | 110 | 92 |
| 128 | 2616 | Waterworks..... | | 92-97 |
| 129 | 2590 | Sewers..... | 111 | 92 |
| 130 | 2583 | Roads..... | 111 | |
| 131 | 2546 | Paving..... | 112 | 93 |
| 132 | 2404 | Building construction..... | 112 | 99, 127 |
| 133 | 2509 | Mechanical division..... | 113 | 107 |
| 134 | 2426 | Colon division..... | 114 | 82 |
| 135 | 2487 | La Boca division..... | 115 | 88 |
| 136 | 2599 | Chagres R. surveys and division..... | 116 | 85 |
| 137 | 2507 | Maps and lithography..... | 116 | 114 |
| 138 | 2518 | Meteorology and river hydraulics..... | 116 | 113 |
| 139 | 2449 | Culebra division..... | 117 | 86 |
| 140 | 2541 | Panama R. R..... | 121 | |
| 141 | 2440 | Conditions, ¹ Isthmus, July 1, 1905..... | 124-132 | |
| 142 | 2440 |do. ² | 133-146 | |
| 143 | 2440 |do. ³ | 139-145 | |
| 144 | 2529 | Washington office organization..... | 148 | |
| 145 | 2461 | Department of construction and engineering—organization..... | 151 | |
| 146 | 2400 | Employment—conditions..... | 157 | |
| 147 | 2572 | Purchases, etc.—regulations..... | 159-170 | |
| 148 | 2396 | Bids—form of proposal..... | 171 | |
| 149 | 2395 | Auditing—organization..... | 179-180 | |
| 150 | 2470 | Expenditures—details..... | 181-193 | |
| 151 | 2581 | Receipts..... | 194 | 118 |
| 152 | 2528 | Laws, orders, and resolutions of I. C. C. No. 2 subsequent to previous R. ⁴ | 195, 340 | |
| 153 | 2618 | Yards, receiving and forwarding..... | | 8 |
| 154 | 2601 | Yards, terminal; and wharves..... | | 8 |
| 155 | 2616 | Water and sewer systems, Panama..... | | 8 |
| 156 | 2616 | Water and sewer systems, Colon and Cristobal..... | | 9 |
| 157 | 2580 | Railway equipment..... | | 10 |
| 158 | 2425 | Clerical force—classification..... | | 12 |
| 159 | 2549 | Canal type—lock plan decreed..... | | 13 |
| 160 | 2493 | Legislation..... | | 14 |
| 161 | 2565 | Locks and dams, location..... | | 14 |
| 162 | 2487 | Labor, Chinese..... | | 14 |
| 163 | 2441 | Construction of canal by contract..... | | 15, 128, 132 |

¹ Jno. F. Stevens, Chief Engineer to Apr. 1, 1907. Appointed July 1, 1905. R. dated Sept. 30, 1905, for 3 months ending Sept. 30, 1905.

² R. by Chief Engineer Stevens.

³ R. by Col. P. C. Hains and B. M. Harrod of what had actually been done by Chief Engineer Wallace from June 1, 1904, to June 28, 1905.

⁴ R. by Col. O. H. Ernst.

⁵ Embracing details of 61st meeting of I. C. C. No. 2 from Dec. 8, 1904, to 90th meeting, Mar. 29, 1905.

Table of subjects in the reports indexed in Part V.

1906.*

| No. | Pages of this Index. | Reports. | 1906 |
|-----|----------------------------|---|------------------------------|
| | | | Paging of the reports. |
| 164 | 2396 | Board of Consulting Engineers of 1906¹ | 1-426 |
| 165 | 2396 | Summary of proceedings..... | 9 |
| 166 | 2397 | Physical characteristics—Panama..... | 15 |
| 167 | 2397 | Climate..... | 16 |
| 168 | 2397 | Sanitation and hygiene..... | 18 |
| 169 | 2397 | "Present conditions"..... | 22 |
| 170 | | Projects— | |
| | 2566 | Bates..... | 26, 247 |
| 171 | 2567 | Bunau-Varilla..... | 30, 199 |
| 172 | 2566 | I. C. C. No. 1 (1901)..... | 33 |
| 173 | 2566 | Gillette..... | 34 |
| 174 | 2567 | 60-foot summit level <i>v.</i> sea level..... | 35 |
| 175 | 2453 | Defense..... | 36 |
| 176 | 2567 | Lock canal transformation to sea-level canal..... | 38 |
| 177 | 2568 | Capacity of canal for traffic..... | 39 |
| 178 | 2583 | Control of Chagres, etc..... | 41 |
| 179 | 2451 | Dams..... | 45 |
| 180 | 2565 | Sea-level plan recommended by board..... | 47 |
| 181 | 2565 | Lock canal recommended by minority..... | 67 |
| 182 | 2565 | Comparison—lock <i>v.</i> sea-level plan..... | 79 |
| 183 | 2565 | Time of completion—sea level and 85-foot projects..... | 83 |
| 184 | 2569 | Relative time of transit..... | 85 |
| 185 | 2576 | Capacity for traffic of two projects..... | 86 |
| 186 | 2570 | Safety of locks and structures..... | 89 |
| 187 | 2569 | Safety of ships in two types of canal..... | 92 |
| 188 | 2570 | Land damages..... | 93 |
| 189 | 2570 | Relocation of Panama R. R..... | 94 |
| 190 | 2569 | Estimate, lock canal..... | 95 |
| 191 | 2570 | Upkeep, etc..... | 96 |
| 192 | 2570 | Dams..... | 98 |
| 193 | 2396 | Proceedings of B. C. E. ² | 105-148 |
| 194 | 2479 | Geological study, Isthmus of Panama, by Bertrand and Zürcher ³ | 149-163 |
| 195 | 2481 | Dimensions of largest ships and improvements in channels and harbors, by Gueyard..... | 165-170 |
| 196 | 2406 | Principal canals of the world..... | 171-184 |
| 197 | 2482 | Hydraulics, Panama Canal..... | 185-197 |
| 198 | 2481 | Depth of harbors..... | 267 |
| 199 | 2451 | Gatun Dam—C. O. Ward..... | 279 |
| 200 | 2397 | Hearings before B. C. E..... | 283-393 |
| 201 | 2397 | J. F. Stevens..... | 283 |
| 202 | 2398 | F. B. Maltby..... | 296 |
| 203 | 2398 | H. F. Dose..... | 307 |
| 204 | 2399 | C. Bertoneini..... | 315 |
| 205 | 2399 | W. E. Dauchy..... | 321 |
| 206 | 2400 | J. F. Wallace..... | 346, 375 |
| | | Notes of..... | 350 |
| | | Diagram, Culebra excavation..... | 372 |
| 207 | 2448 | Excavation, summary of, July 1, 1904, to Oct. 1, 1905..... | 395 |
| 208 | 2406 | Traffic capacity, lock canal, 85-foot summit level, by Noble and Ripley..... | 397 |
| 209 | 2506 | Time to pass locks at Bohio or Gatun, by Welcker..... | 403 |
| 210 | 2580 | Equipment recommended for excavation, by I. Randolph..... | 405 |
| 211 | 2586 | Vital statistics, by Gorgas..... | 407 |
| 212 | 2405 | Transformation of lock canal into sea-level canal..... | 411 |
| 213 | 2549 | History of Panama Canal; sketch by A. Noble..... | 415 |
| 214 | 2397 | Unit prices..... | 419 |
| 215 | 2617 | Artificial waterways, their improvement and navigation..... | 421 |
| 216 | 2565 | Estimates, lock canal..... | 425 |

¹ Appointed June 24, 1905, by President Roosevelt. Gen. G. W. Davis, U. S. A.; Alfred Noble, W. B. Parsons, W. H. Burr, Gen. H. L. Abbot, U. S. A.; F. P. Stearns, Joseph Ripley, Isham Randolph, for the U. S. A.; W. H. Hunter, British Government; Eugén Tincanzer, German Government; Adolphe Guerard, French Government; E. Quellenc, consulting engineer, Suez Canal; and J. W. Welcker, the Netherlands. To consider "various plans proposed * * * for canal * * * the deliberations * * * shall continue as long as they may deem necessary * * * before they make their R. to the commission (I. C. C. No. 3)." R. Jan. 10, 1906. Majority R. in favor of sea-level plan. Minority R. for lock canal. Signed by A. Noble, H. L. Abbot, F. P. Stearns, J. Ripley, and I. Randolph. R. of I. C. C. No. 3, dated Feb. 5, 1905. Majority of commission favor lock canal plan. Minority R. (M. T. Endicott) favored sea-level plan. Secretary, Capt. J. C. Oakes, Corps of Engineers, U. S. A.

² From Sept. 1, 1905, Washington, D. C., to 30th meeting, New York, Jan. 31, 1906.

³ Translated by Capt. J. C. Oakes, secretary, Board of Consulting Engineers. (See No. 223, p. 2366 of this Index.)

Table of subjects in the reports indexed in Part V.

1907-1914.

| No. | Pages of this Index. | Reports. | Paging of the reports. | | | | | | | |
|-----|----------------------|---|------------------------|------------------|------------------|--------------------|--------------------|--------------------|--------------------|-------------------|
| | | | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 ⁴ |
| 217 | 2484 | Isthmian Canal Commission (No. 4) ¹ | 1-239 | 1-358 | 1-356 | ² 1-443 | ² 1-581 | ² 1-618 | ² 1-633 | 1-603 |
| 218 | 2480 | Chairman and Chief Engineer ³ (Lt. Col. Geo. W. Goethals, Corps of Engineers, Col., 1910)..... | 1-38 | 1-34 | 1-32 | 1-46 | 1-63 | 1-68 | 1-71 | ⁴ 1-66 |
| 219 | 2464 | Department of excavation and dredging (Maj. D. D. Gaillard, Corps of Engineers)..... | 39 | 35 | ..... | ..... | ..... | ..... | ..... | ..... |
| 220 | 2497 | Department of lock and dam construction (Maj. W. L. Sibert, Corps of Engineers)..... | 54 | 57 | ..... | ..... | ..... | ..... | ..... | ..... |
| 221 | 2522 2548 | Department, municipal engineering, motive power and machinery, and building construction (Civil Engineer H. H. Rousseau, U. S. N.)..... | 59 | 71 | ..... | ..... | ..... | ..... | ..... | ..... |
| 222 | 2508 | Division, material and supplies (W. G. Tubby)..... | 103 | 221 | ..... | ..... | ..... | ..... | ..... | ..... |
| 223 | 2479 | Geology (Ernest Howe). (D. F. MacDonald, 1912)..... | 108 | ..... | ..... | ..... | ..... | ⁶ 205 | ⁶ 565 | ..... |
| 224 | 2487 | Department, labor, quarters and subsistence, (Jackson Smith, to 1908)..... | 139 | ⁶ 247 | ..... | ..... | ..... | ..... | ..... | ..... |
| 225 | 2419 2619 | Department, civil administration (Jo. C. S. Blackburn. ¹ M. H. Thatcher, 1910-1913. Col. Geo. W. Goethals, 1913-)..... | 144 | 255 | 257 | ⁷ 363 | 413 | 455 | ..... | ..... |
| 226 | 2585 | Department, sanitation (Col. W. C. Gorgas)..... | 188 | 281 | 289 | 409 | 503 | 529 | 527 | ..... |
| 227 | 2614 | General purchasing officer and Washington office (Lt. Col. H. F. Hodges, Corps of Engineers)..... | 211 | 355 | ⁸ 353 | 439 | 537 | 561 | 561 | ..... |
| 228 | 2376 | Expenditures, classified, 1906-07 (H. L. Stuntz)..... | 214 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 229 | 2375 | Estimates, appropriations, 1908-09..... | 215 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 230 | 2419 | Organization—charts..... | 239 | ..... | 357 | 443 | 541 | 619 | 633 | ..... |
| 231 | 2476 2498 | Foundations, Gatun Locks (Maj. C. Harding, Corps of Engineers)..... | ..... | 121 | ..... | ..... | ..... | ..... | ..... | ..... |
| 232 | 2451 2498 | Gatun Dam investigations (C. M. Saville, assistant engineer)..... | ..... | 127 | ..... | ..... | ..... | ..... | ..... | ..... |

¹ Members of commission No. 4: 1907—Lt. Col. Geo. W. Goethals, Corps of Engineers, chairman and chief engineer, to Apr. 1, 1914; Maj. D. D. Gaillard, Corps of Engineers, to Apr. 1, 1914; Maj. Wm. L. Sibert, Corps of Engineers, to Apr. 1, 1914; Civil Engineer H. H. Rousseau, U. S. N., to Apr. 1, 1914; Col. W. C. Gorgas, Medical Department, U. S. A., to Mar. 31, 1914; Jo. C. S. Blackburn, to Dec. 4, 1909 (see "Thatcher" below in 1910); Jackson Smith, to Sept. 14, 1908. I. C. C. No. 4 assumed its duties Apr. 1, 1907. Appointed by President Roosevelt. **Rs.** made thereafter for fiscal year ended. 1909—Lt. Col. H. F. Hodges, Corps of Engineers, appointed Sept. 14, 1908, to Apr. 1, 1914. 1910—Hon. M. H. Thatcher, appointed Apr. 12, 1910, to June 14, 1913.

² Plus portfolio of plates.

³ Assistant chief engineer, Lt. Col. H. F. Hodges, 1909. (See footnotes, pp. 2361-2368, for Engineers.)

⁴ Prior to 1914 **Rs.**, the **Rs.** are rendered as the **Rs.** of the I. C. C. The 1914 **R.** is rendered as the **R.** of both the Isthmian Canal Commission and "The Panama Canal," dated at the "Office of the Governor"; and signed by the "Governor." Effective Apr. 1, 1914, by Executive order and in conformity with Panama Canal act of Aug. 24, 1912, "existing organization" abolished, and "the one" contemplated by the act, viz, "The Panama Canal," made effective. **P-14, 3.**

⁵ "Land Slides—Culebra Cut." (See No. 194, p. 2365 of this Index.)

⁶ Signed by 1st Lt. R. E. Wood, 3d Cavalry, U. S. A., assistant manager.

⁷ **Rs.**, 1910-12, signed by Hon. M. H. Thatcher, member I. C. C. No. 4.

⁸ Capt. F. C. Boggs, 1908-14; Maj., 1911.

Table of subjects in the reports indexed in Part V.

1907-1914.

| No. | Pages of this Index. | Reports. | Paging of the reports. | | | | | | | |
|-----|----------------------------|--|------------------------|------------|------|------------------|------------------|------------------|------------------|------|
| | | | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 |
| 233 | 2478 2497 | Designs, lock gates and movable dams (Lt. Col. H. F. Hodges, Corps of Engineers) | | 197 | | | | | | |
| 234 | 2542 | Panama R. R. Co. (H. J. Slifer, general manager ¹) | | 201 | 135 | ¹ 197 | ² 193 | ² 281 | ² 269 | |
| 235 | 2375 | Expenditures, inception to June 30, 1908 | | 218 | | | | | | |
| 236 | 2454 | Disbursing officer (E. J. Williams) | | 324 | 253 | 361 | 411 | 453 | 451 | |
| 237 | 2369 | Examiner of accounts (W. W. Warwick, 1910. H. A. A. Smith, 1911) | | 343 351 | 231 | 337 | 385 | 407 | 411 | |
| 238 | 2581 | Y. M. C. A. (A. B. Minear) | | | | | | | | |
| 239 | 2431, 2497 | First division, office, Chief Engineer, I. C. C. Designing locks, dams, regulating works, etc. (Lt. Col. H. F. Hodges, Assistant Chief Engineer; Col., 1911) | | | 33 | 47 | 65 | 69 | 73 | |
| 240 | 2382 | Atlantic division (Maj. Wm. L. Sibert; Lt. Col., 1901) | | | 43 | 111 | 101 | 109 | 111 | |
| 241 | 2410 | Central division (Lt. Col. D. D. Gaillard) | | | 67 | 137 | 133 | 143 | 139 | |
| 242 | 2531 | Pacific division (S. B. Williamson) | | | 91 | 161 | 157 | 171 | | |
| 243 | 2509 2381 2447 | Second division, office, Chief Engineer. Motive power and machinery, architecture, costs, etc. (Civil Engineer H. H. Rousseau, assistant to Chief Engineer) | | | 143 | 205 | 201 | 215 | 193 | |
| 244 | 2518 2513 | Third division, office, Chief Engineer. Meteorology, surveys, investigations, etc. (C. M. Saville, assistant engineer) | | | 181 | 275 | 247 | | | |
| 245 | 2573 | Quartermaster department (Maj. C. A. Devol, Q. M. D., U. S. A., 1909-10. Lt. Col., 1910-1912. Capt. R. E. Wood, 1913) | | | 205 | 305 | 353 | 377 | 371 | |
| 246 | 2596 | Subsistence department (Maj. E. T. Wilson, U. S. A.; Lt. Col., 1913. Lt. F. O. Whitlock, U. S. A., 1911-12) | | | 221 | 323 | 371 | 395 | 395 | |
| 247 | 2425 2581 | Clubhouses, department of (A. B. Minear, superintendent, 1909. F. C. Freeman, Secretary International Committee, Y. M. C. A., 1910-11. A. B. Dickson, 1912) | | | 338 | ³ 435 | 531 | 557 | ⁴ 555 | |
| 248 | 2462, 2549 | Estimates, cost of Panama Canal | | | 337 | | | | | |
| 249 | 2478, 2432 | Intermediate gates, advisability of using in locks (Lt. Col. H. F. Hodges) | | | | 65 | | | | |
| 250 | 2442 | Cost-keeping accountant (Ad. Faure) | | | | 243 | 289 | 293 | 273 | |

¹ R. for 1910 signed by F. Mears, chief engineer.² R. for 1911 signed by Lt. F. Mears, U. S. A.³ R. for 1910 signed by F. C. Freeman.⁴ R., 1913, signed by A. B. Dickson.

Table of subjects in the reports indexed in Part V.

1907-1914.

| No. | Pages of this Index. | Reports. | Paging of the reports. | | | | | | | |
|-----|----------------------|---|------------------------|------|------|------|-------|------|------|-------|
| | | | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 |
| 251 | 2500 | Mechanical division, department of construction and engineering (A. L. Robinson, superintendent, 1912; Lt. Col. T. C. Dickson, Ordnance Department, U. S. A., 1913-). | | | | 265 | 233 | 269 | 255 | ..... |
| 252 | 2490 | Department of law (F. Feuille). | | | | | 1 481 | 515 | 511 | ..... |
| 253 | 2610 | Treaties and acts of Congress relating to Isthmian Canal (with its special index). | | | | | 543 | 593 | 607 | ..... |
| 254 | 2460 | Salaries and personnel—tables showing increases by departments, etc. | | | | | | 565 | 583 | ..... |
| | 2584 | | | | | | | | | |
| 255 | 2471 | Fifth division, office, Chief Engineer. Lock and dam construction, "Pacific division." (H. A. Cole). | | | | | | 161 |  | ..... |
| | 2531 | | | | | | | | | |
| 256 | 2531 | Sixth division, office, Chief Engineer. Dredging, etc., of "Pacific division." (W. G. Comber). | | | | | | 187 |  | ..... |
| | 2592 | | | | | | | | | |

¹ Embracing also "acts and doings" of the counsel and chief attorney from Mar. 10, 1910, to June 30, 1911.

THE PANAMA CANAL, 1914.

| No. | Pages of this Index. | Reports. | 1914 |
|-----|----------------------|---|------------------------|
| | | | Paging of the reports. |
| 257 | 2540 | The Panama Canal (see I. C. C. No. 4 above). | 1-603 |
| 258 | 2489 | Governor (Col. Geo. W. Goethals, Corps of Engineers, U. S. A.). | 1-66 |
| 259 | 2526 | Engineer of maintenance (Col. H. F. Hodges, Corps of Engineers, U. S. A.). | 67 |
| 260 | 2459 | Electrical and mechanical engineer (C. J. Embree, assistant engineer). | 95 |
| 261 | 2522 | Division of municipal engineering (G. M. Wells, resident engineer). | 127 |
| 262 | 2483 | Chief hydrographer (F. D. Wilson). | 141 |
| 263 | 2601 | Engineer of terminal construction (Civil Engineer H. H. Rousseau, U. S. N.). | 155 |
| 264 | 2457 | Dredging division (W. G. Comber, resident engineer). | 233 |
| 265 | 2509 | Mechanical division (Constructor D. C. Nutting, U. S. N., superintendent). | 243 |
| 266 | 2527 | Canal transportation division (Capt. Hugh Rodman, U. S. N.). | 261 |
| 267 | 2597 | Chief quartermaster, supply department (Capt. R. E. Wood, U. S. A.). | 269 |
| 268 | 2598 | Permanent building division, supply department (F. Holmes, resident engineer). | 311 |
| 269 | 2372 | Accounting department (H. A. A. Smith, auditor). | 323 |
| 270 | 2588 | Department of health (Col. C. F. Mason, U. S. A.). | 375 |
| 271 | 2425 | Executive secretary. | 403 |
| 272 | 2446 | Cost-keeping bureau (Ad. Faure, cost-keeping accountant). | 443 |
| 273 | 2395 | Special attorney (F. Feuille). | 511 |
| 274 | 2614 | General purchasing officer and chief of the Washington office (Maj. F. C. Boggs, Corps of Engineers, U. S. A.). | 525 |
| 275 | 2460, | Salaries and personnel—Table of increases. | 531 |
| | 2584 | | |
| 276 | 2373, | Acts of Congress and Executive orders. | 553 |
| | 2527 | | |
| 277 | 2419 | Charts of organization. | 603 |

THE PANAMA CANAL REPORTS.

SECTION B—SUBJECTS.

A.

Abbot, Gen. H. L. (See No. 164, p. 2365 of this Index.)

Absorption.

Rocks and soils, Gatun Dam studies, **P-08**, 177.

Accidents.

Canal transportation, **P-14**, 263.

Accountant. (See Costs.)

Accountant, Cost-keeping.

Reports. (See No. 250, p. 2367.)

Accounts. (See Nos. 42, 237, 269, p. 2362, 2367, 2368 of this Index.)

Each annual report usually contains tables showing appropriations, expenditures, receipts, charges, collections, bills, meal tickets, injuries, revenues, money orders, balances, etc.

Accounting department, **P-14**, 52.

Acts of Congress covering, **P-11**, 558, 559.

Classification; construction and engineering.

P-09, 153.

General accounting, **P-12**, 407.

Isthmian Canal Commission No. 2; audited and closed, **P-05**, 21.

Material and supplies, **P-08**, 226.

Organization of department. (See No. 230, p. 2366.)

Property accountability, **P-09**, 212.

System of accounting, Isthmian Canal Commission, **P-12**, 417.

System, permanent, **P-13**, 418; **P-14**, 324.

Waterworks, **P-14**, 326.

Zone government, **P-08**, 344; **P-09**, 235;

P-10, 342; **P-11**, 390; **P-12**, 413; **P-13**, 414; **P-14**, 328.

Accounts and Disbursements, 1904-1914.

1904. System established after consultation with Secretary of Treasury and other officials. Disbursing officer selected; disbursements to be by customary U. S. methods; disbursing officer to be treasurer of the zone. **P-04**, 53.

1908. Administrative examination of the disbursing officer's accounts before their transmission to the Auditor for the War Department; inspection of the accounts of all officials of the commission, on the Isthmus, charged with the care of funds or property; time inspection by which the time books in the hands of the timekeepers and foremen engaged upon the work of all departments is checked; checking collections made by the disbursing officer from the record of claims

payable to the Isthmian Canal Commission. Examiner of accounts also the auditor for the zone. Created by Executive order Aug. 15, 1907, when the positions of general auditor and local auditor were abolished. **P-08**, 29, 30.

1909. Organization: Rearrangement of duties made Oct. 1, 1908, so that the examiner of accounts performs, in addition to the duties outlined previously, those of the disbursing officer, with the exception of the disbursement of funds, collection of accounts and claims, and issuance of coupon books and meal tickets. Property accounts were transferred to the Q. M. department. Treasurer appointed Oct. 1, 1908, to handle zone funds. Changes resulted in decreased employees and expense.

Examiner of accounts, duties: Division of accounts, in charge of the books of the Isthmian Canal Commission; classification of expenditures and statistical work; handling of bills due the Isthmian Canal Commission; and accounting for coupon books and meal tickets.

Voucher division, which handles the claims and accounts presented for payment.

Inspection division, which has charge of inspecting books and accounts of all employees having to do with the receipt and disbursement of money and the custody and issuance of coupon books and meal tickets, examining and checking time kept by foremen and in shops, and reporting the neglect or misuse of U. S. property.

The pay roll division, which examines and checks all rolls of the Isthmian Canal Commission.

Audit: Advance audit secured prior to payment.

Liability act: Claim officer of the Isthmian Canal Commission has been connected with the examiner of accounts' office, in connection with the employers' liability act May 30, 1908, subsequently modified by act Feb. 24, 1909. Classes under Isthmian Canal Commission given relief by Congress fewer than in any other branch of the service; hardship income cases. Delays caused through long distance, etc. Time would be saved through settlement of claims on Isthmus. **P-09**, 24, 25.

Disbursing officer, duties: In addition to securing, disbursing, and accounting for all funds paid out or collected, is charged with care and issuance of hotel and commissary books and meal tickets by the various departments of the Isthmian Canal Commission. **P-09**, 25, 26.

1910. Bookkeeping improvements made in the classification of expenditures and the compilation of statistics. Distribution of accumulated plant charges made; plant now shown in the expenditure accounts by divisions and by units of the work.

Four inspectors engaged inspecting accounts of bonded employees on Isthmus, and witnessing transfers. Cash accounts inspected and verified at regular intervals. Coupon and meal-ticket accounts inspected about once a month. Twice during the year cash in hands of disbursing officer counted. Money in hands of the treasurer of the Canal Zone verified.

For convenience of time inspection, Isthmus divided into 5 districts, with senior inspectors located at Ancon, Empire, Gorgona, Gatun, and Cristobal. Time inspectors increased from 41 to 46. Gangs on hourly basis inspected 3 or 4 times a week; some every day. Twelve men engaged in inspecting time keeping in all time keeping offices; examination made to see if pay rolls contain only amount of time on rolls; time of sickness, court attendance, etc., verified from certificates attached to rolls.

Claims of employees on account of personal injuries largely increased; paid on injuries, \$96,810.33; on death claims, \$21,053.22. Paid on meritorious sick leave, \$16,010.30. Separate pay roll established for compensation to injured employees.

The classes of persons under the Isthmian Canal Commission given relief by Congress are fewer than in any other branch of the service covered by law; has imposed hardships in some cases. Distance from Washington, etc., has caused much work which would not be required if claims settled on the Isthmus, where facts can be readily determined.

Examiner of accounts also auditor for Canal Zone government. More than \$1,000,000 kept on deposit in a bank in the city of Washington; principally money-order funds held pending settlement. Interest (3½ per cent), \$36,867.94, received on this deposit; credited as revenue of the Canal Zone for public improvements and schools. **P-10**, 39, 40.

1911. The number of bills rendered against employees and other individuals and companies reduced by improved methods of collection. Considerable decrease in monthly average of bills rendered; volume of business materially increased. Accounts of bonded employees charged with collection of revenues audited and balanced each month.

For the past 3 years coupon books and meal tickets issued by disbursing officer on requisition of bonded employees. Saving effected during the year by the adoption of uniform meal tickets of 30 and 40 cent denominations; 520,000 coupon books and 1,423,000 meal tickets issued. Proposition for sale of coupon books for cash under consideration.

Improvement made in handling claims, by consolidation of smaller accounts into one and the rendition of monthly claim; \$10,077,000

audited and paid; at the close of the fiscal year unpaid claims on hand, \$454,000.

Administrative examination of the disbursing officer's account made monthly. Careful permanent record maintained of unpaid salary and wages due employees of the commission record gradually increasing. Unpaid salary and wages June 30, 1911, \$217,081.86.

Supervision and direction of time keeping as questions relating thereto placed under examination of accounts; the effect a more uniform method among all departments and division of handling questions relating to time keeping; greatly improved form in which the pay rolls are submitted for examination.

The inspection of the accounts of all bonded employees continued during the year with force of 3 inspectors, a reduction of 1. Monthly accounts rendered by all financially responsible employees; accounts audited and balanced at close of each monthly period.

Time inspection increased because of field covered; gradually grown larger. Average of men engaged on this work, in addition to 5 senior inspectors located at Ancon, Culebra, Gorgona, Gatun, and Cristobal. On May 1911, senior inspectors reduced to 4; districts rearranged, with headquarters at Ancon, Empire, Gatun, and Cristobal. Average inspections daily, 11,363; in addition, 3,000 special reports.

Cash balance of disbursing officer verified; detailed count made Dec. 31, 1910, and March 31, 1911.

Under the existing agreement with the Republic of Panama whereby U. S. is to construct and maintain waterworks, and be reimbursed at expiration of 50-year period, with interest at 2 per cent per annum, there has been expended on June 30, 1911, \$1,461,303.3 in the city of Panama and \$1,225,922.50 in the city of Colon. Republic of Panama has been credited with \$568,690.45; balance still to be paid, \$2,118,535.36. Of amount credited, \$22,420.63 represents the water rental paid by Isthmian Canal Commission and Panama R. R. Co. in Panama and Colon and \$546,269.82 represents collections for water rentals.

Examiner of accounts also handles claims under employer's liability act; adjusted 1,611 claims developed from 1,573 injuries and 112 deaths. The sundry civil appropriation, Mar. 4, 1911, sec. 5, extended provisions of the injury compensation law to all employees under the Isthmian Canal Commission injured or killed, and provided that claims should be settled by chairman, Isthmian Canal Commission. Result, settlements made in considerably less time.

Accounts of all fiscal officers of zone audited and balanced each month; involved examination of 552 monthly accounts. Funds of the treasurer maintained in 2 banks in Washington and in 1 depository on Isthmus. Average monthly balance at Washington, \$981,620.75; on Isthmus, \$43,239.99, from

which \$27,763.40 interest received. P-11, 45, 46, 47, 48.

1912. The system of classified expenditures for construction of canal extended to include accounts for department of law, terminal facilities at Cristobal and Balboa, lighting and buoying the canal, inspection of lock gates, installation of lock machinery, emergency dams, and fortifications. Since establishment of method of absorbing plant charges, begun July 1, 1909, \$25,226,779.74 charged to construction costs up to June 30, 1912, leaving \$3,590,949.49 still to be absorbed. Classification of accounts recommended by the Commission on Economy and Efficiency for all U. S. departments would necessitate radical departure and confusion; recommended new system be not put in force on the Isthmus until after accounting method has been adopted for operation and maintenance of canal; approved by President.

Accounts of employees making collections audited. Bills against employees and outside parties for charges due the Isthmian Canal Commission increased; monthly average, 490.

Examination of disbursing officer's accounts made monthly. Check made of unpaid salaries and wages representing amounts earned by employees, not collected; balance, accumulating since beginning of work, \$238,634.02, June 30, 1912.

Under revised agreement with Panama for the construction and maintenance of waterworks, sewers, and pavements within Panama and Colon and for reimbursement to U. S., there were expended \$1,432,110.68 in Panama and \$1,297,566.04 in Colon, a total of \$2,729,676.72; during the same period \$757,025.76 reimbursed, of which \$219,163.92 was interest, leaving balance due U. S., \$2,191,814.88. Included in reimbursed amount is \$27,830.51, value of water used by Isthmian Canal Commission in the two cities.

Forty-nine bonded employees engaged in issuing coupon books and meal tickets; 593,900 coupon books and over 1,700,000 meal tickets issued. On June 1, 1912, the method of selling commissary books for cash by the Panama R. R. Co. was installed at several points, in addition to existing practice of issuing books for payment by pay roll deduction; reduced work of issuing clerks, increased volume of business in the commissaries during the early and latter parts of the month on the days when the issue of commissary books was prohibited. Purchase and issue of commissary books to issuing clerks transferred to Panama R. R. Co. on July 1, 1912; \$3,123,220.96 paid Panama R. R. Co. on account of commissary coupon books issued and collected by Isthmian Canal Commission.

Accounts of bonded employees charged with collection of funds inspected. A more complete and detailed checking of accounts of

post offices, hospitals, and Hotel Tivoli instituted, made necessary by increasing business and installation of postal-savings system. Effective Nov. 1, 1909, Illinois Surety Co. executed schedule bond covering employees of the Isthmian Canal Commission and the zone government who were required to give bond under the regulations; bond to run for 3 years. Arrangements made with surety company to continue bond in effect from year to year from July 1, 1912, at the rate heretofore paid—\$3 per thousand.

Claims audited and vouchers prepared 3,440, involving disbursements of \$10,440,047.25; over \$9,000,000 represents payments to Panama R. R. Co. Increase in claims largely due to payments to landowners and others in region to be occupied by Gatun Lake. Unsettled claims at end of year, \$114,176.99, of which \$73,107.05 included several large claims for land purchased but not completed for payment.

To largest division of office is assigned duty of auditing pay rolls of Isthmian Canal Commission and keeping up personnel file of gold employees. One hundred and twenty-one pay rolls each month; over 36,000 payments, involving approximate monthly disbursements of \$1,500,000. To this division is assigned duty of examining recommendations for sick leave; 5,141 cases; in payments, \$55,838.25.

In time-inspection division, districts reduced to 3; senior inspectors located at Ancon, Empire, and Gatun; reduction in inspectors made from 46 to 42.

Verification of cash balance in hands of disbursing officer made on Sept. 1 and Nov. 1, 1911; complete check, including count of all cash, made Dec. 15, 1911.

In accordance with sec. 5 of act of Mar. 4, 1911, 1,849 claims filed during year on account of injuries and 50 deaths—total, 1,899; 1,410 injury claims and 31 death claims allowed. Total amount paid during the year in these claims, \$259,993.14. From Aug. 1, 1908, to June 30, 1912, \$691,753.07 paid to employees for injuries received in course of employment, including sick leaves.

Congress has appropriated \$293,561,468.58 on account of canal work and chargeable against the authorized bond issue. To June 30, 1912, \$5,856,426.77 collected and returned to Treasury as "miscellaneous receipts," and this amount should be deducted from the total appropriations in order to determine the net amount available for actual canal purposes. On the other hand, Isthmian Canal Commission has received benefits from moneys collected which were not expected when the estimates of 1908 were prepared, namely, water rentals paid by Republic of Panama as a repayment of the amount expended in installing waterworks, sewers, and pavements in Panama and Colon, and the net receipts from sale of scrap. To June 30 Isthmian Canal Commission has had the use of \$625,654.54, received from the water rentals;

\$67,492.60, received from the sale of French scrap, and \$98,605.75, received from the sale of American scrap, or a total of \$791,752.89. Total amount available for canal work under its various departments to June 30, 1912, therefore, \$288,496,794.70.

The total zone revenues for year, \$370,272.81; expenditures, \$312,459.75. Increase in expenditures during year principally due to increase in construction and maintenance of roads and trails and payments made steamship companies on account of ocean transportation of mails from 1905 to 1912. Falling off in revenues, due to abandonment of some districts; as other towns are abandoned, revenues will continue to be reduced. Average monthly balance in Washington, \$1,121,707.64; on deposit on Isthmus, \$43,625.73; interest, \$20,784.96. P-12, 54, 55.

1913. Effective May 1, 1913, greater part of detail check made by disbursing officer of every voucher, pay roll and pay receipt discontinued; responsibility formerly carried by the clerks of the disbursing office for such check transferred to clerks in pay roll and voucher division of examiner of accounts' office. Effective Jan. 1, 1913, time-keeping division organized by consolidating the work of preparing time and pay rolls for various departments and divisions, and continued under this department until July 1, 1913, when it was transferred to the fourth division of the chief engineer's office.

The only change made in accounting system during year was extension of the classified expenditure accounts to provide for new operations, including construction of new buildings, electric transmission line, and clearing the lake, and a further separation of accounts for construction and maintenance of water-works and sewers to care for permanent water supply. Material and supply account closed at the end of the year and a new account opened, designed to provide a more exact record of material and supplies on hand and issued. Continuance of the method of absorbing plant and equipment charges resulted in distributing plant charges of \$27,550,635.24 to construction divisions to June 30, 1913, leaving to be absorbed \$1,941,488.61. Cash payments for materials and supplies furnished and services rendered adopted during the year. Collection of money due the Isthmian Canal Commission considerably reduced.

Total amount expended in city of Panama, \$1,626,267.58, and in city of Colon \$1,550,030.46, a total of \$3,176,298.04, including interest; this interest has aggregated \$270,733.72. At close of year \$975,439.71 reimbursed; included in this, \$32,785.01, value of water used by Isthmian Canal Commission in the two cities.

Purchasing and issuing commissary coupon books transferred to Panama R. R. Co.; work of department reduced but little; 60,790 hotel books and 1,363,100 meal tickets issued. In addition, \$3,235,122 worth of commissary books issued and collected on pay rolls.

Administrative examination of disbursing officer's accounts made monthly; periodical examination of fiscal officers' records of financial transactions and auditing of their accounts continued, involving complete check of records and cash and cash values in hands of over 200 officers. There were passed to disbursing officer for payment audited vouchers amounting to \$9,022,000 and pay rolls amounting to \$20,700,000. At close of business June 30 there were unaudited claims of \$57,197, the greater portion in favor of the Panama R. R. Co. Force assigned to inspection of time books reduced. A few cases of padded time books discovered; 5 or 6 negro timekeepers, foremen, and laborers convicted. One thousand eight hundred and nine claims for compensation on account of injuries filed, and 41 claims were filed on account of deaths—a total of 1,850; 1,452 claims for injuries allowed. Of the death claims, 21 were allowed; 4,715 cases sick leave allowed. Total amount expended during the year in settlement of these claims, \$224,071.72; total, Aug. 1, 1909, to June 30, 1913, \$915,824.79.

Congress has appropriated \$349,505,223.14 for canal construction, including appropriations contained in the act of June 23, 1913. Of this amount, \$10,676,950 for fortifications, of which \$4,870,000 were appropriated by act of June 23, 1913, and \$21,411.56 for relief of private persons. The balance, \$333,806,861.58, including \$16,265,393 appropriated by act June 23, 1913, appropriated for construction of canal and is a charge against the total authorized bond issue of \$375,200,900. This leaves \$36,394,038.42 available for appropriation. Actual cash balance on hand June 30, 1913, for the construction of the canal, excluding amount available for fortifications, \$20,673,904.79. Up to June 30, 1913, \$5,856,838.35 collected and returned to Treasury as miscellaneous receipts. This item represents the total amount appropriated by Congress which, after being used for miscellaneous purposes in connection with canal work, was covered back into Treasury and lost to canal appropriations.

The amount of revenues derived from rentals and taxation of zone decreased from \$259,759.68 in 1912 to \$212,266.83 in 1913. Disbursement of Canal Zone revenues increased from \$214,000 in 1912 to \$233,000 in 1913; increase being principally due to sanitary work in native villages and increased expenditure for maintenance of Canal Zone roads and trails. P-13, 58, 59, 60, 61.

1914. Department organized Apr. 1, 1914, in accordance with the provisions of the Executive order putting into effect the new organization, and consists of the auditor, Mr. H. A. A. Smith, who has supervision of the entire department and is in direct charge of the auditing and accounting work; Mr. J. H. McLean is in direct charge of disbursements, and Mr. T. L. Clear of all collections. Attempt made to revise system of accounting that has been in effect during the construc-

tion period so as to make it applicable to the operation of the canal. The assistance of the Treasury Department sought, and 2 committees visited the Isthmus; result, the approval of certain forms for use in connection with the rendition of public accounts. New classification of accounts established beginning with the fiscal year 1915.

Expenditures to June 30, 1914, in city of Panama, were \$1,761,328.49 and in city of Colon \$1,659,640.20; a total of \$3,420,968.69, including accrued interest. For work in Panama, this interest \$186,588.26, and for work in Colon, \$139,665.63. Reimbursed to the U. S., \$1,213,918.37; leaving balance of \$2,207,050.32 still due.

Forty-one thousand two hundred and thirty-three hotel books, valued at \$580,319.40, and 980,283 meal tickets, valued at \$353,253.20, issued. In addition, \$2,888,437.50 collected on the pay rolls for commissary books issued to canal employees.

Examination of accounts of 225 officers and employees having collection, custody, and disbursement of money made.

Total disbursements on Isthmus on account of salaries and wages of employees, etc., \$27,749,135.69. Disbursements in U. S., \$14,614,403.71; total of \$42,363,539.40.

Total collections during year, \$8,106,469.42; of which \$4,718,024.30 repaid to appropriations, \$379,365.02 deposited as miscellaneous receipts, and \$2,963,148.96 collected on account of Panama R. R. commissary. Balance, \$27,931.14, collected for railroad, bonding company, and other contractors.

Inspection of time books and the work of time-keepers in the field continued.

Property accounting transferred to this department on Jan. 1, 1914; for 6 months that it had charge, records maintained of purchases and sales of quartermaster's stores, and material and supplies received of value of \$7,887,431.66, of which \$4,840,245.92 were for stock and \$3,047,185.74 were for material, supplies, and equipment delivered direct to construction divisions. During this period issues from storehouses amounted to \$5,423,585.41; amount received from direct sales to outside interests, \$142,377.56.

Separate business of zone reduced materially during year. Revenue derived from rentals, taxation, etc., decreased from \$212,266.83, 1913, to \$168,076.64, 1914. Audited expenditures, \$261,064.17. In operation of post offices there was decrease in number of orders, 238,316, 1913; 198,009, 1914.

Canal clubhouses received total revenue of \$132,624.05 and expended \$133,086.95. Balance June 30, 1914, clubhouse funds amounted to \$26,513.96; outstanding obligations, \$10,534.53.

Provisions of injury compensation act May 30, 1908, superseded Apr. 1, 1914, by Executive order of Mar. 20, 1914, promulgated in accordance with authority contained in sec. 5 of the Panama Canal act. Since Aug. 1, 1908, the sum paid out in injury claims amounted to \$1,145,085.71. For the first 3 months under

the compensation order of Mar. 20, 1914, \$4,283.83 expended. This does not represent the total that will be allowed on account of injuries received during the period, as no allowances were made on account of long-continuing periods of disability nor on account of death claims.

Congress has appropriated total of \$374,048,194.59 for canal, including appropriation continued in the sundry civil act approved Aug. 1, 1914. Of this amount, \$12,050,825 for fortifications and \$22,508.01 appropriated for relief of private persons, so that there were \$361,974,861.58, including the amount covered by the sundry civil act of Aug. 1, 1914, appropriated for construction of canal and its adjuncts. Except for portion used in maintaining and operating the canal, to which \$161,608.52 were charged, and \$2,000,000 appropriated for colliers, the amount chargeable against the total authorized bond issue of \$375,200,900 is \$359,813,253.06; up to June 30, 1914, \$6,254,203.37 collected and returned to Treasury as miscellaneous receipts, so that the cost of the canal, including appropriation of Aug. 1, 1914, stands at \$353,559,049.69. P-14, 52, 53, 54.

Accounts, Examiner of. (See Accounts.)

Acetylene.

Plan for use in beacons, P-12, pl. 77.

Acknowledgments.

Act relating to acknowledgment of land deeds, P-11, 560.

Acts, P-11, 543; P-12, 593; P-13, 605; P-14, 553. (See Nos. 28, 253, and 276, p. 2362, 2368 of this Index.)

Accounts, P-11, 558, 559.

Appropriations, P-11, 549; P-12, 595; P-13, 607; P-14, 330, 553.

Allens, eliminating act from operation of 8-hour law, P-11, 560, 562.

Bonds, Panama R. R. contract with canal, P-11, 581.

Bonds, Panama R. R.; purchases of, P-11, 563.

Bonds, employees and officers, P-11, 574.

Bonds, issue of, for cost of canal, P-11, 551, 558, 573, 578, 580.

Bonds, acting disbursing officer, P-11, 572.

Claims, McClintic-Marshall Construction Co., P-14, 558.

Contracts, continuous; authorizing, P-11, 574.

Deficiency acts, etc., P-13, 607, 608.

Diplomatic and consular service, P-13, 607.

Earthquake sufferers; authorizing Isthmian Canal Commission to relieve, in Costa Rica, P-11, 575.

Employees, prohibiting increase of, P-11, 580.

Employees, injured; relating to compensation of, P-11, 568, 569, 581.

Estimates, annual; requiring, P-11, 559, 577.

Exposition to celebrate opening of Panama Canal, P-11, 578; P-13, 608.

Fleet, visiting, P-14, 559.

Fortifications, P-11, 550, 580; P-12, 597; P-13, 611; P-14, 65.

Hours of labor, etc., P-12, 595.

Isthmian Canal Commission, creating, P-11, 551.

Isthmian Canal Commission, acts and resolutions of; approved, **P-14**, 599.

Insurance, Panama R. R. prohibited from carrying, **P-11**, 566, 577, 580.

Lands, acknowledgment of deeds, **P-11**, 560.

Lands, survey of zone, **P-11**, 570, 576.

Lands, use, control, and ownership of, in zone, **P-11**, 569.

Lock canal, prescribing, **P-11**, 560.

Marine quarters, **P-13**, 607.

Material available to be used on Alaska railroads, **P-14**, 556.

New Panama Canal Co., purchase of rights, **P-11**, 549.

Officers or men of the Army and Navy retired, compensation, **P-11**, 573.

Opening, maintenance, and operation of the canal, and sanitation and government, **P-12**, 599; **P-14**, 557, 559.

Opium imports, **P-14**, 555.

Panama R. R., subsidy to U. S. abolished, **P-11**, 577.

Panama R. R., remitting payments to U. S. for equipping, **P-11**, 580.

Panama R. R., purchase of, by U. S., **P-11**, 550.

Pay for supplies; deductions from pay, **P-11**, 564.

Persons entering U. S. from zone; status, **P-11**, 558.

Prohibiting longevity and lay-over allowances, **P-11**, 571, 577, 580.

Purchases of material to be from lowest responsible bidder in U. S., **P-11**, 560.

Rights granted to U. S. by Republic of Panama; payment, **P-11**, 555, 573, 575.

Sale of old material, **P-11**, 577, 581.

Seamen, relief of, **P-14**, 558.

Spooner Act. (See Spooner) **P-11**, 549, 550.

Treaties and acts relating to canal, **P-11**, 543.

Zone, providing for government, **P-11**, 558.

Admeasurements, Board of, P-14, 262.

Administration.

Building (office), Panama, **P-05**, 28.

Building, Ancon, **P-07**, 80, pl. 95.

Building, Culebra, **P-07**, 8, pl. 1.

Buildings, permanent; erection, **P-13**, 186, pl. 54; **P-14**, 312.

Estates, **P-06**, 34. (See Estates.)

Expenses, distribution of, **P-10**, 234; **P-11**, 215; **P-12**, 309; **P-13**, 287; **P-14**, 455.

Administration, Civil. (See Civil Administration.)

Aeration.

Mount Hope Basin, **P-14**, pl. 17.

Agglomerate, Volcanic.

Character of, Isthmus, **P-13**, 582, pl. 70.

Agriculture.

Possibilities of the zone, **P-13**, 567.

Air. (See Meteorology.)

Air and Water Service, P-07, 83; **P-10**, 157, 270, 272; **P-11**, 152, 241; **P-12**, 167, 275; **P-13**, 155; **P-14**, 87.

Air Drills. (See Drills.)

At work, **P-07**, 40, pls. 15, 16.

"Ajax." (See Cranes.)

Allens.

Act eliminating from operation of 8-hour law, **P-11**, 560, 562.

Allanca, S. S.

Lockages, **P-14**, 116.

Allowances.

Act prohibiting longevity and lay-over day allowances, **P-11**, 571, 577, 580.

Alternative Line. (See Line, Alternative.)

Gatun-Bohio. (See No. 18, p. 2361 of this Index.)

Amber.

Deposits, zone, **P-13**, 577.

America, Central and South.

"All American" cables, **P-07**, 148.

American Occupation.

Reviving the commerce and industry of the zone and adjacent cities, **P-05**, 53.

Americans. (See Quarters.)

America, South. (See Quarantine.)

Analysis. (See Materials.)

Anchorage. (See Basins; Gates; Locks.)

Ancon.

And vicinity, **P-07**, 30, pl. 8.

Ancon, S. S.

Lockage, **P-14**, 119.

"Ancon," Suction Dredge.

Coaling at dry dock, **P-07**, 48, pl. 35.

Animals. (See Corrals.)

Annual Estimates. (See Estimates, Annual.)

Apparatus, Mechanical. (See Inspections.)

Approaches. (See Locks.)

Appropriations and Expenditures. (See No. 229, p. 2366 of this Index.) **P-04**, 75; **P-06**, 48; **P-09**, 152, 239; **P-10**, 346; **P-11**, 394, 395, 396, 549; **P-12**, 418, 419, 595; **P-13**, 418, 420, 609; **P-14**, 330.

TABLE A.—APPROPRIATIONS BY CONGRESS. (See P-99, 10; P-14, 330.)

| 1899.— | | | | |
|---|----------------|--|---|--|
| Act Mar. 3, 1899 (Isthmian Canal Commission, No. 1, 1899)..... | | | | \$1,000,000.00 |
| 1902-1905.— | | | | |
| Canal rights from French company (act of June 28, 1902)..... | | | | 40,000,000.00 |
| Canal Zone rights from Republic of Panama (act of Apr. 28, 1904)..... | | | | 10,000,000.00 |
| Canal connecting Atlantic and Pacific Oceans..... | | | | 21,000,000.00 |
| Act of June 28, 1902..... | | | \$10,000,000.00 | |
| Act of Dec. 21, 1905..... | | | 11,000,000.00 | |
| Deficiency for fiscal year 1906 (act of Feb. 27, 1906)..... | | | | 5,990,786.00 |
| Miscellaneous material purchases in United States..... | | 1,000,000.00 | | |
| Miscellaneous material purchases on Isthmus..... | | 400,000.00 | | |
| Payments to Panama R. R. Co..... | | 200,000.00 | | |
| Isthmus pay rolls..... | | 2,100,000.00 | | |
| Salaries and services in the United States..... | | 75,000.00 | | |
| New equipment purchases..... | | 1,565,786.00 | | |
| Reequipment of Panama R. R..... | | 650,000.00 | | |
| Total for purchase of rights and for lump-sum appropriations common to all departments..... | | | | 76,990,786.00 |
| 1907-1914.— | | | | |
| | Total. | Act of June 30, 1906 (i. y. 1907). | Acts of Mar. 4, 1907, and Feb. 15, 1908 (i. y. 1908). | Acts of May 27, 1908, and Mar. 4, 1909 (i. y. 1909). |
| Expenses in the United States: | | | | |
| Salaries..... | \$1,326,056.33 | \$251,063.33 | \$202,600.00 | \$149,000.00 |
| Incidental expenses..... | 521,179.36 | 117,179.36 | 69,000.00 | 27,000.00 |
| Construction and engineering: | | | | |
| Officers and employees..... | 27,029,212.00 | 2,650,512.00 | 2,982,700.00 | 4,000,000.00 |
| Skilled and unskilled laborers..... | 94,809,961.00 | 9,050,661.00 | 13,526,300.00 | 10,858,000.00 |
| Miscellaneous material purchases..... | 100,881,514.24 | 9,032,814.24 | 15,131,700.00 | 15,200,000.00 |
| Incidental expenses on Isthmus..... | 5,915,250.00 | 434,550.00 | 715,700.00 | 400,000.00 |
| Civil administration: | | | | |
| Officers and employees..... | 4,007,000.00 | 600,000.00 | 486,000.00 | 225,000.00 |
| Skilled and unskilled laborers..... | 191,000.00 | 50,000.00 | 50,000.00 | 16,000.00 |
| Material and expenses..... | 1,106,200.00 | 318,200.00 | 289,000.00 | ..... |
| Sanitary department: | | | | |
| Officers and employees..... | 5,091,000.00 | 550,000.00 | 766,000.00 | 700,000.00 |
| Skilled and unskilled laborers..... | 2,916,968.00 | 579,068.00 | 637,900.00 | 500,000.00 |
| Material and expenses..... | 5,287,367.15 | 822,367.15 | 800,000.00 | 375,000.00 |
| Reequipment of Panama R. R..... | 4,185,000.00 | 1,000,000.00 | 1,385,000.00 | 1,100,000.00 |
| Relocation of Panama R. R..... | 7,815,000.00 | ..... | ..... | 1,085,000.00 |
| Redemption of first-mortgage bonds of Panama R. R. Co..... | 2,298,367.50 | ..... | 2,298,367.50 | ..... |
| Sanitation, Panama and Colon..... | 800,000.00 | ..... | ..... | ..... |
| Survey of lands, Canal Zone..... | 75,000.00 | ..... | ..... | ..... |
| Fembroke B. Banton for injuries..... | 10,000 | ..... | ..... | 10,000.00 |
| Total regular fiscal year appropriations..... | 244,103,175.58 | 25,456,415.08 | 27,161,367.50 | 29,187,000.00 |
| Total deficiency appropriations..... | 20,162,900.00 | ..... | 12,178,900.00 | 5,458,000.00 |
| Total for fiscal years 1907 to 1914, inclusive, less fortifications..... | 264,266,075.58 | 25,456,415.08 | 39,340,267.50 | 34,645,000.00 |

TABLE A.—APPROPRIATIONS BY CONGRESS—Continued.

1907-1914—Continued.

| | Acts of Mar. 4, 1909, and Feb. 25, 1910 (f. y. 1910). | Act of June 25, 1910 (f. y. 1911). | Act of Mar. 4, 1911 (f. y. 1912). | Act of Aug. 24, 1912 (f. y. 1913). | Acts of June 23, 1913, and Apr. 6, 1914 (f. y. 1914). |
|--|---|--|---|--|---|
| Expenses in the United States: | | | | | |
| Salaries..... | \$150,000.00 | \$140,000.00 | \$130,000.00 | \$150,000.00 | \$153,393.00 |
| Incidental expenses..... | 75,000.00 | 70,000.00 | 50,000.00 | 50,000.00 | 63,000.00 |
| Construction and engineering: | | | | | |
| Officers and employees..... | 3,871,000.00 | 3,900,000.00 | 3,900,000.00 | 3,000,000.00 | 2,725,000.00 |
| Skilled and unskilled laborers..... | 12,000,000.00 | 13,500,000.00 | 16,500,000.00 | 11,000,000.00 | 8,375,000.00 |
| Miscellaneous material purchases..... | 10,517,000.00 | 15,000,000.00 | 19,000,000.00 | 12,000,000.00 | 5,000,000.00 |
| Incidental expenses on Isthmus..... | 1,000,000.00 | 900,000.00 | 950,000.00 | 790,000.00 | 725,000.00 |
| Civil administration: | | | | | |
| Officers and employees..... | 546,000.00 | 600,000.00 | 550,000.00 | 500,000.00 | 500,000.00 |
| Skilled and unskilled laborers..... | 20,000.00 | 20,000.00 | 20,000.00 | 15,000.00 | ..... |
| Material and expenses..... | 140,000.00 | 100,000.00 | 110,000.00 | 75,000.00 | 74,000.00 |
| Sanitary department: | | | | | |
| Officers and employees..... | 725,000.00 | 600,000.00 | 600,000.00 | 700,000.00 | 450,000.00 |
| Skilled and unskilled laborers..... | 450,000.00 | 200,000.00 | 200,000.00 | 200,000.00 | 150,000.00 |
| Material and expenses..... | 740,000.00 | 750,000.00 | 800,000.00 | 500,000.00 | 500,000.00 |
| Reequipment of Panama R. R..... | 700,000.00 | ..... | ..... | ..... | ..... |
| Relocation of Panama R. R..... | 1,980,000.00 | 2,000,000.00 | 2,750,000.00 | ..... | ..... |
| Redemption of first-mortgage bonds of Panama R. R. Co..... | ..... | ..... | ..... | ..... | ..... |
| Sanitation, Panama and Colon..... | 800,000.00 | ..... | ..... | ..... | ..... |
| Survey of lands, Canal Zone..... | ..... | 75,000.00 | ..... | ..... | ..... |
| Pembroke B. Banton for injuries..... | ..... | ..... | ..... | ..... | ..... |
| Total regular fiscal-year appropriations..... | 33,638,000.00 | 37,855,000.00 | 45,560,000.00 | 28,980,000.00 | 16,265,393.00 |
| Total deficiency appropriations..... | 76,000.00 | ..... | ..... | ..... | 2,450,000.00 |
| Total for fiscal years 1907 to 1914, inclusive, less fortifications..... | 33,714,000.00 | 37,855,000.00 | 45,560,000.00 | 28,980,000.00 | 18,715,393.00 |

SUMMARY.

| | |
|----------------------|------------------------------|
| 1899..... | \$1,000,000.00 |
| 1902-1905..... | 76,990,786.00 |
| 1907-1914..... | (See Table B) 264,266,075.58 |
| Total..... | 342,256,861.58 |
| Fortifications..... | 10,926,300.00 |
| Relief acts..... | 21,411.56 |
| Court of Claims..... | 1,096.45 |
| Grand total..... | (See Table C) 353,205,669.59 |

TABLE B.—DISTRIBUTION, 1907-1914.

(See Summary of Table A above.)

| | |
|--|----------------|
| Expenses in the United States..... | \$1,847,235.69 |
| Salaries..... | \$1,326,056.33 |
| Incidental expenses..... | 521,179.36 |
| Construction and engineering..... | 228,635,937.24 |
| Pay of officers and employees..... | 27,029,212.00 |
| Pay of skilled and unskilled laborers..... | 94,809,961.00 |
| Miscellaneous material purchases, etc..... | 100,881,514.24 |
| Incidental expenses on Isthmus..... | 5,915,250.00 |
| Civil administration..... | 5,304,200.00 |
| Pay of officers and employees..... | 4,007,000.00 |
| Pay of skilled and unskilled laborers..... | 191,000.00 |
| Material and expenses..... | 1,106,200.00 |
| Sanitary department..... | 13,295,335.15 |
| Pay of officers and employees..... | 5,091,000.00 |
| Pay of skilled and unskilled laborers..... | 2,916,968.00 |
| Material and expenses..... | 5,287,367.15 |

TABLE B.—DISTRIBUTION, 1907-1914—Continued.

| | | |
|--|----------------|---------------|
| Reequipment of Panama R. R. | \$4,185,000.00 | |
| Relocation of Panama R. R. | 7,815,000.00 | |
| Redemption of first-mortgage bonds of Panama R. R. Co. | 2,298,367.50 | |
| Sanitation in the cities of Panama and Colon. | 800,000.00 | |
| Survey of lands, Canal Zone. | 75,000.00 | |
| Relief of Pembroke B. Banton for injuries. | 10,000.00 | |
| Total for fiscal years 1907 to 1914, inclusive, less fortifications. | 264,266,075.58 | |
| Total for canal construction, rights, etc., to June 30, 1914. | 341,256,861.58 | |
| Fortifications. | | 10,926,300.00 |
| Armament of fortifications. | \$3,075,000.00 | |
| Seacoast batteries. | 5,365,000.00 | |
| Land for military purposes. | 50,000.00 | |
| Surveys for military purposes. | 62,000.00 | |
| Causeways. | 150,000.00 | |
| Submarine mines structures. | 275,200.00 | |
| Field fortifications and camps. | 394,350.00 | |
| Manufacture and test of ammunition. | 575,000.00 | |
| Submarine mines. | 111,750.00 | |
| Electric light and power plants at fortifications. | 173,000.00 | |
| Searchlights for seacoast fortifications. | 285,000.00 | |
| Sanitary clearing, filling, etc. | 210,000.00 | |
| Fire control at fortifications. | 200,000.00 | |
| Private acts for relief. | | 21,411.56 |
| Elizabeth G. Martin, June 17, 1910. | 1,200.00 | |
| Marcellus Troxell, Jan. 13, 1911. | 1,500.00 | |
| W. L. Miles, Feb. 13, 1911. | 1,704.18 | |
| Chas. A. Caswell, Mar. 2, 1911. | 1,056.00 | |
| Heirs of Robert S. Gill, July 3, 1912. | 2,520.00 | |
| Douglas B. Thompson, July 3, 1912. | 1,500.00 | |
| Allessandra Comba, July 10, 1912. | 500.00 | |
| Peter Wiggington, Feb. 7, 1913. | 500.00 | |
| Raymond R. Ridenour, Feb. 7, 1913. | 500.00 | |
| Heirs of Chas. E. Stump, Feb. 7, 1913. | 1,500.00 | |
| Parents of Edward Maher, Feb. 18, 1913. | 1,980.00 | |
| Oscar F. Lackey, Feb. 18, 1913. | 1,500.00 | |
| Pedro Sanchez, Feb. 18, 1913. | 2,000.00 | |
| John H. Cole, Feb. 18, 1913. | 1,951.38 | |
| Robert Coggan, Feb. 18, 1913. | 1,500.00 | |
| Judgment of the Court of Claims, War. | | 1,096.45 |
| Act of Aug. 26, 1912. | 196.45 | |
| Act of Mar. 4, 1913. | 900.00 | |

TABLE C.—STATEMENT OF MONEYS AVAILABLE FOR AND APPLIED TO THE PURCHASE OF CANAL RIGHTS AND COST OF CANAL CONSTRUCTION TO JUNE 30, 1914.

(See Summary of Table A above.)

| | | |
|--|------------------|----------------|
| Appropriations by Congress (Table A). | \$353,205,669.59 | |
| Less: | | |
| Appropriations for fortifications. | \$10,926,300.00 | |
| Private acts. | \$21,411.56 | |
| Judgments, Court of Claims. | 1,096.45 | |
| | 22,508.01 | |
| Collections returned to the United States Treasury as miscellaneous receipts and lost to canal appropriations. | 6,254,203.37 | |
| | 17,203,011.38 | |
| Net amount available. | | 336,002,658.21 |
| Classified expenditures (Table D). | 333,939,626.28 | |
| Less: | | |
| Fortifications. | \$6,793,089.73 | |
| Private acts and judgments, Court of Claims. | 19,008.01 | |
| | 6,812,097.74 | |
| Unapplied credits to expenditures— | | |
| Water rentals. | 1,213,918.37 | |
| French scrap used or sold. | 1,242,893.97 | |
| Unpaid rolls on June 30, 1914. | 2,429,829.15 | |
| Less unpaid amounts on rolls for fortifications. | 96,159.47 | |
| | 2,333,669.68 | |
| Subsidies from Panama R. R. Co. | 631,875.00 | |
| Dividends from Panama R. R. stock. | 344,945.00 | |
| Interest on loans to Panama R. R. Co. | 473,194.27 | |
| Miscellaneous rentals. | 239,099.57 | |
| | 13,291,693.60 | |
| Net charges to classified expenditures. | | 320,647,932.68 |

TABLE C.—STATEMENT OF MONEYS AVAILABLE FOR AND APPLIED TO THE PURCHASE OF CANAL RIGHTS AND COST OF CANAL CONSTRUCTION TO JUNE 30, 1914.—Continued.

| | |
|--|---------------------|
| Material and supplies and other unclassified items less \$71,199.88 for fortifications..... | \$10, 191, 367. 61 |
| Accounts receivable..... | 1, 408, 156. 75 |
| Due on Treasury Department transfers from fortifications..... | 610, 631. 33 |
| Unexpended appropriation balances except \$4,772,434.84 for fortifications and private acts..... | 6, 588, 550. 34 |
| Maintenance and operation of canal..... | 161, 608. 52 |
| | <hr/> |
| | 339, 606, 247. 23 |
| Less accounts payable..... | 3, 608, 589. 02 |
| | <hr/> |
| Total accounted for..... | \$336, 002, 658. 21 |

TABLE D.—DETAILED STATEMENT OF CLASSIFIED EXPENDITURES FROM THE BEGINNING OF THE WORK TO DATE.

| | Total to June 30, 1914. |
|---|----------------------------|
| Civil government and law: | |
| Administration..... | \$656, 977. 20 |
| Supreme and circuit courts..... | 396, 429. 00 |
| Prosecuting attorney..... | 39, 558. 47 |
| Division of revenues..... | 196, 019. 21 |
| Division of posts..... | 846, 424. 08 |
| Division of customs..... | 88, 853. 79 |
| Division of lands and buildings..... | 102, 046. 07 |
| Division of estates..... | 33, 601. 04 |
| Police and prisons..... | 2, 528, 523. 86 |
| Fire protection..... | 892, 311. 04 |
| Maintenance and operation of waterworks and sewers— | |
| Panama..... | 243, 701. 96 |
| Colon..... | 313, 276. 82 |
| Repairs and maintenance of pavements— | |
| Panama..... | 70, 756. 71 |
| Colon..... | 55, 490. 04 |
| Miscellaneous zone public works..... | 34, 150. 52 |
| Treasurer of the Canal Zone..... | 52, 944. 05 |
| Construction of buildings..... | 514, 526. 89 |
| Repairs of buildings..... | 25, 075. 05 |
| Survey of Canal Zone lands..... | 76, 000. 00 |
| Office of counsel and chief attorney, special attorney..... | 52, 145. 21 |
| Land office..... | 9, 419. 34 |
| District court..... | 3, 349. 14 |
| District attorney..... | 2, 089. 64 |
| Canal Zone marshal..... | 1, 687. 97 |
| | <hr/> |
| | 7, 231, 357. 10 |
| Less amount prorated to— | |
| Cost of work done for and sales to private persons..... | 8, 011. 99 |
| Operation and maintenance of canal..... | 5, 946. 58 |
| | <hr/> |
| Total, civil government and law..... | 7, 217 404. 53 |
| Health department: | |
| Administration..... | 888, 719. 22 |
| Hospitals and asylums— | |
| Medical storehouse, Colon..... | 48, 536. 77 |
| Ancon hospital..... | 4, 011, 177. 26 |
| Colon hospital..... | 1, 965, 410. 32 |
| Tobogo sanitarium..... | 131, 428. 43 |
| Santo Tomas hospital..... | 72, 447. 82 |
| Other hospitals, dispensaries, and sick camps..... | 2, 185, 540. 34 |
| Quarantine..... | 407, 668. 64 |
| Sanitation, Panama and Colon— | |
| Sanitation proper, Panama..... | 846, 537. 77 |
| Disposal of garbage, street cleaning, etc., Panama..... | 92, 957. 69 |
| Sanitation proper, Colon..... | 635, 430. 85 |
| Disposal of garbage, street cleaning, etc., Colon..... | 47, 671. 15 |
| Zone sanitation— | |
| Sanitation proper..... | 4, 246, 233. 93 |
| Disposal of garbage, street cleaning, etc..... | 537, 004. 86 |
| Construction of buildings..... | 1, 037, 745. 06 |
| Repairs of buildings..... | 110, 726. 46 |
| Corozal farm..... | 15, 798. 43 |
| | <hr/> |
| | 17, 281, 035. 00 |

TABLE D.—DETAILED STATEMENT OF CLASSIFIED EXPENDITURES FROM THE
BEGINNING OF THE WORK TO DATE—Continued.

| | Total to June 30, 1914. |
|---|----------------------------|
| Health department—Continued. | |
| Less amount prorated to— | |
| Cost of work done for and sales to private persons..... | \$10,540.01 |
| Operation and maintenance of canal..... | 10,697.69 |
| Total, health department..... | 17,259,797.30 |
| Department of construction and engineering: | |
| Atlantic district— | |
| Dry excavation (prism), construction work..... | 1,483,709.72 |
| Dredging excavation (prism)— | |
| Construction work..... | 9,076,914.85 |
| Plant..... | 127,067.21 |
| Gatun Dam and Spillway— | |
| Construction work..... | 12,205,938.44 |
| Plant..... | 1416,444.07 |
| Gatun Locks— | |
| Construction work..... | 30,004,213.49 |
| Plant..... | 109,036.36 |
| Gatun power plant, permanent— | |
| Construction work..... | 674,292.69 |
| Plant..... | 4,208.01 |
| Rock and sand account— | |
| Porto Bello rock plant..... | 17,093.84 |
| Transportation plant..... | 141,591.68 |
| Colon Breakwater— | |
| Construction work..... | 4,089,056.40 |
| Plant..... | 163,124.20 |
| Gatun-Mindi Levee..... | 119,005.31 |
| Terminal facilities, Cristobal— | |
| Construction work..... | 485,157.24 |
| Plant..... | 35,270.51 |
| Clearing channel in Gatun Lake..... | 12,014.58 |
| Trinidad River Dam, construction work..... | 37,810.65 |
| Total, Atlantic district..... | 58,017,714.17 |
| Central district— | |
| Dry excavation— | |
| Construction work..... | 86,012,107.67 |
| Plant..... | 116,837.53 |
| Dredging excavation— | |
| Construction work..... | 2,454,293.78 |
| Plant..... | 711,026.33 |
| Clearing channel in Gatun Lake..... | 157,151.18 |
| Masonry— | |
| Construction work..... | 12,432.77 |
| Plant..... | |
| Total, central district..... | 89,230,174.20 |
| Pacific district— | |
| Dry excavation (prism)— | |
| Construction work..... | 3,511,930.46 |
| Plant..... | 194,618.98 |
| Dredging excavation (prism)— | |
| Construction work..... | 11,485,691.75 |
| Plant..... | 637,027.88 |
| Pedro Miguel Locks and Dams— | |
| Construction work..... | 13,441,556.31 |
| Plant..... | 24,123.65 |
| Miraflores Locks and Dams— | |
| Construction work..... | 21,797,177.67 |
| Plant..... | 123,495.58 |
| Rock and sand account— | |
| Ancon rock plant..... | 124,417.18 |
| Chame sand plant..... | 17,724.95 |
| Miraflores power plant, construction work..... | 208,609.96 |
| Naos Island Breakwater, construction work..... | 851,338.19 |
| Terminal facilities, Balboa— | |
| Construction work..... | 7,264,838.59 |
| Plant..... | 134,175.77 |
| Total, Pacific district..... | 59,206,213.64 |

1 Credit.

TABLE D.—DETAILED STATEMENT OF CLASSIFIED EXPENDITURES FROM THE BEGINNING OF THE WORK TO DATE—Continued.

| | Total to June 30, 1914. |
|---|----------------------------|
| General: | |
| Aids to navigation— | |
| Construction work..... | \$560,686.52 |
| Plant..... | 30,941.27 |
| Permanent town sites, construction work..... | 720,624.39 |
| Permanent buildings— | |
| Construction work..... | 1,590,252.30 |
| Plant..... | 21,349.06 |
| Electric transmission line— | |
| Construction work..... | 1,916,383.43 |
| Plant..... | 752.36 |
| Permanent oil pipe line, construction..... | |
| Total, general..... | 4,840,969.33 |
| General items: | |
| Hotels, messes and kitchens, operations..... | 1 104,232.32 |
| Hotel equipment..... | 61,146.63 |
| Hotel, incidental expenses..... | 51,917.12 |
| Hotel Tivoli..... | 1 175,577.55 |
| Hotels, messes and kitchens, alterations and improvements..... | 141,569.58 |
| Lands purchased— | |
| For construction work or to be flooded..... | 552,624.93 |
| For other purposes..... | 312,141.93 |
| Joint land commission..... | 343,844.70 |
| Cristobal terminals— | |
| Docks and wharves..... | 232,595.06 |
| Dredging..... | 84,773.74 |
| Balboa terminals, docks and wharves..... | 160,887.07 |
| Panama R. R. second main track..... | 1,123,522.22 |
| Relocation of Panama R. R.— | |
| Construction work..... | 8,942,372.37 |
| Maintenance..... | 118,200.75 |
| Plant..... | 210,606.28 |
| Purchase, improvement, and repair of steamers— | |
| Panama..... | 655,942.48 |
| Colon..... | 579,812.22 |
| Cristobal..... | 716,085.43 |
| Ancon..... | 728,271.88 |
| Construction of buildings, department of construction and engineering..... | 9,611,827.29 |
| Alteration and repair of buildings, department of construction and engineering..... | 783,490.73 |
| Purchase from New Panama Canal Co..... | 40,000,000.00 |
| Payment to Republic of Panama..... | 10,000,000.00 |
| Loans to Panama R. R. Co..... | 3,247,332.11 |
| Purchase of Panama R. R. stock..... | 157,118.24 |
| Construction of waterworks and sewers— | |
| Panama..... | 682,563.28 |
| Colon..... | 616,268.09 |
| Zone waterworks and sewers, construction— | |
| Zone proper..... | 3,376,001.79 |
| Panama system..... | 490,073.45 |
| Colon system..... | 644,364.89 |
| Ancon filtration plant..... | 19,816.33 |
| Permanent supply..... | 776,857.30 |
| Maintenance..... | 1,585,635.68 |
| Paving Panama..... | 577,718.28 |
| Paving Colon..... | 534,938.72 |
| Zone roadways— | |
| Construction work..... | 1,438,798.79 |
| Repairs and maintenance..... | 261,482.83 |
| Miscellaneous grading and other municipal work..... | 4,142.62 |
| Moving and care of French material and equipment..... | 2,833.23 |
| Plant in Panama R. R. service..... | 789,506.65 |
| Permanent plant..... | 36,987.66 |
| Total, general items..... | 90,374,263.38 |
| Fortifications: | |
| Atlantic— | |
| Seacoast batteries, emplacement..... | 1,612,841.96 |
| Fire control..... | 213.98 |
| Submarine mines structures..... | 116,184.79 |
| Plant..... | 10,806.27 |
| Total, Atlantic fortifications..... | 1,740,047.00 |

TABLE D.—DETAILED STATEMENT OF CLASSIFIED EXPENDITURES FROM THE
BEGINNING OF THE WORK TO DATE—Continued.

| | Total to June 30, 1914. |
|---|----------------------------|
| Fortifications—Continued. | |
| Pacific— | |
| Seacoast batteries, emplacement..... | \$1,986,687.25 |
| Power plants..... | 15,260.01 |
| Searchlights..... | 61.65 |
| Fire control..... | 4,763.56 |
| Submarine mines structures..... | 78,836.97 |
| Causeway..... | 64,699.01 |
| Plant..... | 8,207.72 |
| Total, Pacific fortifications..... | 2,158,516.17 |
| Land defenses and barracks— | |
| Surveys..... | 46,069.10 |
| Field fortifications and camps..... | 196,450.79 |
| Total, land defenses and barracks..... | 242,519.89 |
| Guns and ammunition— | |
| Armaments to fortifications..... | 2,596,745.72 |
| Ammunition..... | 903.62 |
| Submarine mines material..... | 54,357.33 |
| Total, guns and ammunition..... | 2,652,006.67 |
| Total, fortifications..... | 6,793,089.73 |
| Grand total..... | 1,332,939,626.28 |

¹ To which should be added the appropriation, 1899, \$1,000,000, for Isthmian Canal Commission No. 1.

Aqueducts. (See Bridges.)**Arches.** (See Standards.)

Center wall, Pedro Miguel Lock. P-11, 192,
pl. 48.

Standard concrete culverts, Panama R. R.
P-09, 142, pl. 73.

Architect.

Office of. P-09, 150.

1913. Architectural force organized under Mr.
Austin W. Lord, architect, July 1, 1912, to
draw up plans of administration building,
a general scheme for establishment of new
town to be created at Balboa, near Pacific
entrance of canal, and prepare designs for
houses for permanent operating force.
P-13, 2.

1914. A force under a landscape architect was
gathered together to lay out the grounds and
construct streets, water, and sewer systems for
the Balboa town site, independent of the divi-
sion of municipal engineering. P-14, 1, 2.

Architecture and Building. (See No. 243, p. 2367
of this Index.)

Bureau of, established. P-05, 130.

Status of bureau work, July 1, 1905. P-05, 135.

Arms, Fire.

Executive order. P-14, 562.

Army.

Compensation of men and officers of, retired.
P-11, 573.

Army and Navy.

Purchases from persons in; Executive order.
P-12, 612.

Arrests. (See Civil administration.)**Artesian Conditions.**

Gatun Dam studies. P-08, 182.

Artesian Well. (See Well, Artesian.)**Asphalt, Concrete.**

Mixing plant, and road making, Balboa. P-14,
pls. 29, 30.

Assets.

Isthmian Canal Commission No. 3; statement.
P-05, 21.

Assistants, Chief Engineer. (See Nos. 243 and
244, p. 2367 of this Index.)

Asylum. (See Lepers.)**Athletics.** (See Recreation.)

Atlantic Division. (See No. 240, p. 2367 of this
Index.)

1909. Gatun Locks, excavation: Steam shovels and a suction dredge at work; 933,546 c. y. in the dry and 479,950 c. y. in the wet removed; trenching for curtain walls in progress at end of year.

Foundations: Tests have proved that the soft sandstone has sufficient resistance to bear safely the greatest loads that will be brought on it by the structures. Curtain walls to prevent any underflow. Holding qualities of sandstone tested by application of power to pull out French rails embedded or anchored into it; result, decided to give thickness of 13' to the concrete floor of the locks between the upper miter sill and the sill for the intermediate gates, and to use old French rails on hand for the anchorages. Rails being placed. Sumps also planned with telltales. In the forebay between the sill for the emergency dam and the first miter sill of the lock a 20' thickness of concrete has been adopted for the floor.

Plant, lock construction: Installed. Sand, stone, cement, to be brought in barges up the French canal to unloading docks on either side of the east division, to which a channel has been dredged. Cement shed with capacity of 100,000 barrels. Electric cranes used. Sand and stone barges tie up at west dock; unloaded with single and duplex cableways on towers; materials transported thus to stock piles with capacity of about 200,000 c. y. stone, and 100,000 c. y. sand.

Concrete mixing and placing: Electric railway from piles to cement shed, thence to mixers; automatic cars; cableways convey to deposit point; forms of steel.

Power, electric: Plant located in a temporary house, to be moved finally to spillway.

Porto Bello quarry: Plant installed for crushing stone. Machine shop equipped. Expected that plant will furnish 2,400 c. y. daily.

Sand supply: Nombre de Dios the source selected. Arrangements made for water supply, and for accommodations of employees. Dredging to secure safe harbor, and channel to sand deposits; sand dredged and sent to Gatun for concrete needed in spillway construction. Clamshell dredge to be used; under construction.

Transportation plant: 3 tugs and 14 barges, each with a capacity of 600 c. y., provided for transporting sand and stone to Gatun. **P-09, 3, 4.**

Gatun Dam, plan: Cross section changed, as noted in 1907 report, to make slopes flatter. Dam to be constructed of 2 rock piles 1,200' apart, and made of spoil from Culebra Cut, lock site, and excavation for the spillway, between which piles selected material to be deposited hydraulically, forming impervious part of the dam.

Operations: Work on south rock pile done until it reached approximate elevation of 58' crossing the Chagres River and the French

canal. Before north pile was started a suction dredge removed deposits accumulated in the Chagres River over the 1,200' length, and also over same distance in the French canal; this done, the north rock pile was started across the channels, and water areas thus inclosed were pumped out, sheet piling up to sea level permitting the accomplishment of this.

Slip, notable: When the water level in the French canal had been reduced to -10', on Nov. 20, 1903, a slip of a portion of the south toe occurred at the intersection of the rock pile and the east bank of the French canal. The depression in the crest was about 20'; length affected, 200'; a track on the north slope at about elevation 30' moved northward about 10'; the track on the south side, however, at about the same elevation was undisturbed. "The slip was of no more significance than those which had occurred on the railroad embankment in the vicinity of Gatun."

Special examination of dam, etc.: Because of a feeling of uneasiness in the U. S. concerning what the aforesaid slip suggested, the President sent the Hon. W. H. Taft (President-elect), with Engineers F. P. Stearns, A. P. Davis, H. A. Allen, J. D. Schuyler, I. Randolph, J. R. Freeman, and Allen Hazen, to report upon the matter. Plan for dam with uniform slopes to top submitted to them, placed at 105' above sea level. Reported there would be no seepage, that materials to be used would make a tight, stable, and permanent dam; that type of dam had unanimous approval; that dam more than a third of a mile in horizontal thickness at its base, and "the design upon which the work is now being prosecuted abundantly fulfills the required degree of stability, and goes far beyond the limits of what would be regarded as sufficient and safe in any less important structure"; could readily understand "how incorrect deductions may have been drawn from these occurrences" (slips of material piled at a steeper slope than would ultimately be the case); considered proper height for the crest, and concluded it could be safely reduced 20'; of opinion that the sheet piling proposed under the base of the dam could be safely omitted; recommended continuation of narrow cut-off trench to be filled with sluiced material, through upper earth stratum; changes thus proposed would facilitate work of construction and reduce cost; "a full study of all the data at hand and of the materials, and of the plans that are proposed with the above modifications leaves no doubt in our minds as to the safe, tight, and durable character of the Gatun Dam."

Dam construction: South rock fill raised to elevation 58; from this elevation material was so dumped on the upstream side as to secure the proper slope. West of the spillway spoil from various sources was dumped east of the west diversion through which the Chagres dis-

charges up to reference 24. Embankment inside north rock toe carried up to plus 35 east of the spillway; at the close of the year three 20' suction dredges depositing material over area between rock piles, which had been cleared of all vegetation and trenched to make proper bond; this fill had reached average elevation of plus 16. Total of 2,501,372 c. y. placed in dam during year. P-09, 6, 7, 8.

Excavation, through Spillway Hill, practically completed.

Gatun Lake, beginning of: Concrete floor below area to be occupied by the dam laid. As soon as side walls and floor are finished, and provisions made for construction of concrete dam, earth dam can be carried across west diversion. This will cause the river to discharge through the spillway channel. Closing the diversion will be the first step toward the formation of the Gatun Lake, the rising level of which will be subject to control by means of culverts with valves placed at a low level in the spillway dam.

Spillway: The concrete channel below the dam is 960' long and 285' wide between the walls. Floor varies in thickness from 1' at the lower extremity to 4' near the dam; side walls will average 27' in height. Sand and stone brought from Nombredé Dios and Porto Bello to temporary dock on the French canal below the dam, where two 2-yard mixers were installed. Concrete taken to site by narrow-gauge road; average length of haul, 4,520'. Floor slopes from elevation 10 to elevation 2.2; laid in monoliths 30' by 20'. Side walls in 35' sections. Regulating works will permit discharge of 140,000 cu. ft. per second, when surface of lake is at plus 87.

During year 359,821 c. y. removed from Spillway Hill, and placed on dam. There were laid, also, 30,464 c. y. concrete.

Mindi Hills section: Excavation started by steam shovels; expected that when shovels reached sea level dredges would have to continue the work because of the French canal being so close to the area, and the Mindi River also. Found that small dike and clay overlay were good protection against seepage. Excavation in dry continued. One shovel at 32' below sea level, or 9' above bottom line. Floods pumped out. Total amount removed during the year, 615,146 c. y., of which 448,287 rock.

Mindi to deep water: Dredging fleet (1 sea-going suction dredge, two 5-yard dippers, and 3 French ladder dredges) removed a total of 6,039,934 c. y. (427,005 c. y. being rock).

Rock blasted: Holes averaging 15' apart churned to 50' below sea level; loaded with dynamite.

At close of year nearly 3 miles of channel (41') completed.

Dredging done also in connection with other work, amounting to 155,073 c. y. and 49,689 c. y. rock.

Limon Bay Breakwaters: Breakwaters parallel to the axis of the channel proposed by Board of Consulting Engineers (1906), for protection

against northers and filling of channel. Plans changed to gain dissipation of entering waves, etc.

Plans and estimates prepared for 2 breakwaters; 1 about 10,000' long from Point Toro in a general northeasterly direction, and the other about 3,500' long running out from Manzanillo Bay, in a northwesterly direction. Exact location of the works to depend on investigations in progress. West one to be built first; easterly one may not have to be built; future to determine.

Marine shops at Cristobal added to and partly enlarged. Great amount of work done. P-09, 8, 9.

Municipal building and sanitary work—Gatun water supply: Existing source the Gatun River; supply never satisfactory; formation of Gatun Lake, etc., makes necessary a new source of supply; to be obtained from storage reservoir created by a dam across the Agua Clara Creek, east of the new village of Gatun.

Reservoir dam: Rock and earth fill, with a concrete wall. Capacity behind it of 612,000,000 gallons. Work on it begun.

Roads: Road from Gatun to Mount Hope continued. Considerable street, road, and sewer work done, particularly in new village of New Gatun.

Buildings: 33 of various kinds built.

Sanitary work: Regrading, cleaning, and widening of ditches. P-09, 9, 10.

1910. William L. Sibert, Corps of Engineers, U. S. Army, as division engineer.

Gatun Locks: Excavating locks continued by steam shovels, and by dredges, resulting in removal in lock chambers of 3,965,699 c. y. in the dry and 435,178 c. y. in the wet. In addition, 646,520 c. y. of material removed in auxiliary work, including dredging in French canal. Excavation in upper locks completed, including trenching for curtain walls and for lateral culverts. With exception of some trenching, excavation for intermediate locks completed. Excavation for lower locks undertaken; 375,000 c. y. remain to be removed. In preparing foundations for concrete, including excavation for trenches for lateral culverts, 33,343 c. y. removed during past 6 months. Anchorages in upper locks for tying concrete to natural rock completed, as well as the filling of curtain wall trenches around upper part of upper locks.

At close of 1909 unloading cableways in partial operation. Entire plant completed in time to permit laying of concrete Aug. 24.

Unsatisfactory operation during early stages of their use resulted in construction of additional unloading plant, consisting of sand bin having capacity of 200 c. y., so arranged as to feed into automatic cars, and 2 rock bins having capacities of 300 and 200 c. y.; derricks were erected for unloading sand and rock from barges. These supplemented by stiff-leg derrick erected at Mindi, with docking facilities, for unloading sand and stone from barges to

cars; when floods in Nov. prevented use of French canal by tugs and barges, arrangements made for unloading barges at Dock 13, using locomotive crane. Mindi plant in service Nov. to June, and plant at Dock 13 from Dec. to Apr. To deliver material unloaded by these plant additions to stock pile, and to unload in stock pile sand from Pacific division, a trestle 179' long constructed over east sand tunnel.

Unloading plant operated 24 hours per day since Apr., when searchlights were installed. Material handled, 2,458 c. y. large rock, 358,665 c. y. crushed stone, and 155,458 c. y. sand; unloading cableways handled 314,854 c. y. crushed stone and 138,813 c. y. sand.

Cement deliveries by Atlas Portland Cement Co. commenced July, 1909, and with cement shed full, the difficulties met with in operation of plant caused supply to accumulate faster than could be used. Rather than stop deliveries, instructions issued to lay as much concrete as possible, and for erection of auxiliary plant. Work was prosecuted daily, including Sundays, until Nov., when Sunday work discontinued. On Sept. 6 a 12-hour day for permanent plant instituted, and continued throughout the year.

Auxiliary plant, two 2-yard mixers similar to those used in the permanent plant, began operations Dec.; continued on basis of 8-hour day.

Permanent plant laid 409,381 c. y., including large rock placed in concrete, and auxiliary plant, 104,422 c. y.; total, 513,803 c. y. Of total amount of concrete to be placed in Gatun Locks, including the approach and wing walls, amount remaining is 1,532,297 c. y.

Average cost of the concrete per yard in place for the year was \$7.355, including plant.

With view to reducing cost of concrete, instructions issued Nov. to embed large stone in concrete to about 20 per cent of mass; up to close of year aggregated a total of 10,756 c. y. Stone selected from material shipped from central division for toes of the dam, and 2,458 c. y. of large stone procured from Porto Bello quarry in May and June. On account of excessive cost of the latter, \$6.284 per c. y. delivered at locks, this source of supply abandoned.

Collapsible steel forms used throughout for main and lateral culverts, and steel tower forms used for side and center walls.

Difficulty experienced in handling water as excavation of lock increased; during heavy rains in Nov. and Dec., 1909, pumps unable to keep down inflow. Two additional 12-inch pumps ordered.

Foundation for 150' of south approach wall put in. To the south of this section the ground is low, requiring a fill; about 90 per cent of this work completed.

Stone and sand: Crushed stone for concrete of locks and spillway obtained from Porto Bello quarry, which was developed during year with single face length of 2,500' and height

of 140'. To overcome delays, and to increase output, a No. 21 crusher ordered in Nov.; under erection; 12-hour working day increased to 16 hours Dec. 27 by operating two 8-hour shifts; continued during remainder of year.

Total amount quarried and crushed, 549,678 c. y. New pressure pump installed and pipe line laid for doing the necessary stripping by hydraulic process. Two boilers, a dynamo, engine, and condenser were also installed. Wireless station erected and clubhouse and commissary building constructed.

Sand obtained from Nombre de Dios and from Pacific division. On Apr. 8 fire destroyed 73 buildings; replaced by new buildings in rear of Nombre de Dios. Dredge "Nombre" sank in Sept. and raised in Nov.; converted into 12-inch pipe-line dredge; began pumping Mar. 1, moving toward deposits in the town. In addition, sand obtained by clamshell dredge temporarily mounted on a barge, by locomotive crane, and by dipper dredge "Chagres" operating until removed to Limon Bay in Dec. Total sand obtained from Nombre de Dios, 187,123 c. y. During year, 101,748 c. y. transported from Balboa docks in Pacific division and delivered in stock pile at Gatun.

For transportation of sand, stone, and cement, 3 tugs, 1 stern-wheel towboat, and 14 barges in use. Four additional barges under contract.

Gatun Dam: Prior to Jan., 1910, operations in construction of dam practically limited to portion between locks and Spillway Hill. Decided in Jan. that larger amount of material for toes should be procured from central division. Additional steel dump cars ordered.

Discharge of Chagres River through west diversion continued until Apr. 25, when work in spillway had been advanced to permit its use for this discharge. Efforts then concentrated toward filling in toes crossing west diversion. Some minor slips; none of importance.

At close of fiscal year, the north and south toes of dam east of Spillway Hill had reached 65' above mean tide, and hydraulic fill between the toes 51'. West of Spillway Hill the north toe carried to plus 30, and south toe to plus 35. Three dredges were pumping hydraulic fill into the west section, 2 from south side and 1 from north, and a fourth dredge was put, June 28, on east portion of the dam. Total amount placed in dam during fiscal year, dry fill 2,577,234 c. y., hydraulic fill 2,933,175 c. y.

Auxiliary work consisted in preparing west valley for reception of hydraulic material by clearing and stripping off top soil containing roots, excavating cut-off trench along axis 10' wide and 5 to 10' deep, and a bonding ditch along foot of western ridge. Surface of low-lying areas plowed. Preparatory work required excavation of about 112,000 c. y. over area of 62 acres. Area of 138.45 acres south

of dam over which dredges will operate in securing interior fill thoroughly cleared and grubbed. Area of 51.36 acres to north of dam cleared for same purpose. 7,486' trestles constructed during year.

Excavation for spillway continued during the year, removing 127,210 c. y. Excavation for foundation of spillway dam completed, except at extreme end; that for curtain, side walls, and floor fully completed. Work on floor and side walls continued; 53,632 c. y. concrete placed, at average cost for last 6 months of the year of \$8.602 per c. y. By Apr. 25 side walls, floor, and curtain walls completed, and foundation of dam sufficiently advanced to warrant turning Chagres River through spillway. Time lost owing to excessive floods, Nov. and Dec. As foundations of dam placed at elevation plus 10, and other channels of the river cut off, lake has been backed up so that its surface stands at from 16 to 20' above sea level.

Material carried to toes on west portion of dam by trestles in prolongation of toes, across channel through the spillway; as trestles are liable to be carried out during flood season, a permanent bridge across spillway constructed, consisting of 6 spans on concrete piers.

Chagres River passing through west diversion had access to the French canal, and silting resulted; necessity for closing passage; failure to do so before high water of Nov., 1909, caused considerable silting of French canal and main channel in Limon Bay, and interfered seriously with movement of sand and stone to Gatun. Dec. flood took out what was accomplished on the dam or levee in interval between floods. Work finally undertaken in Mar.; plan contemplates levee connecting Spillway Hill with Mindi Hills, having elevation of plus 25 at spillway, and sloping to plus 21 in a mile; length to be 1½ miles; 126,000 c. y. of material placed.

Channel between Gatun Locks and the Atlantic Ocean: Excavation in the dry in Mindi section continued until Nov. 20, when work was suspended due to the cut being filled by high water in Chagres River, which had access to French canal. There were excavated in the dry 91,572 c. y. earth, and 233,144 c. y. rock. Deepest part of cut had reached 42' depth below sea level at time work was suspended.

Dredges in operations between Mindi Hills and Caribbean consisted of 20-inch suction sea-going dredge "Caribbean"; 5-yard dipper dredge "Mindi"; three French ladder dredges, and dipper dredge "Chagres." Dredges removed 4,556,375 c. y. of earth and 399,285 c. y. of rock from canal prism, at average cost of 23.60 c. per c. y. There were also handled 3,206 c. y. of earth from approaches to Gatun locks, and 69,844 c. y. of earth and 55,036 c. y. of rock from French canal. Dredges also removed total of 247,537 c. y. of earth and rock from Cristobal ter-

minals, and 501,928 c. y. of earth and rock from approach channel leading from canal to Cristobal Harbor. Total silting between miles 1 and 2, 493,365 c. y., and fill for the year in mile 3 amounted to 461,922 c. y.; total fill during year estimated at 3,500,000 c. y., of which 550,000 c. y. resulted from Chagres River flood in Nov., 1909.

An old French hull, overhauled and fitted with 8 Star well drills, was worked successfully on subaqueous drilling. Dry-dock shops enlarged to provide for installation of additional machines, and the fleet of dredges, barges, and tugs in charge of the Atlantic division was maintained.

Breakwater: The location of west breakwater for protection of Limon Bay and canal channel through these waters definitely fixed Mar. 10, 1910, after examinations by soundings and borings covering extended area. Plan originally contemplated breakwater running out to a 44' depth. Decided to adopt the plan, because sufficient protected area beyond 40' contour would be obtained, and because of economy.

Preliminary work toward laying of tracks, clearing land, construction of quarters, and establishment of permanent water supply undertaken preparatory to construction of trestle for actual work of building the breakwater.

Municipal improvements: Construction of the Agua Clara Reservoir, with exception of filter plant, continued; completed during year at total cost of \$202,147.05, exclusive of the filters. Pumping station on Gatun River in operation until May 28, 1910, when supply was furnished from new system. New village of Gatun supplied with water from new system, and about two-thirds of water service required completed.

Sewer system for New Gatun completed, and progress made toward installation of plumbing.

Mount Hope-Gatun road completed. Road fenced on both sides from Mount Hope to Mindi, 5½ miles. Additional roads constructed about Gatun facilitate access to commissary and corral.

Condition of water in reservoir at Brazos Brook excellent. Owing to slight settlement of dam and dikes, they were raised to elevation 55, 1,715 c. y. of earth being required. Repairs made to concrete apron under 48' waste pipe.

To prevent erosion o. beach at Cristobal by wave action from Limon Bay, 173 concrete blocks made and placed in line along beach. Municipal improvements undertaken in Colon. Sanitary work consisted of constructing new drainage ditch 500' long; on an average 8,200' of ditch regraded, cleaned, and widened each month. P-10, 6-14.

1911. Gatun Locks: During year excavation of lower lock practically completed to include location of caisson sills. 475,875 c. y. removed

by steam shovels. Original estimated amount increased by reason of slides in lower lock, especially on east side, and at north end of east side wall it was necessary to go to 66' below sea level to secure suitable foundation. Excavation to north of caisson sills will be done by dredges; to prevent water from flooding lock while excavation in progress, concrete dam 50' high projected, at estimated cost of \$30,000 for construction and removal. In preparation of foundations for locks there were removed by shovel, crane, and hand 152,582 c. y.

Construction plant modified by changing automatic railroad from third-rail system to trolley system, resulting in more satisfactory service. The sand bin was taken down and rebuilt farther to the north on same level with stone bins previously erected. Derricks which had been used for unloading at Mindi moved about Jan. 1 to vicinity of cement shed. Erection of additional derrick, making 5 derricks, all told, and rock screen completed Feb., and used for supplying screened stone for reinforced concrete work and for making concrete piles. Auxiliary plant continued in use at original location, but part of narrow-gauge equipment, formerly operated in connection therewith, employed in carrying concrete supplied by permanent plant through chutes to places in the floors and walls where concrete was required.

During year the unloading cables were operated for 24 hours per day, except Sundays; handled 500,550 c. y. of crushed stone and 241,858 c. y. sand. Material handled during year by average of 3.93 derricks, operated on an average of 19.12 hours per day, was 294,665 c. y. of crushed stone and 166,606 c. y. of sand; a total of 461,271 c. y. Major portion of material unloaded by derricks was used at auxiliary plant. Derrick and rock screen furnished 2,003 c. y.

During year 945,525 barrels cement received into storehouse; in May, 1911, bags substituted for barrels. During year an average of 6.08 of the eight 2-yard mixers installed in the construction plant furnished 602,851 c. y. of concrete. Two auxiliary plant mixers operated on average of 9 hours a day, except between Sept. 21 and Nov. 5, 1910, when they operated on 12-hour basis, and mixed 226,476 c. y. Four $\frac{1}{2}$ -yard mixers purchased and, together with small amount mixed by hand, produced 10,175 c. y.

Product of construction plant mixers was placed by cableways or transferred by chutes to narrow-gauge equipment, from which the concrete was dumped in place. Cableways operated 12 hours per day, handling 616,661 c. y. concrete and large rock. Narrow-gauge equipment handled 286,265 c. y. concrete and large stone. Total masonry (concrete and large stone) laid by construction plant, auxiliary plant, portable mixers, and hand aggregated 911,137 c. y. Stone laid in concrete selected from material taken to Gatun from

Culebra Cut. On basis of estimated amount of concrete required in Gatun Locks, 2,095,000 c. y. masonry work at close of year 68.34 per cent completed.

Backfilling in rear of side walls of all the locks partly placed during year, that for east side of upper lock being completed sufficiently to form storage yard required by gate contractor. Backfilling to amount of 535,669 c. y. accomplished during year; 2,717 c. y. filling were placed in center wall. Ground adjacent to lower locks lower than walls and slopes toward the north so as to necessitate trestles for carrying cableway tracks; these have been built; will be utilized in making fill in rear of lock walls. To protect lock pit against material sliding into it, toe wall constructed along east side and backfilled.

Arrangements made for construction of concrete piles for foundations for upper or south middle approach wall; to be driven into fill, which was partly completed at beginning of fiscal year, extending out to intersection of center line of locks with old east diversion channel; fill completed. 31,060' of piling constructed of improvised reinforcement and 8,196' driven. Sand obtained from Pacific division. Owing to difficulties experienced with longer piles, substitution of creosoted for concrete piling under consideration.

Stone and sand: Crushed stone for concrete locks and spillway obtained from Porto Bello quarry. The single face which had been developed during previous fiscal year increased, with result that its length was 2,600' and maximum height 170'. Shortly after plant was placed in operation, Mar. 2, 1909, it was manifest that the largest crushers, No. 9, could not economically perform work because of difficulty and expense in reducing stone to proper size. A No. 21 crusher, ordered Nov., 1909, installed and put into operation Sept. 4, 1910. Difficulties experienced with the pan conveyors were remedied after they were remodeled and laid on heavier tracks. Larger crusher receives stone of maximum size handled by steam shovels. Changes resulted in increasing capacity of plant and reducing cost of production. Stone crushed during year, 864,033 c. y. Up to Sept. 17, quarry operated on basis of 2 shifts, or 16 hours per day, on which date 12-hour day adopted and continued until Jan. 16, when working day was reduced to 10 hours, and on Feb. 15 normal working day of 8 hours adopted. Material transported to Gatun in barges, whence transferred to stock piles. Porto Bello quarry also to supply rock needed for outer stone or armor of breakwater at Toro Pt. Necessary plant for this purpose ordered and wharf at Porto Bello under construction.

Sand obtained from Nombre de Dios by means of 2 cranes and 3 dredges, and from Pacific division. At Nombre de Dios the sand procured from channel and from area occupied by buildings destroyed by fire of Apr. 8, 1910. Buildings replaced in rear of town at cost of

\$9,555.05.. Cranes and rolling stock removed in May. Sand obtained, 441,919 c. y., transported in barges to Gatun, whence transferred to stock piles. Pacific division furnished 17,319 c. y. sand.

For transportation of sand, stone, and cement 4 tugs, with occasional service of a fifth, 1 stern-wheel towboat, and 18 barges in use; 4 additional barges received.

Gatun Dam: At beginning of year north and south dry fills of east portion of dam, extending from locks to spillway, had reached 65' above mean tide, and hydraulic or impervious portion between them carried to 51'. At close of year the dry fills raised to 85' and hydraulic fill to plus 73. On July 1, 1910, north and south dry fills of portion on west side of spillway were at 30 and 35', respectively, and intermediate hydraulic material at plus 16; material added during year to make elevations at close of year plus 60, plus 67, and plus 57.3, respectively. In securing this increase in elevation of earth portion of dam cross sections show 2,060,186 c. y. dry material placed in structure; also, that dredges delivered into interior portion of dam 3,758,-870 c. y. In other words, total increase during year was 5,819,056 c. y.

Amounts of material noted as resulting from cross-section measurements of June 30, 1910, and June 30, 1911, differ from aggregate amounts reported monthly as having been placed in the dam, and on which the unit costs are computed, by 1,109,619 c. y. Based on monthly reports of materials placed in the dam, the cost for year averaged \$0.3813 per c. y. for dry fill and \$0.2289 per c. y. for wet fill. The increase between these costs and those that necessarily result from the decrease in quantities shown by the cross sections will be accounted for in determining final cost of the work.

New trestle built across spillway channel at elevation 45 to give easier access to dry fill of west portion of dam, and also to replace old one in bad condition. To handle expeditiously and economically increased supply of material from Culebra Cut permitted by additional cars, an extension of track system made; at close of year there were 21 miles of tracks connected with construction of dam and auxiliary works.

Material for dry fill obtained from Culebra Cut, from lock site, from Mindi, from spillway, and from borrow pit below or north of the dam; based on car measurements, the quantities from each locality amounted to 2,065,272, 320,599, 8,179, and 332,044 c. y., respectively. Service from Culebra interrupted for 1 week during Dec. flood.

Hydraulic fill obtained from above and below dam and placed by 5 suction dredges, 3 of them operating practically throughout the year, 1 operating for 4 months, and the other for over 2 months. From Sept. 16 to Nov. 11 hydraulic filling of east section suspended to enable concentration of available dredges

on west portion of dam, to bring fill up to plus 30 before flood periods, and to permit drying out of east part of dam. From Jan. 1 to Apr. 15 pumping into east portion discontinued to determine to what extent hydraulic fill would dry out and solidify. Tests showed greater solidity on north side of fill and when operations were resumed more of sandy material was pumped along opposite side. While gradual solidification took place during dry season, central portion showed little change; unless this soft material is crowded out during subsequent construction, or hardened by addition of more sandy material, part of fill must be drained off after full height is reached.

In addition to maintenance of tracks, miscellaneous work consisted of installation of pipes, including trestles therefor from dredges to relays, of which 4 were in operation, and from relays to various points along length of dam for delivery of hydraulic fill; laying pipes for draining water and finer material from fills; stripping and spading up subsoil in advance of hydraulic fill; and clearing ahead of dredges.

Based on the estimated amount of material needed in construction of dam, it is 74 per cent completed.

In the construction of spillway, work confined to excavation necessary for east and west approach walls and in forebay. During year concrete work on forebay below reference 45 completed, and approach walls with projections or cores to tie earth portion of dam with spillway completed to elevation 95 for straight horizontal portions and slopes to south. During dry season, after discharge from lake had diminished, construction and sluicing piers begun and carried to 45' above sea level; balanced valve and 3 sluice-gate frames set; cofferdams built on both sides of channel below spillway dam, and foundations prepared and concrete placed to build sufficient of ogee of dam to bring it above high water. Subsequently 2 additional small cofferdams constructed for placing concrete of dam just outside channel flow. After beginning of wet season construction of side sections of dam and of side approach walls continued. Excavated during year, 128,383 c. y., practically completing this part of work. In preparing foundations, 32,245 c. y. material removed. Concrete placed during year, 59,651 c. y. Concrete portion 66 per cent completed. Tracks laid and back fill begun behind side walls of channel below dam. Total back fill at spillway during year aggregated 12,873 c. y.

Levee connecting Spillway Hill with Mindi Hill completed in accordance with approved plan. 51,156 c. y. dry fill placed, and suction dredge placed 20,398 c. y. of hydraulic fill in old Chagres River bed east of levee.

Channel between Gatun Locks and Atlantic Ocean: To north of locks and between them and Mindi Hills 20' suction dredge removed

423,427 c. y. from canal prism, pumping material into swamp areas to east.

Excavation through Mindi Hills flooded, as noted in last annual report; no work done until Oct., 1910, when suction dredge began to cut way from French canal into cut through barrier which had been left to exclude the water so that excavation could be done by steam shovels. Soft material had been deposited by floods; clay moved into cut by slides removed by hydraulic dredge and deposited in swamps to east of canal line; total amount handled, 401,511 c. y. After the removal of dredge in Jan., opening in barrier closed and cut freed from water by pumping. Steam-shovel work resumed Feb. 1 and carried on balance of year; removing 53,199 c. y. earth and 227,106 c. y. rock. Of material excavated, 165,000 c. y. rock used for back fill behind lock walls; balance utilized in filling trestle constructed east of Panama R. R. relocation between Mindi and New Gatun, forming levee behind which it is proposed to pump material excavated between Gatun Locks and Mindi with suction dredges. In construction of levee, 5,650 lineal feet of trestle built and filled. In addition to material obtained from excavation at Mindi, part of material removed from lock pits utilized.

Dredges which operated between Mindi Hills and deep water in Caribbean in excavating canal prism were seagoing dredge "Caribbean," 5-yard dipper dredges "Chagres" and "Mindi," and three French ladder dredges. These removed 4,516,369 c. y. earth and 487,038 c. y. rock, at cost of \$0.2215 per c. y. Silt deposited in channel during year, 2,750,000 c. y.; first 2 miles of channel surveys, June, 1910, and June, 1911, showed silting of 310,901 c. y.; in mile 3 silting was 902,038 c. y.; surveys made immediately after north of Dec. 3 to 5, inclusive, showed fill of about 370,000 c. y. In addition to dredging in prism, 442,350 c. y. earth and 4,853 c. y. rock removed from channel in front of piers 11 to 14, inclusive. Miscellaneous dredging in vicinity of dry-dock slip, Shelter Cove, in French canal, and in front of cement dock at Gatun, aggregated 51,636 c. y. earth and 18,886 c. y. rock.

At dry-dock shops, boiler-shop extension completed, the necessary jib and traveling cranes erected, condenser installed, and oil forge added. These shops maintain fleet of dredges, barges, and tugs in charge of Atlantic division.

Breakwater: Preparations made so that active operations in construction of breakwater leading out from Toro Pt. could be undertaken at beginning of fiscal year. Necessary buildings constructed, machines installed in shop erected for repair work, and construction material collected and stored. Reservoir constructed for water supply, necessitating dams which contain 54,390 c. y. of material; necessary pipe lines laid. Trestle

for breakwater started Aug. 9, 1910. Steam shovel began work in Sept., and a second one in Oct. At end of year 5,365 lineal feet double-track trestle completed, and 359,890 c. y. fill dumped from trestle. In addition, 619,152 c. y. rock dredged from prism dumped in vicinity of breakwater.

Municipal improvements: Rapid gravity mechanical filter plant authorized for Agua Clara Reservoir in Jan. at estimated cost of \$37,447. At close of year 94 per cent of concrete work completed, and filter plant as a whole 80 per cent completed.

Sewers extended 4,425', and usual maintenance work in connection with sewage system carried on.

16' macadam road built from incinerator to New Gatun, 1,400'; 12' road, 650' long, constructed from corral to lumber yard for fire protection, and 101' of road entering carrol rebuilt. 3,100' of curb and gutter constructed along streets in Gatun. In addition, municipal improvements carried on in Colon.

Sanitary work consisted of cleaning and grading 197,834' of ditches and cleaning 29,160' of road ditches. P-11, 6-14.

1912. At close of previous year excavation for construction of so much of Gatun Locks as lie above lower caisson sills completed, with the exception of excavation for lateral culverts in lowest lock. This was completed during year just ended by removal of 8,888 c. y. Material to be excavated too soft to support steam shovels; recourse must be had to dredging. Suction dredge operated in area between Dec., 1908, and June, 1909, and again between Jan. 1, 1911, and Apr. 14, 1911. Nothing further done until Feb. 1, 1912, or until after completion of temporary dam mentioned in last annual report, designed to prevent water from flooding locks during excavation. This dam, completed Jan. 15, 1912, 46' 4" high by 200' long, consists of series of reinforced concrete buttresses supporting timbers. Material used, 1,040 c. y. concrete and 98,736' b. m. lumber. Amount removed by dredges, 883,918 c. y. Estimated that 89,570 c. y. will complete excavation necessary to permit unwatering of area, so that construction of wing walls and north center approach pier can begin. To secure suitable foundation, necessary to excavate in places to 70' below sea level, which required closing opening through which dredges were admitted by an earth dam and lowering the water so that dredges could work to this depth. Material removed by dredges pumped behind levee constructed east of Panama R. R.; large portion escaped, filling Mindi River and French canal where these two cross; none reached new channel. After Mar. 31, 1912, material pumped to west of canal prism.

From July 1, 1911, cableways operated on single shift of 9 hours until June 1, 1912; subsequently occasional 12-hour shifts worked to facilitate delivery of sand from new source

of supply in Chagres River. Cableways unloaded 237,750 c. y. of rock and 109,017 c. y. sand. Five derricks were in use for unloading rock and sand until Nov. 16, 1911, when the 2 sand derricks were put out of commission; remaining 3 ceased operations Apr. 29, 1912. While in service they unloaded 139,143 c. y. rock and 53,768 c. y. sand; total, 192,916 c. y. In addition to unloading, cableways also transferred rock and sand from stock piles to tunnel hoppers.

When deliveries of crushed stone from Porto Bello were stopped, the rock screen, which had been supplied by a derrick unloading directly from barges, was dismantled, placed on a car, and moved to one side of the rock-storage pile where the cableways had access to it, and since May 23, 1912, 1 duplex cableway employed exclusively with rock screen. From July 1, 1911, until Apr. 30, 1912, when delivery of cement in barges was discontinued, cement shed cranes unloaded 448,700 barrels cement. On latter date arrangements made for delivering remainder of cement in cars, to be unloaded by hand. Amount required at end of fiscal year for completing the work, in addition to that in storage, 190,000 barrels.

During year an average of 4.30 of the eight 2-yard mixers installed in construction plant furnished 343,364 c. y. concrete (bucket measurement) and were operated daily, except Sundays, on basis of 12 hours per day, July 1 to Jan. 31, 1912, and 9 hours per day from Feb. 1 to June 30, 1912. Two auxiliary plant mixers operated on average of 9 hours a day until Mar. 11, 1912, when plant was shut down and dismantled; this plant mixed 80,544 c. y. concrete during year. An average of three $\frac{1}{2}$ -yard mixers, together with small portion mixed by hand, produced 15,758 c. y. concrete. Product of construction-plant mixers placed by cableways, or transferred by chutes to narrow-gauge equipment, from which concrete was dumped in place. Cableways operated 12 hours a day to Jan. 31, 1912; subsequently 9-hour day used, handling 309,534 c. y. of concrete and large rock. Narrow-gauge equipment handled, in addition to large stone, 100,990 c. y. concrete from mixers and 24,434 c. y. previously handled by cableways.

Work on upper or south approach pier continued throughout year on fill reported in last annual report. For foundation of the wall 73,695 linear feet of concrete piling manufactured, at cost of \$1,2156 per linear foot, and 75,474' driven. As previously reported, difficulty experienced with longer concrete piles; 51,450' creosoted piles substituted. Reinforced concrete construction used for south approach pier and 31,000 c. y. concrete laid in it during year, completing about 67 per cent. Guide walls at south end of locks completed and 6,000 c. y. placed for this purpose.

Total masonry—concrete and large stone—laid by concrete plant, auxiliary plant, port-

able mixers, and by hand, 451,025 c. y.; of this amount, 59,883 c. y. were reinforced. Of this total, 371,388 c. y. laid during 12-hour day time, so that only 79,637 c. y. laid since Jan. 31, 1912. Large stone laid in concrete, 14,194 c. y. Total concrete laid in locks to close of year, 1,875,965 c. y. On basis of 2,000,000 c. y., masonry work of Gatun Locks 93.80 per cent completed.

Slides at north end of locks continued to give trouble, interfering with extension of cableway tracks.

Back filling in rear of side walls of all locks continued. Back fill in center wall of upper and middle locks completed. Material secured from borrow pits and excavation at Mindi; 922,215 c. y. placed behind side walls, at \$0.4615 per c. y. Back fill placed during year, added to that in last annual report, makes total of 1,462,074 c. y. Total fill in center wall aggregates 97,291 c. y.

Crushed stone for concrete of locks and spillway obtained from Porto Bello quarry until Apr. 30, 1912, when crusher plant shut down. Crushing plant not operated at full capacity; output limited to 3 barges per day subsequent to June 19, 1911. Total produced to shutdown, 440,413 c. y. Material transported to Gatun in barges, thence to stock piles.

Porto Bello quarry supplying rock for outer stone armor of breakwater at Toro Pt. On Aug. 18 production begun. Quarry on site lower than quarry for crushed stone, being developed in 2 benches. 1,100 linear feet of lower bench developed; length of upper one practically 1,700'. Total quarried, 65,133 c. y. Sand was obtained from Nombre de Dios until Nov. 17, 1911, when work closed down. Total secured from July 1, 1911, to this date, 144,123 c. y. Chame sand procured from Pacific division during Jan., Feb., and Mar., when the Pacific division's equipment not sufficient to permit further shipments; 20,315 c. y. placed in stock pile from this source. Decided to use sand secured by dredge from old bed of Chagres River, and since May 15, 40,531 c. y. obtained.

For transportation of sand, stone, and cement an average of 3 tugs, including 1 stern-wheel towboat, 6 lighters, and 16 barges in use. Feb. 2, 1912, 1 tugboat and 3 barges sent around to Pacific side of canal, with intention of increasing equipment at this locality to furnish balance of sand required by Atlantic division. Tug and barges left Cristobal Feb. 11, 1912, and arrived at Balboa June 17, 1912. Sand from old Chagres River bed renders unnecessary further procurement of sand from Pacific division.

At close of previous year dry fills for east portion of Gatun Dam, extending from locks to spillway, had been raised to 85' and hydraulic fill to 73' above mean sea level, while north and south dry fills of portion west of spillway were at 60' and 67' above sea level, respectively, and hydraulic fill between the

dry fills at 57.3' above sea level. At close of fiscal year sufficient material added to raise dam length of 1,000' east of spillway to 103.35'; for balance of portion east of spillway the dry fills had reached general elevation of 96' and hydraulic fill between them general elevation of 85' for portion of dam way, north and south fills had reached general elevation of 98' and hydraulic fill elevation varying from 87' at spillway to 78' at drains located in northwest corner. In securing increases in elevation noted the cross sections taken June, 1912, show that dry fill was increased by 2,544,526 c. y. and hydraulic fill by 2,543,086 c. y. In obtaining this amount of 5,087,612 c. y. of net fill, 9,048,896 c. y. material were handled. For use in dry fill portions of the dam, 1,465,596 c. y. spoil obtained from central division between July 1, 1911, and Feb. 15, 1912. On the latter date old double-track line of Panama R. R. south of Gatun abandoned, necessitating reduction in number of trains per day that could be sent from Culebra Cut. Delivery of spoil from Culebra Cut stopped and borrow pits as source of supply adopted. Two to six steam shovels in these pits and in vicinity of spillway removed 1,467,675 c. y. In addition, 15,962 c. y. obtained from excavation through Mindi Hills, 62,689 c. y. from power-house excavation, and 448 c. y. from lock excavation.

Hydraulic fill was pumped into dam by 5 pipe-line dredges working in borrow pits upward of 1½ miles distant, maximum lift being 100'. One or two relay pumps were installed to assist dredges. A dredge on south side worked between Feb. 1 and July 6 pumping material along south toe of extreme western portion of dam, spreading foundation of structure to overcome slipping taking place in blanket over face of hill on west on which dam rests. It handled 582,410 c. y. A dredge on south side handled 594,495 c. y. in spreading fill made to support south approach pier of locks, which began to settle under weight of pier. Of this total, 36,000 c. y. handled in Sept., 1911; balance between Jan. 1 and May 31, 1912.

The construction of the dam proceeded in accord with recommendations or plans of 1906, 1908, and 1909, except that for construction purposes authority was given to continue the practically 1 on 8 slopes on upward, the change of slopes to be made later. Cheapest filling available that supplied by dredges; evident if this did not dry out properly a condition might arise which would result in producing such a head against dry fill that a blowout might occur. Accordingly, in Nov., 1909, instructions given to increase dry fill on both upstream and downstream sides, encroaching if necessary into hydraulic fill to secure masses such that any hydrostatic pressure produced by hydraulic fill would tend to act downward on exterior masses instead of upward and outward. Drying out tried in dry season of 1910-11 showed unsatisfactory

condition regarding consolidation of at least central portion of hydraulic fill in part of dam east of spillway, but it was believed if construction proceeded along lines of the instructions given the soft material would be squeezed out as height of dam increased.

In order to determine settlement taking place in dam, observations were required on hubs located as described in last annual report and monthly record kept. Observations showed gradual settlement until on Oct. 12, 1911, movement occurred in east half of dam. On north side, for 1,000', top of dry fill settled 4 or 5'. This vertical movement accompanied by horizontal movement, greatest at 75' contour, where it amounted to 14.2', and gradually diminishing down slope to 31' contour, where horizontal displacement about 3.2' in length of about 700'. While the crest of the slope moved downward, lower portions of slope bulged upward to certain extent, measurements showing rise of 1.25' on 60' contour at point 1,150' from center of spillway channel. Movement was within dam, as verified by test pit sunk where bulging greatest, which showed masses of dry fill desired had not been secured. Material was piled to north of 31' contour, giving additional weight to toe, and blanket of spoil to make continuous slope from 31' berm to top of dam placed over north face. No motion after this additional weight had been added other than gradual settlement. In addition to these steps, instructions issued to pump sand into hydraulic fill along 1,000' length where settlement occurred at top, and to bring the dry fill up on regular slopes, gradually crowding hydraulic fill until the distance between dry fills on two sides was 25', after which hydraulic fill to be covered with red clay and tamped wet until height of 103.35' reached, where thickness would be 100'. Proposed to continue observations and ultimately to bring dam to 105' above sea level and, if necessary, subsequently to raise it to height originally advocated.

Movement occurred about same time on south slope, greatest lateral motion being 6.5' on 75' contour. On the 60' berm there was lateral movement of 0.5'. Heavy toe added on 60' level, extending from dam to spillway channel wall and to berm.

In adapting cross section proposed by the board in 1909 to the ground, slopes modified where dam is practically a blanket over spur projecting from hills on west side against which dam abuts; here the plan proposed of making upstream slope 1 on 4 and downstream slope 1 on 5 was approved. As dry fill was added on upstream face of hill a condition developed indicating that material on bottom extending out from foot of hill would not bear the weight; necessary to flatten slope, which was accordingly authorized to be 1 on 7.67. Heavy fill placed on ridge that was pushed up outside of toe of this slope, and, in addition, dredge operating to south of dam extended foundation outside of rock fill by dis-

tributing material over bottom, adding to spread given foundations.

In construction of spillway, work confined during first half of year to east and west flanks, where abutments, ogee, and crest piers were completed to elevation 69, or top of dam. With the beginning of dry season about two-thirds of the central section, held at elevation 10 except for construction piers, inclosed with a cofferdam, and the concrete work carried well above water level. Full closure then made within cofferdam covering balance of central section. Three Stoney gates and one cylindrical valve installed to control flow through four undersluices. Program contemplated completion of central portion to elevation 50 by Apr. 1, so that lake could be allowed to rise to this height at dam. This done for total length, except about 120', which remains at elevation 45, portion to be built up to required height in advance of water reaching 45' level. Though gates controlling undersluices closed on Apr. 30 and lake allowed to rise, they were subsequently raised, as noncompletion of lock gates did not permit proposed lake level. Sluice gates raised and lowered, depending upon circumstances, until Aug. 17, 1912, when condition of lock gates was such they could be closed. On this date lake had reached 32.01'. Trestle built from eastward at elevation 95 and derrick erected near west abutment to enable construction work on east and west flanks to proceed during first half of current year. Total concrete laid, 58,666 c. y.

Plans prepared by first division O. C. E. for hydroelectric power plant, below spillway, having been approved, excavation started in May; total accomplished during the year, 72,119 c. y. During year 10,062 c. y. back fill placed about the spillway.

In channel between Gatun Locks and Atlantic Ocean excavation in dry continued through Mindi Hills and, with exception of dike separating cut from French canal, completed Feb. 24, 1912. Sluicing operations reported last year completed by removal of 1,000 c. y. mud. Two steam shovels removed 56,703 c. y. earth and 368,169 c. y. rock. When dry excavation of channel completed, barrier blown up, for which purpose 81,750 linear feet drilling done and 183,150 pounds dynamite used. Of material removed from Mindi in the dry, about 350,000 c. y. rock used for back filling at Gatun, cost of dumping being charged to locks.

Dredges which operated between Mindi Hills and deep water in the Caribbean in excavating from canal prism were seagoing dredge "Caribbean," 5-yard dipper dredges "Chagres" and "Mindi," and the French ladder dredges "No. 1" and "No. 5." They removed 3,859,445 c. y. earth and 495,595 c. y. rock. Silting during year amounted to 3,036,000 c. y., making net earth excavation in this section 823,445 c. y. Between Mindi and Gatun dredges "No. 4" and "Sand-

piper" removed 515,787 c. y. earth south of old Panama R. R. line. Total dredging in prism aggregated 4,870,827 c. y. In addition, 883,918 c. y. earth and rock removed just south of locks. Miscellaneous dredging outside prism included 3,762 c. y. from dry-dock slip, 72,798 c. y. from east diversion at Gatun, 23,496 c. y. earth and 872 c. y. rock from east diversion at Mount Hope, 4,767 c. y. earth and 2,181 c. y. rock in front of dynamite deck at Mindi, 80,296 c. y. earth from pit for rock dump north of Gatun Locks, 2,785 c. y. earth from front of fortification trestle at Mindi, and 2,450 c. y. earth from slip at cableways. Total output for year from canal prism and lock site, 5,754,745 c. y.; and from accessory works, 444,327 c. y.

At dry-dock shops, oxyacetylene and thermit welding processes put in operation; shops maintained fleet of dredges, barges, and tugs in charge of Atlantic division.

Breakwater extending from Toro Pt. not intended to give protection against the waves produced by the trade winds, which generally are from the northeast. So far as the waves caused by the latter winds are concerned, consensus of opinion among seafaring men that no shelter is necessary; on this account construction of east breakwater has not been undertaken. While present indications point to necessity of construction of east breakwater for maintenance of channel against silting, expenditures in this direction not yet warranted.

During fiscal year 5,514 lineal feet of double-track and 48 lineal feet of single-track trestle completed, making total length of trestle on July 1, 1912, 10,927'. Fill dumped from trestle, 460,040 c. y.; in addition, 6,498 c. y. used for ballast and 4,680 c. y. furnished fortifications, all procured from Toro Pt. quarry, shut down June 22, 1912. Porto Bello rock for exterior of breakwater delivered Aug., 1911. Rock shipped in barges, transferred to Lidgerwood trains by locomotive cranes, and plowed off on the north side of the trestle; 65,133 c. y. unloaded in this way. Of rock removed by dredges from canal prism, 510,730 c. y. dumped in vicinity of trestle.

Filtration plant authorized for Agua Clara Reservoir Jan., 1911, completed Dec. 29, 1911. Due to shortage of water in Colon, Toro Pt., and Porto Bello, water transferred from Gatun water supply in barges, from Jan. 25 to May 23 to Toro Pt., from May 10 to June 24 to Cristobal, and from May 9 to 16 to Porto Bello.

During year usual maintenance done on roads, sewers, and drains. 10,000 sq. y. macadam laid and repaired, 15,000 lineal feet road ditches cleaned, 2,800 lineal feet curb and gutter laid, and 3,000' of sewers installed. In addition, municipal improvements carried on in Colon.

Sanitary work consisted of cleaning and grading 336,000 lineal feet ditches; constructing 8,000 lineal feet of ditches, and lining with

concrete 2,300 linear feet of ditches. **P-12**, 12-24.

1913. The work of excavating channel between Gatun Locks and deep water in Caribbean was in charge of Atlantic division until May 1, 1913, when it was transferred to sixth division of O. C. E. On this same date the dry dock and shops transferred to mechanical division.

At beginning of fiscal year dredges at work excavating area north of caisson sills of locks, within which flare or wing walls and north approach pier to be constructed. Wing walls built on rock and approach pier partly on rock, but for greater part on piling. For the former it was necessary to remove material to 70' below sea level to uncover rock; as dredges could excavate only to 41', level of the pool had to be lowered for them to perform the work. Clay dam built across cut excavated by dredges to reach this area, and water in resulting inclosure lowered by pumping with dredges. Excavation for flare walls carried well to rear and made sufficiently wide for walls and for rock fill to sustain the material back of it from sliding as water lowered. Fill also formed foundation on which to carry cableway tracks. Expected that by extending the rock fill to north cableway tracks could be laid, so that construction plant could build entire length of center approach wall; because of softness of material this plan had to be abandoned.

For approach pier dredges removed material to 55' below sea level and for width of 140' along center of excavated area. On completion of dredging, Nov., 1912, pit was filled with water, clay dam removed, dipper dredge and suction dredge taken out, and suction dredge, pump barge, and 2 coal barges left inside the area. Clay dam rebuilt and water pumped out, exposing foundations. Dredge grounded at 55' below sea level and used to keep water below foundations. Two steam shovels worked over portion of center wall foundations where rock appeared, and excavated such material from approach to west locks as could be handled. Channel excavation and preparation of foundations accomplished by shovel, crane, cableways, and by hand.

Flare walls built solid. North approach wall or pier 58' wide and consists of piers placed 50' centers longitudinally and 40' laterally, in which direction they are connected by arches of 22' span, while longitudinally they are spanned by steel girders incased in concrete. In plan the piers are 10' by 18'. Piers rest upon a slab of concrete, heavily reinforced with old rails near top and bottom, built on piling. First 6 of openings north of locks closed by curtain walls to prevent objectionable cross currents while locks emptying. Plan originally contemplated pier 1,200' long, measured from angle of flare walls. Dec., 1912, division engineer recommended wall be shortened 200'. Slide

occurred at north end of pit when it was dewatered, covering foundation of this portion of wall; removal of this slide, which would have to be done largely by hand, would be tedious and require considerable time; furthermore, this would make north approach wall correspond more nearly to one at south, which is 994.5' long. Local conditions where south wall terminated such as to make cost of building additional length prohibitive; however, as considerable saving in time of completion would result, recommendation was approved and length of north approach pier fixed at 1,000'. Foundation for pier required 5,000 piles, aggregating 200,549 linear feet. For curtain walls 5,657 sheet piling driven. On Jan. 25, 1913, while this work in progress, slide occurred on east side, which covered large part of foundation with 6 to 18' of material, destroying 2 pile drivers and delaying work. Material was partly removed by crane and hand, but largely by sluicing and pumping, dredge handling material from sump.

Concrete in flare walls laid by cableways, which were also used for so much of the center pier as could be reached. Remaining portion of latter laid by cranes and dump cars operated by construction locomotives, concrete being supplied by cableways through hoppers and chutes. Total concrete laid in locks, 164,750 c. y.; 5,530 c. y. concrete used for construction of lampposts and bases, snubbing-button bases, machinery-room covers, control house, paving between upper lock and Panama R. R. station, under emergency dams, and for work of first division, making total handled by Atlantic division 170,280 c. y. Total concrete laid in locks by Atlantic division to close of fiscal year, 2,040,715 c. y.

Last fall estimated concrete of locks would be completed by July 1, 1913. By shortening north approach pier 200', all concrete, except miscellaneous finishing, completed June 14, 1913. Miscellaneous work consists of lamp-post bases, snubbing-button bases, mooring-post bases, stair-wall parapets, paving, and the closing of a few openings left for construction purposes.

In addition to handling sand from barges to stock pile, unloading cableways were used for transferring sand and rock from stock piles to tunnel hoppers and for loading rock for sale to outside parties. Sufficient broken stone in storage; none crushed during year. 171,866 c. y. taken from storage pile for use by the division, 1,568.5 c. y. for issue to other divisions and sale to outside parties. To storage pile on hand at beginning of year 43,851 c. y. sand added, secured from Chagres River by suction dredge. Cement, in bags, amounting to 225,000 barrels, received and handled, partly by barges from ship and crane into cement shed, partly by car transfer, then by hand into shed. 227,000 barrels issued for use.

Back filling of side walls and filling of center wall made of material from borrow pits and from canal prism, aggregating 637,226 c. y., all removed by steam shovels. Of this, 565,756 c. y. placed behind side walls, and 15,872 c. y. in center wall by cableways. Total material used for back fill to June 30, 1913, 2,027,830 c. y. placed behind side walls, and 113,163 c. y. placed in center wall. Teams and scrapers put to work Mar., 1913, and continued to end of year, bringing back fill to final grade and for construction of wagon road along east side of locks. About 1,500 c. y. handled in this way. Decided to pave exposed surface of back fill between locks and Panama R. R. station with concrete slabs 5' by 5' by 6", extending from elevation 78 to top of slope, and laid on from 4 to 6" of broken stone from Ancón quarry. Below concrete paving slope to be covered with riprap down to elevation 74. On June 30, 1913, surfacing of broken stone completed and 125 sq. y. of concrete paving finished.

Lamp-posts and bases for illuminating locks constructed, bases erected, and lamp-standards cast; of the latter, 211 were made.

Control house for Gatun Locks begun Apr., 1913.

At close of previous year Gatun Dam raised to 103.35' for 1,000' east of spillway, and for balance of this portion of dam dry fill had reached 96' and hydraulic fill between them 85'. On portion of dam west of spillway north and south fills had reached 98' and hydraulic fill 87' at spillway and 78' at drains in northwest corner of dam.

At close of current year sufficient material added to raise dam to full height, with 3 to 5' additional along axis for settlement. Dry fill secured from borrow pit, beyond west end of dam, and clay used to top off hydraulic fill from borrow pits north of dam and in vicinity of locks. Two to six steam shovels engaged in procuring this material removed 2,159,159 c. y.; 922,877 c. y. were rock.

Hydraulic fill supplied by 3 pipe-line suction dredges operated in borrow pits $1\frac{1}{2}$ miles distant. Total handled, 493,145 c. y. Hydraulic fill stopped Sept., 1912. No complete survey made during year, but partial cross sections run monthly until Feb., 1913, from which material in place calculated, and for following months, estimates based on borrow-pit measurement. Estimated dry fill deposited aggregated 1,714,367 c. y. Total consolidated fill for year, 1,967,841 c. y. Levels run monthly to determine settlement, observations being taken on hubs placed about 250' apart longitudinally and about 100' apart transversely.

On Aug. 29 bulging and sliding movement began along north slope of dam near west end and continued. There could be no question that the movement was within the dam itself, consequently test pits not resorted to, as in the case of the movement on the east part of the dam a year ago. Line of

wash borings with drive samples made. Borings indicated relative proportions of hydraulic fill and dry fill which would bring about the desired section of hydraulic fill—wedge shape, with the point down—not secured; on the contrary, hydraulic fill in section was opposite of this. Evident provision had not been made against slipping of dam material on itself. As in the case of the movement on north face of east portion of dam, toe was heavily reinforced and slope flattened to an average of about 1 on 7.67.

To prevent injury to dam from wash of south slope, by waves in lake, necessary to pave portion of slope. Decided to use riprap laid on broken stone. Estimated waves 5' in height might exist, so paving was extended over that portion of the slope lying between elevations 74 and 92. Layer of crushed stone laid over dam within these limits to thickness of 4". Over this riprap was placed to protect broken stone from waves. Area of 115,740 sq. y. covered with crushed stone, of which 15,740 c. y. were used, completing this work in Apr. Riprap placed at close of fiscal year aggregated 68,739 c. y., covering area of 102,030 sq. y.

At beginning of year spillway dam had been completed, including abutments; ogee, and crest piers, to elevation 69, while central portion, 370' in length measured along the crest, practically completed to elevation 50. Four sluices had been left—three closed by Stoney gates and one by a cylindrical valve—to permit control of water during construction of dam. During year the flanks carried to completion, while central portion, finished to elevation 50, was left at this height to allow flood waters to escape. Work on closing these openings commenced as soon as level of lake could be dropped below elevation 50 and work pushed. Trestle erected on flanks at elevation 95 and extended entirely around dam when full height of 69' reached. From it the west abutment and part of crest piers built to elevation 115, or full height, and 14 crest gates installed. On completion of west abutment trestle beside each gate dismantled in succession and upstream side of pier, interfered with by trestle, constructed. In Feb. sluice operated by cylindrical valve closed, but it was impracticable to complete remaining crest piers and east abutment until the 3 remaining sluices could be closed. Lake, controlled by sluices, held at about elevation 32 until last week in Aug., when completion of guard gates and caisson sills of locks permitted it to be raised. During Nov. and early part of Dec. water reached maximum elevation of 56.3, notwithstanding flow through opening left in central part of dam and through sluices. After rainy season water lowered to elevation 48 so that work might be resumed on spillway, and sluices finally closed June 27, as plans contemplated raising lake to full height during "present" rainy season, starting with water at Gatun at ele-

vation 50, July 1, 1913. Elevation of lake at Gatun on this date, 49.15. Advantage taken of flow over spillway to dispose of floating islands, snags, and old timbers. Anchorage basin to east of channel and channel itself for 6 miles south of Gatun cleared. Obstructions in channel 14' thick. Such aggregations broken into small sections by floating pile driver.

Concrete laid in spillway for year, 21,719 c. y. Excavation, 175 c. y. Total concrete thus far placed in spillway, 224,132 c. y.

Architectural features added to plans prepared by first division of O. C. E. for hydroelectric power plant below spillway at estimated cost of \$147,950; its construction undertaken by Atlantic division. Excavation completed, and during year 14,948 c. y. material removed—rock and earth; in preparation of foundations, 11,684 c. y. Total excavation to date, including preparation of foundations, 98,751 c. y. Steel work for structure advertised; lowest bid amounted to \$25,456.37. Successful bidder offered to erect steel structure in 45 days at additional cost of \$6,496.74. Atlantic division estimated \$4,643. This work assigned to Atlantic division. Erection of steel work commenced May 16; at close of year about 65 per cent had been erected and 90 per cent of the field rivets driven. Penstocks incased with concrete, except for curved portions near head gates. Forebay walls with trash-rack and stop-plank grooves about 95 per cent completed.

West breakwater, Limon Bay, continued. 599' of trestle, single-track, added, making total length of trestle 11,526'. Total rock received from Porto Bello and placed on breakwater, 183,762 c. y., of which 102,508 c. y. handled from barges to Lidgerwood cars by locomotive cranes and subsequently plowed off. Balance placed by derrick barges. In addition, 220,433 c. y. rock removed from channel by dredges and dumped on breakwater. Small pile wharf built for handling rock by cranes to cars, and 3,000 c. y. sand dredged by derrick barge for barge berth.

Quarry at Porto Bello worked during year for supplying large rock required for breakwater. Because of peculiar formation of hill it was found sufficient large rock could not be secured from the 2 benches to complete breakwater; development temporarily suspended. In Nov., 1912, operations resumed by steam shovel in old crushed-rock quarry, above the 2 benches; after the first of the year 2 more shovels put to work on this higher level. Broad-gauge equipment, substituted for narrow gauge previously in service, placed in operation on Oct. 5, 1912, and output increased from 2 to 3 barges per day. In securing rock of proper size about 60 per cent of output wasted.

Waves from trade winds have been washing shores of Limon Bay in vicinity of canal entrance; survey made Mar., 1913, showed that channel in vicinity of shoreline, dredged to full

depth, had filled as to give available depth of only 27' and that in center of channel. Estimated that silt deposited in channel during previous 12 months was 2,213,032 c. y. On investigation, believed this silting is due to wave action disturbing soft material of bottom of bay. Atlantic Fleet during its visit anchored under lee of west breakwater; at times trade winds made it difficult for small boats to reach ships. General Board of the Navy advocated detached breakwater for protection of anchorage area. Construction of detached breakwater on east side contemplated. Investigations undertaken to find quarry more accessible than Porto Bello. To still further protect channel against material washed from shores of bay experimental stone dikes to be constructed.

As previously reported, water supply for Colon not adequate; plans submitted for modern filtration plant and pumping station. Project approved on July 12, 1912, at cost of \$193,768. It contemplates tunnel through divide separating Gatun Lake from Brazos Brook Reservoir, within which is to be laid a 20" main, with its inlet at an elevation of approximately 5' below extreme low-water level in Gatun Lake. This pipe line, 600' in length, extends to Brazos Brook Reservoir, and by means of control house water in reservoir is maintained at minimum low level of 1' below spillway crest, so that additional amount of water required over that furnished by the watershed will be taken from Gatun Lake. Additional 20" main laid from Brazos Brook Reservoir to Mount Hope. In connection with these there are included aeration basin, sedimentation basin, and filters after passing which water enters clear-water basin having capacity of 650,000 gallons. Basin connected by underground conduit to pump sump beneath floor of pumping station. Pumps will be operated electrically. Work commenced Oct., 1912, and at close of the year all work between Gatun Lake and Brazos Brook Reservoir practically complete. Pumping station completed ready for installation of machinery; filter building completed to and including operating floor; sedimentation basin 75 per cent completed; and foundations and floors of mixing chambers and aeration basin laid. In addition to operation of purification plant at Agua Clara Reservoir, usual maintenance work carried on.

Approximately 70,000 sq. y. macadam laid and repaired, 44,000 linear feet road ditches cleaned and dug, 9,500 linear feet of curb and gutter laid, and 4,600' of sewers installed. In addition, municipal improvements carried on in Colon. Of appropriation of \$800,000 made by act of Mar. 4, 1909, for extending municipal improvements in Colon and Panama, there were expended during year in the former locality \$53,939.15, making total in Colon to end of year \$505,909.54. In addition to completing improvements previously undertaken, money expended in replacing curbs and gut-

ters which had settled, resurfacing, and in extending improvements to include G Street between Second and Ninth Streets, and in extension of E Street to its intersection with the Mount Hope Road.

Sanitary work consisted of cleaning and grading 237,000 linear feet of ditches; constructing 53,000 linear feet of ditches, and lining with concrete 26,000 linear feet of ditches. In addition, 6,800 linear feet of pipe and tile drains were laid and cleaned. **P-13, 13-22.**

1914. Effective Oct. 15, 1913, concrete work remaining to complete the construction of the locks at Gatun transferred from the Atlantic division to first division, which could do it in connection with installation of themachinery, and towing tracks with the same supervisory force; similar unfinished work in connection with the Pacific Locks was also transferred to the first division at the same time. **P-14, 2.**

Remaining work in Atlantic and fifth divisions having reached such a stage as not to justify the administrative charges that the existing organizations called for, these two divisions were abolished Feb. 1. Their property accountability transferred to quartermaster's department and their records turned over to fourth division, O. C. E. **P-14, 2.**

Construction of west breakwater and operation of Porto Bello quarry transferred to second division, O. C. E., while work remaining at Gatun Dam, El Cano saddle, back fill at Miraflores, Miraflores spillway channel, Ancon quarry, and the sluicing at Gold Hill were placed directly under the chief engineer. **P-14, 3.**

Atmosphere. (See Meteorology.)

Attorneys. (See Nos. 252, 273, p. 2368 of this Index.)

Chief attorney. (See Orders, Executive.)

Prosecuting attorney, duties defined by zone laws. Acts as legal adviser to the governor; prosecutes offenses against laws of the zone; investigates and settles claims against the Isthmian Canal Commission. Work expected to assume large proportions as work of construction increases. **P-05, 68.**

Special attorney's office, **P-14, 409, 511.**

Auditing. (See Nos. 75 and 149, pp. 2363, 2364 of this Index.) (See Accounts.)

Canal costs to be audited by Auditor for War Department, **P-11, 558.**

Final audit of all expenditures should rest with Isthmian Canal Commission, **P-50, 121.**

Organization for canal, zone, and Panama R. R., **P-05, 21.**

Auditor. (See Nos. 123 and 269, pp. 2364, 2368 of this Index.)

Audits and Disbursements.

Under laws of zone, auditor and disbursing officer of the Isthmian Canal Commission made, respectively, auditor and treasurer of the zone, **P-05, 72.**

Auditor for the War Department.

Canal costs to be audited by, **P-11, 558.**

Final audit of Isthmian Canal Commission accounts vested in, **P-05, 21.**

Automatic Railroad Signals. (See Signals.)

B.

Bachelor Quarters. (See Quarters.)

Backfill. (See Fill.)

Bacteriology.

Examinations of reservoirs, **P-07, 78.**

Water supply, **P-08, 111, 115.**

Panama and Colon water supply, **P-08, 118.**

Ball and Bonds.

Executive order, **P-14, 561.**

Balances. (See Accounts.)

Ballast. (See Panama R. R.)

Banks. (See Slides.)

Breaks, Chagres R., **P-10, 160, pl. 28.**

Breaks in, Culebra, **P-10, 160, pl. 39; P-12, 170, pl. 41; P-13, 160, pl. 41.**

Cut in, Empire; letting Obispo diversion through, **P-10, 160, pl. 24.**

Slides in, Culebra, **P-11, 156, pl. 34.**

Barbers. (See Clubhouses.)

Barges.

Concrete, of, **P-10, 196, pl. 49, 50, 115.**

Performance of, Pacific division, **P-11, 168.**

Barges, Derrick.

Placing rock, Toro Point breakwater, **P-13**, 138, pl. 30.

Barges, Drill.

Operation, **P-10**, 174; **P-11**, 169; **P-12**, 184.
 "Teredo," operation, **P-10**, 115; **P-11**, 169; **P-12**, 184.
 Performances, **P-10**, 175.

Barges, Hopper.

Clapets, or self-propelling, French type, **P-07**, pl. 39, 40.

Barracks. (See Labor; Marines.)**Barrier.**

Blowing up between Pacific and Miraflores, **P-13**, 186, pl. 53.

Basalt Dike. (See Dike, basalt.)**Bascules.** (See Bridges.)**Base.** (See Surveys.)**Basins, Anchorage.**

Clearing, Gatun, **P-09**, 80.
 Culebra Cut, view, **P-12**, 170, pl. 23.

Basin, Clearwater.

Gatun waterworks, **P-11**, 132, pl. 24.

Basin, Drainage. (See Discharge.)**Basin, Entrance.** (See Terminals.)**Basin, Sedimentation.** (See Sedimentation.)**Bates Project.** (See No. 170, p. 2365 of this Index.)**Beacons.** (See Channels.)

Channels, **P-11**, pl. 93; **P-14**, pl. 62.
 Plan, general, **P-12**, pl. 77.
 Typical b., **P-13**, 110, pl. 17, 18.

Beams, I.

Reinforcement, Balboa terminals, **P-14**, pl. 23.

Benchmarks. (See Surveys.)

Precise leveling, **P-08**, 127; **P-09**, 127; **P-10**, 297; **P-11**, 280; **P-12**, 247; **P-13**, 244; **P-14**, 207.

Bertoneini, C. (See No. 204, p. 2365 of this Index.)**Bertrand.** (See No. 194, p. 2364 of this Index.)

Geology, Culebra and Emperador, **P-06***, 162.

Bids. (See No. 148, p. 2364 of this Index.)

Preference to be given U. S. bidders, **P-11**, 560.
 Proposal forms, etc., **P-05**, 171.

Billiards. (See Recreation.)**Bills.** (See Account.)

Tables of bills included in reports of examiner of accounts.

Bills of Health. (See Health.)**Bins, Storage.**

Balbao, **P-10**, pl. 116.
 Layout of plant, Ancon quarry, **P-09**, 134, pl. 58.

Birds.

Executive order protecting certain, **P-13**, 616.

Blackburn, Jo. C. S. (See Nos. 217, 225, p. 2366 of this Index.)**Blacksmithing.** (See Shops.)**Blanketing.**

Blanketing ridge of Gatun Dam, **P-11**, 132, pl. 20.

Blasting. (See Barrier; Mining.)

Bas Obispo, **P-07**, 48, pl. 19, 20, 21.
 Before and after blast, San Pablo, **P-08**, 56, pl. 15, 16.
 Central division, **P-09**, 70; **P-10**, 140; **P-11**, 136; **P-12**, 146; **P-13**, 142.
 Chagres division, **P-08**, 45.
 Cucaracha slide, **P-14**, pl. 52.
 Culebra division, **P-07**, 41; **P-08**, 37.
 Drilling, rate of, **P-07**, 41.
 Excavating before and after blasting, **P-08**, 56, pl. 15, 16.
 Obispo, **P-07**, 48, pl. 19, 20, 21.
 Slides, effect on, **P-12**, 214.

Board of Admeasurement, P-14, 262.**Board of Consulting Engineers.** (See No. 164, p. 2365 of this Index.) (See Construction; Canal, Lock; Projects.)

Executive order forming Board of Consulting Engineers. Dated June 24, 1905, at the White House. Issued by President Roosevelt. Names members of board. To convene at Washington, Sept. 1, 1905, "for the purpose of considering the various plans proposed to and by the Isthmian Canal Commission for the construction of a canal across the Isthmus of Panama between Cristobal and La Boca." **P-06***, 9.

Members: George W. Davis, major general, U. S. Army, retired, chairman; Alfred Noble, chief engineer, East River division P., N. Y. & L. I. R. R.; Wm. Barclay Parsons, chief engineer, New York Subway; William H. Burr, consulting engineer, Board of Water Supply, New York City; professor of civil engineering, Columbia University, engineering expert, Aqueduct Commissioners, New York City; Henry L. Abbot, brigadier general, U. S. Army, retired; Frederic P. Stearns, chief engineer, Metropolitan Water and Sewerage Board, Boston; Joseph Ripley, general superintendent, St. Marys Falls Canal; Isham Randolph, chief engineer, Sanitary District of Chicago; William Henry Hunter, member Institute of Civil Engineering, chief engineer Manchester Ship Canal, commissioner, upper Mersey navigation, England; Eugen Tinscauer, Königlich Preussischer Regierungs- und Baurat, Mitglied der Regierung zu Königsberg i. Pr., Germany; Adolphe Guérard, Inspecteur-Général des Ponts et Chaussées, France; E. Quellenec, Ingénieur en Chef des Ponts et Chaussées; Ingénieur Conseil de la Cie. du Canal de Suez, France; J. W. Welcker, Hoofdingenieur-Directeur van den Ryks-Waterstaat, The Netherlands. **P-06***, 3.

Mr. Schussler declined appointment, as did Mr. J. B. Berry, chief engineer of the Union Pacific R. R., named in Mr. Schussler's place. Prof. Jacob Krane representative of

Holland, declined, J. W. Welcker being named in his place. At the first meeting, announced that Capt. John C. Oakes, Corps of Engineers, U. S. Army, had been detailed as secretary of the board. **P-06*, 9.**

Instructions: Board of Consulting Engineers was addressed Sept. 11, 1905, by President Roosevelt. "But if to adopt the plan of a sea-level canal means to incur great hazard and to insure indefinite delay, then it is not preferable. * * * Two of the prime considerations to be kept steadily in mind are (1) the utmost practicable speed of construction; (2) practical certainty that the plan proposed will be feasible—that it can be carried out with the minimum risk. * * * The delay in transit of the vessels owing to additional locks would be of small consequence when compared with shortening the time for the construction of the canal or diminishing the risks in the construction." **P-06*, 12.**

Organization of committees: Executive, chairman, Gen. Abbot, and Mr. Hunter. On preparation of plans for sea-level project, chairman, Messrs. Guerard, Hunter, and Burr, to which Messrs. Parsons and Quellenec were added later. On preparation of plans for lock canal, chairman, Messrs. Stearns, Tincauzer, and Ripley, to which Gen. Abbot and Mr. Noble were added later. On unit prices, Messrs. Parsons, Welcker, and Randolph. **P-06*, 11.**

Minutes, first to thirtieth meeting: First one, Washington, D. C., Sept. 1, 1905; thirtieth, New York, N. Y., Jan. 31, 1906. **P-06*, 105-148.**

Summary of proceedings, P-06*, 9.

Report, 1906. Pages 1-426. (See Projects and No. 164, p. 2365 of this Index.)

Letters of transmittal: President Roosevelt, Feb. 19, 1906. Sec. of War Taft, Feb. 19, 1906, to the President. Chairman Shonts (T. P.), Feb. 6, 1906, to Sec. of War. **P-06*, III to IX.**

Physical data concerning canal projects: In letter of Sept. 1, 1905, the chairman of the Isthmian Canal Commission No. 3 laid before the Board of Consulting Engineers physical data concerning the Isthmus of Panama, and solicited opinion of the Board of Consulting Engineers as to the best plan to be followed in the completion of the Panama Canal, **P-06*, 10.**

Plans laid before Board of Consulting Engineers: Plan of Isthmian Canal Commission No. 1; plan proposed to the New Panama Canal Co. by the Comite Technique assembled by that company; 3 projects prepared by Lindon W. Bates, of New York; the more important results of recent surveys, containing the principal information available for a decision respecting a canal at tide level; paper prepared by Mr. P. Bunau-Varilla, explaining method of construction of a lock canal to be later transformed to one at sea level; paper on the Panama

Canal showing some serious objections to the sea-level plan by Maj. C. E. Gillette, Corps of Engineers, U. S. Army, and paper by C. D. Ward, civil engineer, on the Gatun Dam. The Board of Consulting Engineers received no plans originating with Isthmian Canal Commission No. 3. **P-06*, 11.**

Plans considered: List of data, etc., furnished by the Isthmian Canal Commission No. 3, **P-06*, 106.**

Work done and "present" conditions on the Panama route: Review of the history of work done and that going on at Panama, **P-06*, 22.**

Field work: Examinations requested by the Board of Consulting Engineers to gain additional information relating particularly to possible dam and lock sites at Mindi, Gatun, and in the vicinity of La Boca, **P-06*, 25.**

Inspection of the Isthmus: Record of work of inspection in detail performed by the Board of Consulting Engineers at Isthmus of Panama, Oct. 4-11, 1905, **P-06*, 124.**

Vital statistics: Appendix O. Compiled under direction of Col. W. C. Gorgas, chief sanitary officer, **P-06*, 407-409.**

Unit prices: Report of committee on unit prices. Appendix R, **P-06*, 419-420.**

Hearings of J. F. Stevens, chief engineer: Appendix J., Board of Consulting Engineers. Most advantageous type of excavating machine the steam shovel. State of chaos on the Isthmus on assuming charge. Had not had time, at time of examination by Board of Consulting Engineers, to study any of the engineering problems of the canal. Dumps in use small. No detailed plan for dumps had been worked out; Culebra excavation an unknown quantity; ordinarily 1,000 yards a day per shovel output in excavating; Culebra Cut not in good shape for working in; could get 50 shovels or so installed in about 10 months. "I have never believed * * * that under the greatest stress we would require on the Isthmus the presence of over 100 excavating machines. * * * I am talking about the Culebra Cut." Eight-hour law a handicap. "The question of handling the Culebra Cut is very largely one of transportation; and by transportation I do not mean simply hauling it; I mean disposing of it—getting rid of it. It is going to require the most perfect organization that ever was contemplated." "The French company fell down because they could not dispose of their material. * * * They loaded more than they could get rid of. * * * They used a type of car that would not dispose of the material; it had to be cleared by shoveling. * * * This is no reflection on the French, but I can not conceive how they did the work they did with the plant they had." Discussion of the slopes to be adopted for Culebra Cut. Has made no computations of quantities in the Culebra Cut. Labor will work only about 19 days per month. 13,000 men, white and black, on the work. * * * "Force of men (employed) I have who go

around and put the laborers out of their houses unless they work (large number required for this)." Can not determine the size of the force to employ until the U. S. determines what kind of a canal is wanted. Comparative value of American labor and foreign not to latter's credit. Discussion of unit of cost of excavation. Great deal of the cost of work done due to derailments, and sometimes the gangs were not kept full. Would not recommend that the Board of Consulting Engineers take less than 80 cents as an average of cost per yard for the Culebra Cut. Value of French plant—most of it of little use; some of the rails can be used with bridle rods; dredges of doubtful value. "We have never been able to get over 2,700 or 3,000 yards a day of 10 hours per dredge." Thinks suction dredge the best dredge in the world. Would cut channel with dipper dredge, following it with hydraulic machines. Use of materials excavated—some for concrete material, rock for construction, gravel for concrete. Methods of unloading cars quickly; judicious to keep trackage in good shape; would have several tracks to a dump. Thinks he could find a better method than that proposed by Bunau-Varilla for reducing to sea level. Does not know the nature of the strata in the lower part of the Culebra Cut; could not tell what would be necessary for retaining walls. Using excavated material for earth dams a matter of cost; discussion of methods of handling excavated material for dams; special trackage would be necessary; some material might be pumped. Had no opinion as to safety of earth dams of large sizes on the Isthmus; thinks safety of any dam dependent upon the capacity of the spillway; would prefer earth dam with a masonry core to one without this core; dredged material makes very compact work. Had no opinion as to merits of sea-level or lock canal. "I think either one would carry a ship through all right." Cost of double-track railroad probably \$75,000 to \$100,000 per mile in gold. Culebra slides might be conquered by tunneling under the masses to drain it of water. "Anyhow, I think we need not worry about whether the Panama Canal can be built owing to that slide." Some draining done by French. "Give us the type of canal just as soon as you can. * * * I can not, and I do not believe any human being can, do much more than mark time until that is done. I can fix my quarters, and as far as my limited intelligence permits me I can contract for certain rolling stock. I have contracted for two or three million dollars' worth of plant the last month, but beyond that I can not go. Here is this little railroad; we have got to have better terminals at the south end. I want a better yard at La Boca, but you may select an alignment which will interfere with any improvement I might start now." Discussion of the sources from which materials can be had for concrete, breakwaters, etc.; crush-

ing rock for sand; advantageous mixtures for concrete. P-06*, 283-295.

Hearing of F. B. Maltby, division engineer at Colon, has charge of works there and also those of the Pacific terminus of the canal. Appendix J., to Board of Consulting Engineer's report. P-06*, 296-306.

About 600,000 c. y. dredged in harbors in 6 months of 1905. Only 16' available at La Boca Harbor. Constant fill. Dredging in progress to get 22' below spring low tide. References to unusual high tides at terminals. Silting in harbors at rate of about 1' a month; probably due to drift; very little from Rio Grande River. Capacity of French dredges—139,000 c. y. removed in month at La Boca with a double crew. "That represents her maximum capacity." Prefers hydraulic dredges to those of French or ladder type. Discussion of the cost of pumping dredgings ashore; could be put ashore for 6 or 7 cents; do not believe it would exceed 10 cents; use of cutters advantageous; nature of material determining methods and cost. Probable sources of material for breakwater building; location of rock, its nature; identity of soft rock in dry dock at Cristobal and that from borings on site of Gatun Breakwater and pier construction at terminals; foundations. Maintaining channel entrances; necessity of constant dredging. Constant dredging required at the Suez Canal entrances; at North Sea Canal entrances. Annual dredging at La Boca would require probably 1,000,000 c. y. annually. Breakwater at Guinea Pt. would not be worth its cost. Silting of terminal harbors due to sea currents; does not believe important amount comes from Rio Grande. Dredgings, rehandling cost lower than original dredging; to put dredgings into a dam, say 40 or 50' high, would cost not to exceed 20 cents per yard. Would not recommend suction dredges to load scows; would put in 2 dipper dredges for 1 suction dredge. Tides at La Boca and at Cristobal; tabular matter. P-06*, 296-306.

Hearings of H. F. Dose: By Board of Consulting Engineers. Appendix J. Since July 1, 1904, 700,000 c. y. removed at Culebra, or 800,000 c. y. since Americans assumed control. Cost arbitraries. Different outputs in different month large variations; difference due to rainy season and change in rate of pay for labor, and trains off the track and soft character of material. Yardage computed from the cross sections and checked by car report. Figures for computed excavation and total yardage in the Culebra whence obtained; explanation of discrepancies based on different prisms being employed in computing. Unit cost for material taken out; probably would be 70 cents per c. y. in Culebra. Starting of steam shovels: No. 101 (probably the first) started Nov. 11, 1905. Types of shovels: Five-yard dipper good in heavy work; 2-yard dipper efficient in soft material

and on hillside. Loading and dumping costs; what is included under dumping costs and under transportation. In lower excavating, pumps may have to be used, or else some of the smaller streams may have to be let into the cut or diverted. Eight-hour law a source of increase in cost of excavating. Rock at various points on the canal line. **P-06***, 307-314.

Hearing of Charles Bertoncini: By Board of Consulting Engineers. Appendix J. Draftsman in employment of old French company, the new Panama company, and by the U. S. since work was taken over. Profile of the geological section of the canal; section 40 to 50' long; shows character of material as developed by borings before the year 1883 for a sea-level canal. Various maps and plans, sketches, etc. Cross sections made by the last French company when the work stopped; they made a project for the canal with 2, 4, or 6 locks; sections and profile show amount of material to be excavated; calculating methods of quantities. Book of cross sections of the canal line mentioned; set in existence of profiles from kilometer 0 to kilometer 74 (50' for each kilometer). Panama Bay and Harbor map showing currents. Dike at Rio Grande; proposed dam to make a harbor at La Boca; tidal lock. Control of small rivers like Obispo and Lirio; various methods, aqueducts, syphons, etc. Dredging Culebra from pool; same scheme at Cascadas and others. **P-06***, 315-320.

Hearing of W. E. Dauchy, assistant to the chief engineer of the Panama Canal: By Board of Consulting Engineers. Appendix J. When he took charge at Culebra, Nov., 1904, there were 1 modern American steam shovel and 2 or 3 French excavating machines at work, and about 700 laborers. Instructions were to prepare for installation of steam shovels ordered; intention to carry along the preparatory work in the way of track laying, establishment of dumps, and installation of machines, "keeping the work done along the different branches advanced as rapidly as the needs of the installation of the new shovels should require. At that time the tracks consisted only of the old French tracks, and they were in very bad condition, and there was a large amount of work required to put those tracks in workable shape, as well as to lay new tracks for the use of the trains waiting upon the additional shovels to be installed." In following Aug., 11 steam shovels working; French machines had been discarded; on Aug. 10 majority of steam shovels put out of service on account of the pressing necessity of doing preparatory work, and not having sufficient labor to carry on the work of preparation and the work of operating the steam shovels at the same time. Shovels the only modern implements; locomotives antiquated, cars antiquated, track not up to requirements; dumping grounds not established, trains congested; did not ap-

proximate the capacity of the shovels; weather cut but a small figure on the shovels, affected track, etc. Shovels of 2½-yard capacity should handle 2,000 to 2,500 yards a day of 10 hours, 50 per cent of that the net capacity. Considered an efficient condition of trackage, etc., attainable at Culebra. For removing about 100,000,000 c. y. from Culebra, for sea level, thinks 80 to 100 shovels adequate for economical operation; 2½-yard and 5-yard types. To install this equipment would take about 2 years with the same class of labor as used in 1905-6. Expected that on an average 6 per cent of equipment would be laid up for repairs. No great difficulty expected from night work, nor advantage; not hurtful to health. Labor on Isthmus inefficient—4 men to do an American laborer's work; independent, as they realize shortness of labor supply; about 25,000 men needed for a 100-shovel equipment; in addition, force would be required for preparatory work of track laying, etc. Drainage of surface water; no general plan would cover all instances; some small streams would have to be carried in prism, etc. Effect of 8-hour law to increase cost of output about 30 per cent. Has thought of two methods of solving the labor problem—flooding the Isthmus with labor, forcing competition and dependence, and importation of foreign labor, like Chinese and Japanese. Night work would practically double the call for laborers, etc., and a consequent caring for them in quarters. Shovels, efficiency, net about 1,000 under favorable working conditions, or 300,000 c. y. per year per shovel. Dumping arrangements: Panama R. R. as main track, spurs to it from excavating point, and spurs from it to dumping points; dumps long distance from Culebra, some on the Atlantic coast section; Gamboa Dam site not economical site for dumping; French dumps worked on wrong principle; about 200 to 300 miles of track required for 100-shovel plant; 15 to 20' face dumps best; not economical to dump from trestles. Moving plant of the French valueless almost wholly to Americans; ideal method or plant flat cars permitting unloading with scrapers, etc.; in wet weather material has to be shoveled out of existing cars. Character of material: Great bulk of material called rock is soft rock (indurated clay); unit prices for removing earth at a figure equal to that for soft rock; soft rock will permit slopes of 1 on 1; not safe to channel sides practically vertical; in some places they have stood for years, "in other places they would not stand for months." Sides, slopes, etc.: No slides of any extent noticed in the rock section; disintegration of soft rock would be less swift if the slope were very steep; wash from drainage a cause of disintegration; as work progresses proper slope should be found. Thinks Culebra Hill itself, apparently massive rock, would be safely sloped 1 on ½; existing steep slopes at Culebra might not stand with deeper

excavation. Material of the Culebra Hill section: More or less rock; good deal of clay, too; vegetation, except grass, increases tendency of slopes to slide. Would estimate 50 cents c. y. as proper price were contractor to do the work of the Culebra Cut; if 8-hour law were in operation against contractor, price should be increased probably 25 per cent. If Gamboa Dam were to be built, material of Culebra Cut might make it advisable to bring material from Culebra; otherwise, it would be cheaper to find some other dump for Culebra matter; extra cost might be 15 to 20 cents a c. y. Trackage for dumping: Special tracks necessary for dumping at Gamboa; 1 track for high elevations, and 1 for lower ones; a track to the Gamboa site would be notably expensive; Panama R. R. would have to be double-tracked for satisfactory dumping output; small stretch on summit, about 5 or 6 miles, would not need to be double-tracked. Labor required at Culebra: Probably as estimated by chief engineer, i. e., 30,000; hard to figure on number needed; "at present" the most expensive labor in the world, equal to paying \$6 a day in the U. S.; similar labor in Nicaragua cheaper because supply was abundant. Favorably inclined toward U. S. feeding its labor. Wages of employees from U. S. about 40 per cent higher for same work in U. S.; doubtful if this has attracted efficient men; difference probably 50 per cent when transportation, etc., is included. Slides: Seemingly insignificant compared to the whole body to be removed. Effect of water on sides of rock nearly vertical; would probably not affect rock at depths; advisable to have a berm, however; slope of 1 on 1 without berm might result in slides from toe washing out; should not advocate putting vertical face in soft rock at final or bottom elevation of canal channel; perhaps retaining walls would be needed. "My opinion is that most of that material would be of such a character that it would stand on a slope of 1 on 1, but I doubt whether the majority of it would be of such a character as to stand vertically." (Panama Canal Co. (new) built test pits, filled them with water with depths of not less than 30 or 40'; after a number of years they were pumped out; water had had no disintegrating effect on material of sides.) If sides were 8 to 1 and 200' high, slides would bring large mass into prism; disintegration, lesser quantities. Sand for masonry: Panama beach sand most available; Chagres River sand mixed with other materials; some sand near mouth of Farfan River; sand deliverable along canal line for about 75 cents a c. y. Steam-shovel operation, 1904-05: 24,000 men needed for 100 shovels, of which 20,000 common laborers; lowest expense in Mar., 1905; highest in Aug., 1905; explanation of maximum and minimum cost; supply of laborers did not increase in the proportion required for efficiency; expensive

men increased; preparatory work was not finished; rainy season came on; numerous derailments, etc.; dumps were getting higher; French plant not adapted for rapid handling under such conditions; work was practically stopped at Aug., but the expensive organization still remained, increasing unit cost of what work was done; 8-hour law had an effect, also, corresponding to about 25 per cent increase; after the rainy season 12 to 20 derailments a day; derailments due to poor track; wheel gauges of the wheels of the French cars varied in almost every car; shovels working only about 2 or 3 hours a day; trains had to be unloaded by hand. Dumps varying in height from 12 to 20' recommended, with the use of flat cars with Lidgerwood unloaders. One cause of derailment the imported rails being too high in proportion to width of base. Considers it feasible from his experience on the Isthmus to provide such plans and tracks as would practically obviate the difficulties already recorded. Yardage cost increased through work of shaping up the banks, etc.; percentage of cost greater with smaller equipment of shovels. Stone for jetties: Possibility of opening quarry at Bohio. At time of testifying 11 steam shovels set up and 6 others under erection; total on hand or ordered, 60; 120 locomotives ordered. Table showing estimated force needed to prepare for and operate 29 steam shovels, 50 steam shovels, 81 steam shovels, and 100 steam shovels; also existing force, balance needed, and portion of proposed force needed as each additional steam shovel is received between June 1 and Dec. 31, 1905; Dec., 1906 (2 estimates); and Dec., 1907, respectively. P-06*, 321-345.

Estimates: Notes by Mr. John F. Wallace on the report of the chief engineer, Isthmian Canal Commission. Bohio Locks spillway; excavation Bohio to Miraflores; item relating to Chagres and Gatun diversion; estimates referred to by the "notes" probably in an emergency report called for on short notice. P-06*, 370-371.

Hearing of Mr. John F. Wallace, formerly chief engineer, Isthmian Canal Commission. Appendix F. Board of Consulting Engineers. P-06*, 346-393.

On Oct. 27, 1905: Board of Consulting Engineers would like to have the benefit of his experience and his advice as to what he considers to be the maximum quantity that could be removed from the central cut from Obispo to Paraiso in the course of 12 months after the proper appliances are installed; and what length of time "he contemplates" would be required for the installation of a plant. Mr. Wallace sought a week in which to properly present what information he could give. Those under him saw but one detail; not the general plan as formulated by the head himself. P-06*, 346-349.

Statement of Mr. John F. Wallace, formerly chief engineer, Isthmian Canal Commission. Appendix F. Board of Consulting Engineers. **P-06***, 375-393.

Explanation of diagram (p. 367) for showing carrying on of work of excavation by steam shovels and trains; the more terraces, the steam shovels can work. Papers submitted more apply principally to the 5 or 8 miles of central excavation; when Board of Consulting Engineers was there (Culebra) they saw only a mass of tracks, etc.; this the old French installation; when Mr. Wallace took charge he retained this installation and worked it to ascertain its value; 1 excavator of French type did work at less than 5 cents a yard. Method of determining rate of increase in shovel equipment annually; could get as many shovels as wanted, but based his estimates for plan of practical operation on a minimum; installation of 24 shovels a year additional refers principally to Culebra section. Had not formed any estimate of what the additional cost per yard would be for pumping in a sea-level project. Discussion of the difficulties of cofferdamming in deep and narrow cuts which might be made preliminary to digging a sea-level line. Rock-removal methods mentioned Lobnitz system familiar to a member of the board (Mr. Hunter). Agrees with board that it might be more prudent to regard that the whole of the Culebra may be removed in the dry, down to about 10' above sea level; impossible to say what it would cost to pump out lower levels. Committee on unit prices adopted figure of 45 cents per c. y.; considered a matter of some uncertainty; "no man knows how much it will cost." Drainage to prevent slides; discussions; method probably efficacious; slides as a question should become of less importance with each year of work if material be properly handled in dry season. Condition of bottom at 2 terminal harbors not the same; not so much mud at Panama Bay. Coal: Price lowered from \$7.50 to \$5.50; correction of testimony of Mr. Dose, who announced it as \$7.50. Chagres River treatment would be simplified by construction of Gamboa Dam, leaving only regulated flow to care for; the latter being cared for by the pre-built diversion channels; no precise calculations made as to capacity of these diversion channels. Excavated material of Culebra section to go, most of it toward the Pacific end; excavation material between Bohio and Gamboa could be disposed of over the side, at probably 35 cents per c. y. Material from Culebra Cut could be used for partial earth dams, with a core wall; material in Chagres River could be made available for concrete. Favors a composite dam for Gamboa. Concrete making: Might make 8,000 to 10,000 c. y. a day for Gamboa Dam, depending upon the supply of cement, stone, etc.; local rock could be used. Pumps provided for in general

way; records of this evidently not found by Mr. Stevens (his successor); average haul from Culebra, 10 to 12 miles, with 100,000,000 c. y.; explains general method of handling—flat cars, use of unloaders, power bank spreaders, dumps 15' high, long tracks and many of them, troubles have come from dumps which have been too high, economy in having cars waiting to be loaded, and in wide and high terraces. Concrete work of locks: Thinks 10,000 c. y. concrete could be placed per day in lock building; labor on this work might be 25 to 30 per cent less efficient than in U. S. Local labor about one-half or one-fourth as efficient as similar in U. S.; inefficiency due somewhat to inefficient overseers; 1 batch of 25 foremen sent from U. S. to Isthmus to superintend track work had never laid a rail in their lives. Possible to use dredges on the Atlantic side as far as Bohio. Prefers coal at \$4 a ton to fuel oil; advocates an early building of Gamboa Dam to acquire electric power for work on the canal. Minimum of 21 working days on the Isthmus; would expect to work more; would expect to load more than 800 yards a day. Does not think there is any difficulty about providing materials from the Isthmus for the lock at Ancon-Sosa. Dredging constantly would be necessary to keep open deep ship channels at the Panama entrances. Vote of thanks given to Mr. Wallace for his papers and the information orally. **P-06***, 375-393.

Notes on the Panama Canal, by John F. Wallace, formerly chief engineer, Isthmian Canal Commission. Appendix F. Board of Consulting Engineers. **P-06***, 350-371.

The Chagres Valley, Gamboa Dam site, and river control; borings and alignment; technical studies; Culebra excavating work and cost records; sea-level sections of canal; cost of Culebra work from July 1, 1904, to Oct. 1, 1905; mining; excavations; maintenance of tracks; transportation; dumps; general expenses; arbitraries. Various suggested plans: The Bates plan saves only a small amount of work and substitutes a large amount of dam and dike construction, etc.; plan of first Walker commission objectionable; impracticable to provide a sea-level canal in the future, and Bohio Dam would have to be constructed at a point not wholly desirable; the various high level, multilock plans objectionable, as they render sea-level construction impracticable financially; plan of Bunau-Varilla for deepening and enlarging the canal "entitled to consideration and is ingeniously devised." Wallace has been controlled in his studies of the subject by: (1) No high dam should be constructed that could not be founded on bedrock or to which an imperious curtain wall could not be carried; (2) the construction of any high dam should be avoided, the destruction of which would prevent the operation of the canal until the dam had been replaced; and (3) if it became absolutely necessary to construct dams on

alluvial foundations, the plan should be selected necessitating the smallest amount of construction of this character, and subject to the least possible head of water retained thereby. Time required for sanitation, organization, and preparation would remain practically the same with any plan that might be adopted; output would increase steadily each year; experience would give increased efficiency to the force. The plans which have been suggested by reputable engineers are possible of execution in some time and at some cost. Sees no reason why a sea-level canal can not be completed in 10 or 12 years at the utmost; advances reasons to the effect that sea-level plan is better from almost every point of view. **P-06***, 360, 361.

Board of Health.

Laboratory report, **P-09**, 323; **P-10**, 431; **P-11**, 528; **P-12**, 553; **P-13**, 551.

Board of Local Inspectors, P-14, 262.

Boards, Special.

Report, different density of water, both sides of lock gates, **P-11**, 85-99.

Boats.

Licenses, motor boats, **P-14**, 266.

Landings, **P-13**, 220; **P-14**, 196.

Boggs, Maj. F. C. (See Nos. 227, 274, pp. 2366, 2368 of this Index.)

Bohlo. (See Nos. 18, 209, pp. 2361, 2365 of this Index.)

Boilermakers.

Resignation, **P-11**, 226.

Boilers.

Inspection service, **P-10**, 269; **P-11**, 239; **P-12**, 274.

Boilershop.

Locomotive department, **P-11**, 235.

Bonds. (See Bids; Canals; Employees; Officers; Panama R. R.)

Acting disbursing officers, act, **P-11**, 572.

Bail and, **P-14**, 561.

Bidders, **P-05**, 171.

Employees, **P-11**, 393; **P-12**, 412.

Canal bonds, act, **P-11**, 551, 558, 573, 578, 580.

Officers and employees of U. S., act, **P-11**, 574.

Panama R. R., purchase of, act, **P-11**, 563.

Panama R. R. contracts to furnish supplies, omission act, **P-11**, 581.

Borings. (See Dams; Foundations; Locks; Terminals.)

Along canal line, **P-05**, 13.

Cross sections, Gatun Dam, **P-08**, 196, pl. 158-164.

Experimental dams, Gatun, **P-08**, 134.

Gatun Dam, **P-08**, 196, pl. 87-88.

Gatun Dam site, **P-08**, 196, pl. 86.

Gatun Locks, **P-13**, 192.

Investigation, Gatun Dam foundations, **P-08**, 134, 196, pl. 140-147.

La Boca, **P-06***, 7, pl. 7.

La Boca dredging division, **P-07**, 51.

Locks and dams, Miraflores, **P-08**, 65.

Locks and dams, Pacific division, **P-09**, 121.

Locks and dams, Pedro Miguel, **P-08**, 64.

La Boca, vicinity, **P-06***, 7, pl. 7.

Pacific terminals, **P-12**, 187.

Pedro Miguel **P-08**, 64.

Profile, axis, Gatun Dam, **P-08**, 196, pl. 155, 156, 157.

Profiles, Gatun, **P-06***, 7, pl. 11-13.

Table of, Pacific division, **P-09**, 121.

Boundaries.

Canal Zone, **P-11**, 280.

Locating, zone, **P-07**, 151.

Marks, zone, **P-10**, 297.

Bowling. (See Recreation.)

Boys. (See Recreation: Schools.)

Bracing.

Test pits, Gatun Dam, **P-08**, 196, pl. 71.

Brakes, Post. (See Fenders.)

Chain fenders, locks, **P-11**, pl. 80.

Brass. (See Foundries.)

Foundry work, **P-10**, 272; **P-11**, 241; **P-12**, 275; **P-13**, 263; **P-14**, 257.

Breakers, Rock.

Lobnitz rock breaker, operations, **P-10**, 175; **P-11**, 169; **P-12**, 185.

Performances, Pacific division, **P-10**, 176.

"Vulcan," **P-11**, 169; **P-12**, 185.

Breaks. (See Banks; Slides; Walls.)

Breakwaters, P-14, 38. (See Costs; Trestle-work.) (See Atlantic division and Pacific division.)

Atlantic division, **P-09**, 66, pl. 13.

Colon, **P-09**, 58; **P-10**, 111, 119; **P-11**, 103, 112; **P-12**, 111, 120, 121.

Cost, **P-12**, 301; **P-13**, 280.

Costs, Colon, **P-14**, 449.

Detached, terminals, **P-13**, 21.

Dumps, leading to, Naos Island, **P-11**, 156, pl. 43.

East breakwater, Atlantic terminals, **P-14**, 227.

East breakwater, Limon Bay, **P-14**, pl. 33, 125, 126.

Light and fog signals, **P-12**, pl. 76; **P-13**, pl. 87.

Map, Colon, **P-09**, 66, pl. 13; **P-10**, pl. 96; **P-11**, pl. 93; **P-12**, pl. 78.

Material, placing, Naos Island, **P-14**, 217.

Naos Island, **P-14**, 207, pl. 63; **P-09**, 134, pl. 64.

Needful for protection against northers, **P-05**, 294.

Plan, Naos Island, **P-13**, pl. 96.

Quarry, Atlantic division, **P-12**, 116.

Quarry, west breakwater, **P-13**, 112, 113.

Quarry, Porto Bello, **P-14**, 226.

Rock, unloading, Toro Point, **P-11**, 132, pl. 5, 6; **P-12**, 142, pl. 19.

Rock for, cest, **P-13**, 114.

Rockwork, west breakwater, **P-13**, 192.

- Toro Point Breakwater, views, **P-13**, 138, pl. 30, 31; **P-14**, pl. 34, 35.
- Trestlework, Toro Point, **P-11**, 132, pl. 4, 5.
- West breakwater, Colon, **P-13**, 113; **P-14**, 227.
- Work done, and costs, Atlantic division, **P-12**, 117.
- Brick.**
- Paving, Balboa terminals, **P-14**, 14, pl. 23.
- Bridges.** (See Trestles; Bascules.)
- Construction views, Gamboa, **P-08**, 216, pl. 179, 180, 181.
- Culverts and, Panama R. R., **P-09**, 140.
- Dock department and, Panama R. R., **P-08**, 205.
- Lock gates, bridge for erecting, Pedro Miguel, **P-11**, 192, pl. 46.
- New Gamboa, Panama R. R., **P-08**, 209.
- Old girder span across Gatun, **P-10**, 204, pl. 59.
- Panama R. R. relocation work, Gatun River, **P-11**, 194.
- Bridges, Bascule.**
- Gatun River, **P-13**, 272, pl. 62.
- Panama R. R., Monte Lirio, **P-13**, 269.
- Panama R. R., new line, **P-12**, 284.
- Piers, concrete, Panama R. R., **P-11**, 200, pl. 67.
- Bridges, Pontoon, P-14**, 72.
- Launching pontoon, Paraiso, **P-14**, pl. 64, 136.
- Train crossing, Paraiso, **P-14**, pl. 65.
- Bridges, Railroad.**
- Gamboa Bridge connecting with old French bridge, **P-08**, 216, pl. 178.
- Plan and section for piers, **P-08**, 212.
- Bridges, Spillway.**
- Gatun, **P-10**, 128.
- Bridges, Suspension.**
- Empire, **P-10**, 159.
- Bridges, Track Span.**
- Electric transmission system, **P-14**, 101.
- Bridges, Wagon.**
- Reinforced concrete, Mandingo River, **P-11**, 156, pl. 41.
- British Government.** (See No. 164, p. 2365 of this Index.)
- Brush.**
- Cutting and clearing, Lake Gatun, **P-10**, 153; **P-11**, 148.
- Bubonic Plague.** (See No. 83, p. 2363 of this Index.)
- Two outbreaks of bubonic plague were stamped out. Rigid quarantine established against infected ports. Thorough disinfection. Harboring places of rats, etc., destroyed. Temporary congestion of freight due to quarantine established against Isthmus shipments to South and Central American countries. **P-05**, 35.
- Buffers.**
- Locks, **P-10**, pl. 76.
- Buildings.** (See Houses, and Nos. 60, 99, 132, 221, pp. 2362, 2363, 2366 of this Index.)
- Administration building, Ancon, **P-07**, 80, pl. 95.
- Administration building, Panama, **P-05**, pl. 28.
- Administration building, new, Balboa, **P-13**, 180, 186, pl. 54; **P-14**, 312, pl. 66, 67.
- Alhajuela, **P-07**, 93.
- Ancon, **P-07**, 80, 94, pl. 95.
- Architecture and buildings, status of bureau work, **P-05**, 135.
- Articles for, cost of, as manufactured on zone, **P-08**, 105.
- Authorized, with floor area, Pacific terminals, **P-13**, 205.
- Balboa, **P-09**, 102.
- Bohio, **P-07**, 100.
- Buena Vista, **P-07**, 98.
- Bas Matachin, **P-07**, 99.
- Bas Obispo, **P-07**, 98.
- Building division, reports. (See No. 221, p. 2366, of this Index.)
- Carthagencita, **P-07**, 95.
- Casa Blanca, **P-07**, 97.
- Caballa Viejo, **P-07**, 99.
- Cerro, **P-07**, 97.
- Chagres, **P-07**, 98.
- Changes, clubhouses, **P-13**, 555.
- Classification, table, with costs, **P-06**, 127.
- Clubs and playgrounds, **P-14**, 405.
- Colon, **P-07**, 102.
- Construction of, **P-09**, 150; **P-10**, 194; **P-11**, 356; **P-12**, 379; **P-13**, 375; **P-14**, 274.
- Construction, Atlantic division, **P-09**, 61.
- Construction division, **P-07**, 86. (And see No. 221, p. 2366 of this Index.)
- Construction department, organization, **P-07**, pl. 139.
- Construction work at each station, **P-08**, 97.
- Construction, Gatun, **P-09**, 65.
- Construction municipalities, **P-09**, 62.
- Construction, Pacific division, **P-09**, 103, 114, 116.
- Construction, reports, **P-08**, 71-120. (See No. 221, p. 2366 of this Index.)
- Corozal, **P-07**, 95.
- Costs, **P-09**, 151; **P-10**, 311.
- Cristobal, **P-07**, 101; **P-09**, 66.
- Cucaracha, **P-07**, 95.
- Culebra, **P-07**, 96.
- Cunette, **P-07**, 97.
- Electrical work, **P-14**, 89.
- Empire, **P-07**, 97.
- Employees, for, **P-07**, 141.
- Enterprise, **P-07**, 96.
- Expenditures, **P-08**, 106; **P-09**, 85.
- Gamboa, **P-07**, 98.
- Gatun, **P-09**, 65.
- Gold Hill, **P-07**, 96.
- Gorgona, **P-07**, 99.
- Grounds and, status, **P-05**, 141.
- Haut Obispo, **P-07**, 98.
- Land and, **P-07**, 157; **P-11**, 418; **P-12**, 461; **P-13**, 465.

Mamei, **P-07**, 100.
 Matachin, **P-07**, 98.
 Mount Hope, **P-07**, 101.
 Office building, **P-07**, pl. 129.
 Office, Panama, **P-05**, 28.
 Regulations, Colon, **P-07**, 146.
 Religious buildings, **P-07**, pl. 94.
 Repairs, statements, **P-08**, 107; **P-09**, 84, 347, 209.
 Sale and demolition, **P-11**, 359; **P-12**, 379; **P-13**, 388.
 Stations, Panama R. R., **P-12**, 284.
 Statistics, **P-14**, 293.
 Summary of, **P-11**, 359.
 Various places, **P-07**, 93-100.

Buildings, Construction of. (See Quartermaster.)

Division charged with the preparation of plans and estimates, and the construction and repair of all buildings on the zone. Task tremendous, in view of rigorous requirements of the sanitary department and the liberal policy of the Isthmian Canal Commission. 1,700 to 2,350 men in this division. Hardly a spot in the zone where it has not done work of importance, in the way of repairs, rebuilding, new houses, etc. **P-05**, 112.

At beginning of fiscal year bureau of architecture and building reorganized. Building material began arriving Sept., 1905; actual working force had increased to 3,150 men in Feb., 1906, when force began to decrease, because of lack of supply of requisite material. Tables showing classes of work done, type of houses, etc. Repair and construction done at long list of camps and points in the zone.

Permanent residence for governor of the zone begun. Despite increase in housing accommodations, quarters for white employees never equal to the demand; provision for hotels, messhouses, post offices, schoolhouses, etc., constantly increasing in necessity; generally all new arrivals have been comfortably cared for; conditions steadily growing better. "It is believed that the provision which has been and is being made for the comfort and health of the employees of the commission has never been approached or attempted under similar circumstances and work." **P-06**, 99.

Bullfights.

Executive order against, **P-12**, 608.

Bunau-Varilla Project. (See No. 171, p. 2365 of this Index.)

Buoys. (See Fog signals; Lights.)

Cost of buoying canal, **P-12**, 305.
 Central division, **P-11**, 148.
 Lighting and buoying canal, plans, etc., **P-11**, 298, pl. 89; **P-12**, 159; **P-13**, pl. 87.
 Navigation, aids to, **P-13**, 108.
 Ranges, towers, etc., **P-11**, pl. 90, 91, 92, 93; **P-12**, pl. 75.

Bureaus.

Circular outlining organization, **P-05**, 146.
 Cost-keeping, **P-14**, 405.
 Personal bonds, **P-14**, 405.
 Timekeeping bureau, **P-14**, 405.

Burr, W. H. (See Nos. 1, 26, 164, pp. 2361, 2362, 2365 of this Index.)

C.

Cables.

"All American" cable, South and Central America, **P-07**, 148.
 Cable crossovers, pumps and motors for, **P-14**, 125.
 Ducts, electric cables, **P-13**, 9.
 Installation, **P-13**, 94.
 Insulated, **P-14**, 111.
 Lock-operating machinery, **P-12**, 91.
 Orders for, **P-13**, 95.
 Tunnel, Balboa shops, **P-13**, 254, pl. 58.

Cableways. (See Cables; Costs.)

Caissons.

Coaling station, Cristobal, **P-14**, pl. 32.
 Concrete caissons, piers, Balboa, **P-13**, 254, pl. 60.

Entrances, locks, **P-13**, pl. 81, 82, p. 85.

Fixed irons, **P-13**, 74.

Foundations, reloader, Cristobal coaling station, **P-14**, pl. 31.

Progress on, Pacific terminals, **P-14**, 215.

Sinking, Balboa, **P-13**, 254, pl. 61.

Sinking and manufacturing, Balboa, **P-13**, pl. 104.

Sinking, approach walls, Miraflores, **P-12**, 204, pl. 54; **P-13**, pl. 98.

Sinking, Panama R. R. docks, **P-12**, 186.

Sinking, piers, Pacific division, **P-11**, 174.

Caissons, Floating.

Details, **P-13**, 8.
 Lock gates, **P-11**, 72; **P-12**, 81.
 Pumping system, **P-13**, 8.

Camps, Labor. (See Labor.)

Juan Grande, **P-07**, 96, pl. 110.
Paraiso, **P-07**, 88, pl. 104.
Porto Bello, **P-08**, 70, pl. 35.
Toro Point, **P-10**, 136, pl. 4.

Camps, Sick. (See Health)

Canal, French.

Dredging connection with, **P-10**, 136, pl. 7;
P-11, 132, pl. 25.

Canal, Lock. (See Board of Consulting Engineers;
and Canal, Sea-Level.) (See p. 2365.)

Board of Consulting Engineers created by Executive order of June 24, 1905, to consider on proper type of canal, failed to agree. Two reports presented, Jan. 10, 1906. Eight members (5 foreign representatives) favored sea-level canal; 5 members (Americans) favored lock canal at elevation of 85'. Isthmian Canal Commission No. 3, to whom reports were referred, reported to Sec. of War, Feb. 5, 1906, in favor of lock canal, 1 member only dissenting. Civil Engineer Endicott, U. S. Navy, preferred sea-level canal. Isthmian Canal Commission No. 3 report, accompanied by report of Chief Engineer Stevens, in favor of lock-level plan. Sec. of War transmitted these reports to President Roosevelt, concurring in recommendation of lock-level work, Feb. 19, 1906, and on the same date President Roosevelt forwarded the reports to Congress, expressing concurrence in recommendations for a lock-level canal. On June 21, 1906, Senate, 36-31, authorized lock-level canal, as follows: "Be it enacted, * * * That a lock canal be constructed across the Isthmus of Panama connecting the waters of the Atlantic and Pacific Oceans, of the general type proposed by the minority of the Board of Consulting Engineers created by order of the President under date of January twenty-fourth (June twenty-fourth), nineteen hundred and five, in pursuance of an act entitled 'An act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific Oceans,' approved June twenty-eighth, nineteen hundred and two." The House concurred, and on June 29 the act became a law. **P-06**, 13.

Canal, Panama (general data). (See No. 196, p. 2365 of this Index; see from p. 2361 to p. 2368 of this Index.)

Accounting system, Panama Canal, **P-04**, 55; **P-05**, 20.
Act, opening Panama Canal, etc., **P-12**, 599.
Act, Spooner, **P-11**, 550.
Building, preliminary organization, **P-05**, 150; **P-07**, 241.
Capacity, Spooner Act, **P-11**, 550.
Comparison, lock-level with sea-level canal, **P-06***, 137.
Completed Panama Canal, map, **P-12**, frontispiece.
Conditions, Pacific side, **P-13**, pl. 102.
Construction status, Panama, **P-05**, 139.
Contract, building by, **P-06**, 128.
Cost, estimating, **P-06**, 144.

Delays in, St. Marys River, **P-06***, 421-423.
Docking and general facilities, **P-11**, 206.
Eighty-five-foot summit level canal, **P-06***, 7 (map).
Estimates, completed canal, **P-09**, 337.
Estimating expenses, **P-07**, 215.
Excavation, equipment required, **P-06***, 405.
Geological profile, Panama, **P-07**, pl. 147.
History of Panama Canal, Noble. (See No. 213, p. 2365 of this Index.)
Legislation, **P-04**, 23.
Lock type, act prescribing, **P-11**, 560.
Machinery and equipment, department of, **P-05**, 129.
Navigation, aids to, **P-13**, 12.
Opening, exposition to celebrate, **P-11**, 578.
Opening, committee, **P-14**, 600.
Organization for building, **P-05**, 146; **P-06**, 15.
Plans, sea-level and lock-level, comparison, **P-06***, 137.
Prism, experiments in, **P-05**, 108.
Private rights, Panama, transfer to U. S., **P-04**, 35.
Profiles and cross sections, **P-06***, plates.
Projects, lock-level, **P-09**, 352.
Proposals for building, form of, **P-06**, 132.
Range towers, **P-13**, 12.
Sanitation system, Isthmian, **P-04**, 86; **P-05**, 38.
Shops, machine, **P-07**, 79, pl. 76, etc.
Supplies for, obtaining, Tropics, **P-05**, 15.
Terminal plant, usefulness, **P-14**, 187.
Towage locomotives, **P-13**, 9.
Types, lock-level and sea-level, **P-06***, 142.
Vessel movement, curves, **P-06***, 7.
Vessel movement, St. Marys River, **P-06***, 7.
Zone, establishment, **P-04**, 1, 31.

"Canal Record."

P-14, 61.

Canal, Sea-level. (See Canal, Lock; Board of Consulting Engineers.)

Estimate by Mr. Wallace. (See Culebra, Status of.) **P-05**, 144.
Discussion of views, **P-05**, 296.
Committee reported Feb. 14, 1905: "With the rate of progress which now appears reasonable to anticipate, this committee believes that a sea-level canal, with a tidal lock 1,000' long and 100' usable width, at Miraflores, can be completed within 10 to 12 years from this time, the bottom width of the canal being 150' and the minimum depth of water 35'." Estimate, not exceeding \$230,500,000. **P-05**, 299.
Moved at commission meeting that sea-level plan be approved. Subject referred to committee on engineering plans. **P-05**, 326.

Canal, Transformation of. (See Board of Consulting Engineers.)

Possible to make transformation from lock to sea-level type. Estimate for reducing a lock canal with a terminal lake on the Atlantic side formed by a dam at Gatun, with 3 locks on the Atlantic side and 3 on the Pacific, and with a summit level 85' above mean tide, to a sea-level canal with the dimensions

of prism adopted for the sea-level plan, \$208,985,000. Transformation impracticable from a financial standpoint of view. Date for needed change remote. Time required can not be expressed definitely. **P-06***, 38, 220.

Canals, Capacity of.

For traffic. (See No. 177, p. 2355 of this Index.) Suez Canal presents the nearest analogy to the case of the Panama Canal. Depth 31' 2" (being increased to 34' 5"). Amsterdam Canal, Holland, has one pair of locks, 31' 2" by 82' by 738'. Manchester Ship Canal, England, controlled by tidal locks 80' by 600'. Depth at low water, 26'. Kaiser Wilhelm Canal, Germany, has tidal locks 32' by 82' by 492'. St. Marys Falls Canal, U. S., lock 25' by 80' by 1,400' building. "A just estimate of the growth of traffic on the Panama Canal can not be formed from the statistics of the growth of trade on any existing waterway. * * * It is therefore essential that the Panama Canal should furnish a double road for traffic throughout, and we consider that the locks should be built in pairs; that twin locks should lie side by side, and that the different lengths of the canal should be of such dimensions as to permit two of the ordinarily large-sized commercial steamers to pass each other at any part of the journey." **P-06***, 39.

Canals, Dimensions of.

After considering dimensions of various world waterways, "it is believed, therefore, that for many years the commerce seeking the Panama Canal will be amply accommodated by a depth of water not exceeding 35'." 150' recommended as minimum bottom width, 35' as minimum depth; but that estimates be prepared for a depth of 40' as well. If lock canal be chosen, locks should be 100' by 1,000', fitted with intermediate gates. **P-05**, 300.

Dimensions of ships, channels, and harbors: Appendix C. Report of Board of Consulting Engineers. M. Adolphe Guerard. (Translated.) In 1900 tendency for larger vessels became pronounced. Enlarging of Suez Canal. Greater depths in large harbors. List of large ships building, and those existing, 1905. Large ships increasing among various classes. "The increase in the consumption of coal is out of all proportion with the increase in speed. * * * The development of works in maritime ports follows instead of precedes the dimensions of the steamers, for these works are very expensive when they attain the proportions necessary for the operation of large vessels." Increase of depth in harbors; depths of anchorages in English ports. "Should it be necessary in order to determine the dimensions of the Panama Canal to take into account the exigencies of navigation, we must not lose sight of the fact that navigation must shape its tools, the steamers, to conform with the sizes of the ports and canals." **P-06***, 165-170.

Diagram of speeds through canal and locks. Summary of dimensions and speed of vessels. Plates XXIX and XXX. **P-06***, 7.

Canals, Isthmian; physical characteristics.

(See Nos. 4, 5, 6, 7, 16, 20, and 21, p. 2361 of this Index.)

BORINGS (see Routes, below): Lake Nicaragua, **P-99**, pl. 63.

CURRENTS, wind areas, etc.: Western Hemisphere, **P-99**, pl. 75.

COASTS: Panoramic views, Atlantic coast, Isthmus of Darien, **P-99**, pl. 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20.

CLIMATES: Damp and enervating. Temperature, 70° to 95°, but humidity excessive. Important factor in employing labor. Not much to choose between Nicaragua and Panama. **P-99**, 114.

DISCHARGE (see Routes, below): San Juan River (canalized), Nicaragua route, **P-99**, 273 (Appendix H). Special study, with map, tables, diagrams, **P-99**, 280. Lake Bohio, Panama route (Appendix E), **P-99**, 247. Study of waste weir dimensions and discharge, **P-99**, 247.

DRAINAGE (see Routes, below): Caledonia Bay to Rio Sabana, **P-99**, pl. 5.

EARTHQUAKES (see Volcanos, below): "No portion of it (Isthmus) exempt from earthquakes. No very important earthquake at Panama or Nicaragua since 1886." **P-99**, 112. Mechanical action of earthquake, **P-99**, 113. "A force which would leave the foundation intact might throw down a high wall." "The works of the canal will nearly all of them be underground." "The locks will all be founded upon rock." Probable that lockgates may be distorted, but such an event to be classed with injuries, such as made by collisions, etc., and to be cared for in a similar way, etc. **P-99**, 114. A fissure probable, draining canal, but such an occurrence in a class with an unwonted conflagration. "If a timorous imagination is to be the guide, no great work can be undertaken anywhere." **P-99**, 114.

ELEVATIONS: Observed from sea, Atlantic coast, Isthmus of Darien, **P-99**, pl. 7, 8.

HEALTH. (See Climate, above.)

HYDROGRAPHY OF NICARAGUA (Appendix I). R. by A. P. Davis, chief hydrographer.

Stream measurements—Pacific slope: Grande River, Tola River, **P-99**, 282. Lake Nicaragua: Viejo River, Neuva River, Quebrada Honda, station at Tipitapa, station at Fort San Carlos, Frio River; dry season inflow, **P-99**, 286-296. San Juan River: Station above Sabalos; station at Castello, tributaries of San Juan above Boca San Carlos; Ochoa station on San Juan River; Machado River; San Francisco River; Sarapiquí River; San Juanillo River; miscellaneous tributaries to

San Juan River, **P-99**, 299, 321. Indigo River; Negro branch, **P-99**, 323.

Rainfall: On Lake Nicaragua, **P-99**, 326; Ochoa, **P-99**, 332; Greytown, **P-99**, 332; monthly at all stations, **P-99**, 333.

Evaporation: Observations on evaporation pans, **P-99**, 336; dry season evaporation from Lake Nicaragua, **P-99**, 337.

Control of Lake Nicaragua: Season of maximum supply, **P-99**, 337-340; of minimum supply, **P-99**, 341.

Temperature and relative humidity, **P-99**, 342.

Sediment, **P-99**, 344.

Wind movement, **P-99**, 346.

Illustrations of report on hydrography of Nicaragua route: Momotombo, from the west (fig. 1), **P-99**, 286; San Juan River above Toro Rapids (2), **P-99**, 288; elevations of Lake Nicaragua (3), **P-99**, 295; elevations of Lake Nicaragua if all water had been held by a dam (4), **P-99**, 299; Mica Island, San Juan River (5), **P-99**, 309; sediment trap (6), **P-99**, 311; gauging San Juan River at Ochoa (7), **P-99**, 312; fluctuations of San Juan River (8), **P-99**, 315; hill on left bank of San Juan River (9), **P-99**, 317; head of San Juanillo on San Juan River (10), **P-99**, 319; Castillo Rapids (11), **P-99**, 323; surf at Greytown (12), **P-99**, 323; monthly rainfall at Masaya and Granada (13), **P-99**, 325; comparative monthly rainfall, Greytown, San Carlos, and Granada (14), **P-99**, 332; comparative rainfall at all stations (15), **P-99**, 336; lowering sediment trap on Sarapiquí (16), **P-99**, 337; wharf at Granada (17), **P-99**, 338; rise of Lake Nicaragua, with no outflow nor evaporation, compared with rainfall at Granada (18), **P-99**, 340; compared with rainfall at Masaya (19), **P-99**, 341; discharge capacity of canalized San Juan River (20), **P-99**, 342; estimated inflow of Lake Nicaragua, 1897, based on observations of 1900 (21), **P-99**, 344; fluctuation of lake during driest and wettest years, based on runoff, 1900 (22), **P-99**, 345.

HYDROGRAPHY OF PANAMA (Appendix D). R. by A. P. Davis, chief hydrographer.

Hydrography of Panama, **P-99**, 219; Chagres River, **P-99**, 222, 225; minor streams on Isthmus, **P-99**, 227; floods of Chagres, **P-99**, 227; low water of Chagres, **P-99**, 228; rainfall of Isthmus of Panama, **P-99**, 230; discharge and rainfall observations, by W. W. Schlect, **P-99**, 233.

Illustrations of report on hydrography of Panama route: Scene on upper Chagres River (1), **P-99**, 219; fluviograph at Bohío (2), **P-99**, 220; overhanging ledge on upper Chagres River (3), **P-99**, 220; Cristobal-Colon (4), **P-99**, 220; Alhajuela (5), **P-99**, 220; comparison of gauging curves showing the reason for the discrepancy in the results obtained by the Panama Canal Co. and the Isthmian Canal Commission No. 1 (6), **P-99**, 222; hydrographs of the Chagres River at Gamboa, plotted from observations of the

Panama Canal Co. (7), **P-99**, 225; comparative hydrographs of Chagres River (8), **P-99**, 226; rating curve for floods of the Chagres River at Bohío (9), **P-99**, 228; Obispo lock site, used as a meter-rating station by the Isthmian Canal Commission No. 1 (10), **P-99**, 232; fluviographs (11, 12), **P-99**, 234, 238.

MOUNTAIN RANGES: Isthmus of Darien, **P-99**, pl. 2.

PROFILES: Nicaragua, **P-99**, pls. 48, 49, 50, 51-59; upper San Juan River to Indio, **P-99**, pl. 61-62; Panama route, **P-99**, pl. 22, 23.

RAINFALL (see Hydrography, above): Zones of, Panama route, **P-99**, pl. 71. Nicaragua, **P-99**, pl. 72, 73.

ROUTES: Possible routes, **P-99**, 49. American Isthmus 1,400 miles long, embraces that portion of the Republic of Colombia west of the Atrato River, the whole of the 5 Republics which are grouped together as Central America, and so much of Mexico as lies east of Tehuantepec. General direction of the Isthmus is from se. to nw. For the entire 600 miles the width of this Isthmus is comparatively small, varying from a minimum of barely 30 miles to a maximum of 120 miles. It then widens to 300 miles near the boundary between Nicaragua and Honduras, narrows to about 120 miles opposite the Bay of Honduras, widens again into the great peninsula of Yucatan, and finally narrows to 120 miles at Tehuantepec.

A glance at the map appears to indicate that the only possible routes for an interocean canal must be at Tehuantepec, at the Bay of Honduras, or within the eastern 600 miles. While Tehuantepec is admirable for a ship railway, this route, on account of the probability of poor water supply, cost of locks and the number of them, together with the additional cost of the canal proper, must be considered impracticable, in spite of its convenience of approach and accessibility on both sides by the U. S. **P-99**, 49.

The next point is the Bay of Honduras. It is a mountain region. Out of the question. **P-99**, 49.

Within the limits of the 600-mile stretch at the eastern end of the Isthmus several routes have been proposed. At the western limit of this stretch is Lake Nicaragua. With the exception of Nicaragua and Tehuantepec, all the routes proposed for an isthmian canal terminate in the Gulf of Panama or on the South American coast south of that Gulf, the latter using the Atrato for their Atlantic approach. **P-99**, 49, 50.

The Atrato rises near the 5th degree of north latitude, flows northward about 300 miles, at a comparatively short distance from the Pacific and parallel to it. It is a silt-bearing

river having a considerable fall, and not adapted to the passage of ocean craft without large expenditure for improvement and maintenance. **P-99, 50.**

The routes most talked of for years, terminating on the Gulf of Panama, are: The Panama route, the San Blas route, and the Caledonia route. The Panama, the most westerly of the three, in use for years by means of the Panama R. R.

The chief difficulty of the San Blas route lies in the height of the summit, to cross which tunnels 8 to 10 miles long have been proposed. **P-99, 51.**

The Caledonia route is the location whereby the isthmian way was first crossed by white men. Peterson chose this location for his Scotch colony in 1698, 200 years after Balboa crossed. All vestiges of white men's labors here have disappeared. "It would be hard to find any spot in America where there are fewer signs of the work of the white man." Careful examinations and surveys show the improbability of the existence of any practicable canal location between Panama and the mouth of the Atrato, except by the adoption of a tunnel line, the objections to the latter being obvious. There are three probable tunnel routes via the Caledonia route. Cost of tunneling, per mile, about \$22,500,000.

A tunnel via the San Blas route would be at tide level. Engineering cost, including 4.2 miles of tunnel, \$289,770,000. Length of the line would be about 37 miles.

Length of line by Caledonia route, about 30 miles. Tunnels, of three routes, would be at tide-level canals. Engineering cost, \$263,340,000, \$283,440,000, or \$320,040,000.

The only restriction on the length of a ship passing through tunnels would be the curves. The tunnels would be as absolute restrictions on depth and width as the locks of Nicaragua or Panama.

The only advantage such lines of passage would have over a tide-level line at Panama would be in the superiority of their Atlantic harbors, Mandinga Harbor in San Blas Bay, and Caledonia Bay; not enough to overcome the disadvantage of a tunnel. **P-99, 50, 51, 52, 53, 54, 55.**

General map of Central American Isthmus, Tehuantepec to Buenaventura Bay, **P-99, pl. 1.** Map of Panama route, **P-99, pl. 21.**

Details, Panama route, **P-99, 56.**

Panama route: Narrow Isthmus, low summit, width less than 36 miles in a straight line, only 5 miles more than at San Blas, the narrowest place. High portion of the Isthmus limited to a width of about 6 miles near the Pacific side. Chagres River affords access by canoe navigation from the Atlantic to within 16 miles of the Pacific. Steamship lines to California discharge their passengers at the mouth of the Chagres; conveyance, up that river, thence overland to Panama. Panama

R. R. made its Atlantic terminus at Bay of Limon, 7 miles east of the Chagres mouth. The road follows the valley of the Chagres to Obispo, and thence crossed through the lowest gap to Panama. (Location almost identical with that adopted for the canal.) **P-99, 56.**

At Colon, the Atlantic port, tide range about 1'; at Panama, about 20'. Colon Harbor exposed to "northers"; ships sometimes compelled to go to sea. **P-99, 56.**

Map of San Blas route, **P-99, pl. 3, 4.**

Map of route Caledonia Bay to San Miguel Bay, **P-99, pl. 6.**

Details, Nicaragua route, **P-99, 71.**

Nicaragua route: Water communication by means of a large river and lake from the Atlantic to within a short distance of the Pacific accentuates the natural advantages of this route, "and at the same time tends to exaggerate them and to obscure the attendant difficulties," **P-99, 71.**

Lake Nicaragua, about 103 miles long; maximum width, 45 miles; area, about 3,000 square miles. Its longer axis is parallel to the Pacific coast; resembles Lake Erie somewhat in shape, but has only about one-third the latter's area.

First instrumental survey made by Nicaragua Canal Commission, 1893; found that bottom of the lake is above sea level over the greater part of its area. Maximum depth about 200', found just south of the island of Ometepe, which has an elevation of 5,000'. **P-99, 71.**

About 18 miles to the northwest of Lake Nicaragua, on a prolongation of its axis, lies Lake Managua, extending a distance of 37 miles toward the Gulf of Fonseca, a large, natural harbor opening to the Pacific Ocean **P-99, 71.**

Lake Managua is drained through the river Tiptapa, which is frequently without water in the dry seasons. The lake is 65 miles from the Gulf of Fonseca. A shorter route from Lake Managua to the Pacific crosses the plain of Leon to the Bay of Corinto, about 35 miles in an air line. **P-99, 71.**

Surface of Lake Nicaragua a little more than 100' above sea level. Mr. Menocal in his 1885 report says that the lake was as high as 110.63' above mean sea level at the end of the wet season of 1878. It has been as low as 97' or less. Extremes reached at long intervals. In 3 years' consecutive observation, fluctuations only 6.09'. **P-99, 71.**

The drainage basin of the lake is in great part mountainous. Continental Divide, formerly on eastern side, now between the lake and Pacific. Col. Childs, 1850-1852, developed the lowest crossing, crossing the divide at an elevation of only 153' above mean tide and following the valley of a small stream called the Rio Grande to the Pacific at Brito. **P-99, 71, 72.**

Lake Nicaragua discharges through the San Juan River at Fort San Carlos, follows a tortuous course in a southeasterly direction, and

empties through several mouths into the Caribbean Sea near Greytown. Distance from lake outlet to mouth about 80 miles air line, but 120 by windings of river.

The Indio, which empties into the Caribbean some 6 miles northwest of Greytown, runs parallel to the San Juan, the headwaters of some of its tributaries being only about 15 to 20 miles distant from that river.

The San Juan has a number of tributaries, none of great size, save, perhaps, the San Carlos, the Serapiqui, and the Negro. In flood times the discharge of all these streams affects the San Juan. When the San Carlos is in flood the San Juan current may set upstream. **P-99, 72, 73.**

San Juan: Slopes in various reaches; table, **P-99, 73.**

Below the mouth of the Serapiqui the San Juan River enters the coastal plain, a region of swamps, bayous, and lagoons. About 20 miles from the sea it divides into two outlet branches—the lower San Juan, which discharges through Harbor Head Lagoon near Greytown, and the Colorado, which discharges directly into the Caribbean, about 15 miles to the southward, forming the principal outlet. **P-99, 74.**

Trade winds blow almost constantly; not believed that the winds would seriously interfere with canal navigation at any time, **P-99, 74.**

Along the Atlantic coast in the vicinity of Greytown and for some distance inland the rainfall is the greatest known on the Continent. There is no definite dry season. Rain may be expected any day of the year. On the other hand, the entire drainage basin of Lake Nicaragua lies in a region having a well-defined dry season. The average rainfall near Greytown sometimes amounts to nearly 300". In the drainage basin of Lake Nicaragua the average rainfall is about 65". **P-99, 74.**

Geology: Indications of a general subsidence of the Atlantic coast in the region of the Nicaragua route. The former rocky bed of the San Juan appears to have been depressed. At the dam site adopted by Isthmian Canal Commission No. 1 at Conchuda the distance from the low-water surface to the lowest point in the rock cross section is about 80'. From the mouth of the San Carlos down is a deep rocky trough, which is filled with sand. In the coastal plain, consisting mainly of swamps, vegetable matter intermixed with silt is found to a considerable depth, but within 5 or 6 miles of the coast sand is found extending to a great depth under a light covering of mud. **P-99, 74.**

Attractive favorable transisthmian route immediately after the discovery of gold in California. Passengers arriving by sea at the port of Greytown, at that time an excellent harbor, were transported by steamboats to the west shore of the lake; whence the Pacific was reached by a short stage line, which terminated at the port of San Juan del Sur. Successive projects for interoceanic communi-

cation have had to provide for the increasing dimensions of ships; the serious difficulties nearly all found between Machuca Rapids and the Caribbean. **P-99, 75.**

The region of practicable canal routes is limited to the north side of the San Juan River, by the existence of the San Carlos and Serapiqui Rivers on the south side. Financially it would be impracticable to divert these streams, and it would be equally impracticable to take them into the canal. Hence, all the surveys and examinations for a canal route have been confined to the north side of the river. **P-99, 75.**

Topography of the country in the vicinity of the route generally rough. Hills of medium size bunched and steep; swamps between them. Dense tropical vegetation; few places where transit line can be run 50' without cutting out a line of sight; this accounts for paucity of information.

From Greytown to Castillo the boundary line between the Republics of Costa Rica and Nicaragua follows the right bank of the San Juan. Thence to the lake the boundary is a line on the right bank, generally about 2 miles from the river. Both shores from Castillo to the lake are therefore in Nicaraguan territory. In case the level of the water of the river is raised by the construction of a proposed dam at Conchuda, some of the lands in Costa Rican territory would be submerged, although the canal line proposed from Castillo westward to the Pacific would lie wholly in Nicaraguan territory. **P-99, 75.**

Greytown Harbor; old maps; map of 1832; hydrographic charts of Great Britain; trend of coast; outlets of San Juan; sedimentary deposits; effect of wave action on coast; movement of sand spit; erosion or accretion dependent on direction of waves and sand supply; reentrant angle; apparent recession of 8-fathom curve, of 6-fathom curve; how to stop westerly drift of sand; construction of harbor feasible, **P-99, 92, 93, 94.**

Details of physical features, vicinity of Brito, on the Pacific Ocean, **P-99, 95.**

General map, Nicaragua route, **P-99, pls. 28-47.**

TOPOGRAPHY, Caledonia Bay to Rio Sabana, **P-99, pl. 5.**

VOLCANOES (see Earthquake, above): Central America, **P-99, 112; pl. 70.**

WATER COURSES: Isthmus of Darien, **P-99, pl. 2.**

Canals, World-famous.

Relative efficiency of, considered in report of Isthmian Canal Commission No. 3 on question of lock or sea-level canal for Panama. Most important ship canal in the world that at Sault Ste. Marie, Mich. Tonnage there per annum 3 times that carried by the Suez Canal, and is greater than the aggregate tonnage of

Suez, Manchester, Kiel, and Amsterdam Canals combined. One of its locks the largest in existence; in successful operation since 1896. Majority of Board of Consulting Engineers have attempted to belittle this experience. Isthmian Canal Commission No. 3 majority did not concur in opinion also that a lock properly constructed and managed "is in any sense a menace to the safety of vessels." "Practical experience has demonstrated the contrary beyond dispute." P-06*, xiv.

Canals of the world: Description of, with plates and cross sections. Appendix D. Report of Board of Consulting Engineers. P-06*, 171-184.

The Manchester Ship Canal. By W. H. Hunter. Depth of water, width at bottom, inclination of side slopes, proportion between sectional areas of canal and vessels navigating canal, curvature.

The Kaiser Wilhelm Canal (Kiel Sea Canal). By E. Tincauzer.

The North Sea Canal. By J. W. Welcker.

The Suez Canal. By E. Quellenec. Depth of water, bottom width, inclination of slopes, cross sections, authorized draft, speed of ships, currents, proportion between sectional areas of canal and areas of midship sections of vessels, curves.

St. Marys Falls Canal. By Joseph Ripley. Curvature, side slopes.

The Corinth Canal. E. Quellenec.

Dimensions of the canals of Europe. A. Guérard.

Captains of the Ports, P-14, 261.

Cargoes.

Appliances for handling, P-12, 218.

Electrical cranes, P-14, 89.

Redesign of cranes, docks, P-13, 99.

Car Department. (See No. 157, p. 2364 of this Index.) (See Panama R. R.)

Cars. (See Equipment.)

Car and foundry department, P-09, 145; P-10, 267; P-11, 236.

Dump cars, loading, P-07, pl. 23.

Dumping, P-07, 48, pl. 33.

Loading rock on, quarry, P-11, 132, pl. 6.

Largest number handled in a day, central division, P-12, 151.

Loaded per day, P-10, 144; P-11, 140; P-12, 151; P-13, 147.

Machine shop, P-10, 268.

Number, repairs, cost, etc., P-11, 241.

Push cars, old French cars utilized, P-10, 160, pl. 31.

Repairs, P-10, 273; P-11, 236; P-12, 275.

Shops, P-11, 236.

Castings.

Buffer castings, locks, P-10, pl. 76.

Brass castings, output and cost, P-13, 263.

Iron castings, output and cost, P-13, 262.

Made on Isthmus, lock structures, P-10, 49; P-11, 67; P-12, 72; P-13, 77.

Mechanical division, output of, and cost, P-14, 257.

Steel castings, output and cost, P-13, 262.

Cement.

Material for, site of Panama Canal, P-07, 131.

Supply of, P-10, 111.

Service of, Gatun, P-11, 103; P-12, 111.

Shed, Miraflores, P-09, 97; P-10, 171.

Unloading, P-10, 58.

Cemetery, Mount Hope, P-07, 76.

Census.

Table of elements of the zone population, P-06, 79.

Executive order relating to, P-12, 613.

Central Division. (See No. 241, p. 2367 of this Index.) (Takes in the former Culebra and Chagres divisions.)

1909. Duties: Embraces all the excavation between the Gatun Dam and Pedro Miguel, including the diversion channels; construction of the Naos Island breakwater; clearing of timber from the channel and anchorage basin; and such municipal, sanitary, and building work as may be included within the district limits.

In charge: Lt. Col. D. D. Gaillard, Corps of Engineers, U. S. Army, as division engineer. P-09, 10.

Culebra section: Limits, from Chagres River in the vicinity of Gamboa to Pedro Miguel. Plan, originally contemplated channel 300' wide at the bottom, save for the portion between Las Cascadas and Paraiso, where the width was fixed at 200'. Oct. 23, 1908, the President authorized the widening of this portion so that the minimum bottom width throughout should be 300'.

Divisions: Excessive rainfall; adjacent streams rise rapidly. Obispo diversion, caring for drainage on east side, completed June 1, 1909. Carries water into the Chagres about $\frac{1}{2}$ mile east of Gamboa. Required excavation of 1,132,000 c. y. (two-fifths rock), and dike construction totaling about $1\frac{1}{2}$ miles.

Drainage: Water which falls within the prism, etc., cared for by the cut itself, through means of pilot cuts. Bed of canal at crossing of Chagres River at plus 40; excavation at grade. Dike of natural surface left. Pipes laid through dike for drainage; and pumping plant under way.

Excavation: Widening of top areas sufficiently to secure the required bottom width practically completed. Excavated from the prism during the year, 18,442,624 c. y., place measurement (12,291,472 c. y. rock). At the close of the year 43,574,954 c. y. remained to be removed in order to complete the canal.

Dumps: Various dumps in vicinity of cut abandoned, as they became uneconomical; toward close of year practically all material hauled to dumps at Tabernilla, Miraflores,

Balboa (formerly La Boca), and along the line of the relocation of the Panama R. R. between Caimito and Gamboa. Rock from vicinity of Bas Obispo and Empire was still hauled to Gatun for the dam. Completion of the Gamboa bridge gave access to the line of the heavy embankments to be built on the relocation, and 14,731 linear feet of trestle filled.

Filling: 145 acres reclaimed east of the Panama R. R. wharves at Balboa, with dumpings.

Naos Island breakwater: Dumpings used in building. Object of breakwater, to cut off silt-bearing currents approaching or crossing the excavated channel in the Pacific, thereby reducing the cost of maintenance. Extended out approximately 2 miles; upward of 3,000,000 c. y. deposited from trestle; 1 mile to be done.

Slides: Continue as a source of annoyance. Cucaracha slide extended northward until it joins one just south of Gold Hill. Measures 2,700' along the cut, involving area of 27 acres. Total amount removed for the year, 670,017 c. y.; 700,000 c. y. still in motion. Drainage by the French to prevent slide of no benefit. New Culebra slide next largest. 125,000 c. y. in motion. Other slides. During the year 884,530 c. y. removed from all; estimated that 1,000,000 c. y. still in motion.

Explosives: Number of accidents small; casualties large. Experiments to gain best methods. Electric-light current used for exploding, and firing by fuses in parallel. Danger of unexploded charges found by steam shovels practically eliminated.

Lake section: Limits, extends from Gamboa to Gatun. Formerly constituted the Chagres River division. Chagres River course: Crosses the line 23 times, forming peninsulas numbered as Point 1, Point 2, etc., beginning at Gamboa. Dredging across Points 1 and 2; waters of Chagres turned in June 9 at Point 2; total of 1,784,459 c. y. excavated, 1,350,308 removed during fiscal year. Gravel in large quantities brought into new cut by floods; will be removed by dredges or by drains and utilized for making concrete to revet slopes of Culebra section. Changing course of river permits old bed to be used as a dump. Cutting across Point 3 begun June 12, 1909. At Caimito excavation was begun Oct. 1, 1907; during fiscal year 1,375,599 c. y. removed. At San Pablo excavation continued until Jan. 4, 1909. During the year 558,077 c. y. removed; 220,182 c. y. remains to complete the peninsula. Cano River cut: On west side of Chagres River, nearly opposite Tabernilla. Work begun Dec. 15, 1908; 583,867 c. y. removed. Isolated knolls: Above bottom grade of the canal, vicinity of Bohio. 107,740 c. y. removed; 88,000 c. y. remained for removal.

Buena Vista: Work started near, on right bank of Chagres, to secure necessary width and depth of channel.

Anchorage basin: Flat area south of the Gatun Hills. Clearing of it begun, and the channel,

to elevation 15; roots grubbed, and a total of 1,256 trees cleared. In the channel from Gatun to mile 13, trees cut down over an area of 458 acres, removing all standing timber from the channel 1,000' wide. Between miles 26 and 27, in the vicinity of Mamei, 43 acres were also cleared. **P-09, 10, 11, 12, 13, 14.**

Municipal, building, and sanitary work: Water supply; 15,560' pipe laid in extension. Sewer system, 5,894' laid at various settlements; 59 house connections made. Bridges; suspension bridge begun at Empire. Roads; constructed in vicinity of Culebra, Empire, Gorgona, Bas Obispo, San Pablo, and Tabernilla. Buildings; number of various kinds put up; repairs made. Sanitation; 24,370 linear feet open ditches laid; tile drains and filling. Existing drains maintained. **P-09, 14.**

1910. Five construction districts consolidated into four, as follows: Chagres River district, Gatun to Chagres River at Gamboa; Empire district, Gamboa to Empire suspension bridge; Culebra district, Empire suspension bridge to railroad crossing north of Pedro Miguel Locks; and Pedro Miguel district, embracing excavation between railroad crossing and locks, dumps south of Pedro Miguel, and construction of Naos Island breakwater. Division includes Culebra Cut proper, Gamboa to Pedro Miguel.

Chagres district: Work on Point 1 commenced Feb. 24, 1908, continued until June 15, 1909, when, because of high water, work discontinued; resumed Jan. 20, 1910; excavation at this point completed May 28, 1910; 286,560 c. y. taken out. Total removed from Point 1, 1,246,761 c. y. Point 2, between Matachin and Gorgona, completed May 25, 1909. Bottom of the cut was between 2 and 3' above bottom of Chagres River at a point where the latter crosses the cut, and heavy floods of Nov. and Dec. deposited about 109,000 c. y. gravel. Steam shovel and orange-peel crane put at work to collect this gravel for use as ballast and roads; 56,238 c. y. removed and stored. In consequence of this supply, crushing plant at Bas Obispo put out of service. Point 3 lies on east side of Chagres River opposite Gorgona; excavation begun June 12, 1909; continued until close of year; 832,646 c. y. removed. There remained 157,522 c. y. to complete this section, but as every slight rise of Chagres River stops work, it became necessary to remove tracks and shovels. Remaining material loosened by blasting; hoped that floods of Chagres will remove it; such as may remain will be taken out by dredges. Point 4 lies on left bank of Chagres at Gorgona; excavation begun June 2, 1910; 10,646 c. y. removed. Point 5 at Juan Grande; excavation commenced June 2, 1910; 23,824 c. y. removed. Point 6 north of Juan Grande; work commenced May 2, 1910; 46,741 c. y. removed. Handwork at Point Mamei commenced Apr. 15, 1910, and excavation by steam shovel June 15; 8,315 c. y. removed.

At Mamei work commenced Sept. 17, 1909; 372,671 c. y. removed. Excavation at Caimito in progress at close of the last year continued, removing 338,675 c. y.; completed the work in this locality on Apr. 22, 1910. Total excavation at this point, 2,268,572 c. y. During the year 5,899 c. y. removed from San Pablo section, which leaves 258,000 c. y. remaining. Cano River section on west bank of Chagres nearly opposite Tabernilla. Work begun Dec., 1903; completed Sept. 24, 1909; total removed, 707,031 c. y. Work commenced at Tabernilla Nov. 13, 1909, and carried forward to June 17, 1910; 392,490 c. y. removed. Near Buena Vista, on right bank of Chagres, are 2 hills, parts of sides of which had to be removed to give channel necessary width and depth. Work commenced June 29, 1909; completed Nov. 10, 1909, by removal of 153,026 c. y., transported to and dumped in toes of Gatun Dam. At Bohio, steam-shovel work consisted in removing rock hill near north end of village; commenced Sept. 4, 1909; completed Nov. 10, 1909; 33,874 c. y. removed. Isolated elevations projecting but short distance above proposed level of bed of canal removed by employees or by contractors. That done by Isthmian Canal Commission commenced Jan., 1909, completed Nov. Total excavated in vicinity of Bohio, 184,148 c. y. Contract made for removal of 160,947 c. y. from prism between San Pablo and Bohio; all removed excepting 14,223 c. y. Contract entered into for excavation of 202,410 c. y. between Tabernilla and Bohio. Third contract entered into Feb. 10 to excavate 397 c. y. on miles 14 and 15 and miles 19 and 20; finished Mar. 15. Total amount removed from Chagres section from 1907 to close of the last year, 9,497,673 c. y., leaving estimated amount of 3,415,944 c. y. This amount increased over estimate of Sept., 1903, by 251,965 c. y., for excavating to elevation 39 above sea level instead of 40, made necessary by floods, and by allowing 670,000 c. y. for silting. Clearing, grubbing, and burning of trees in channel of Lake Gatun commenced; 950.4 acres cleared.

Culebra Cut: During the year 14,921,750 c. y. excavated, leaving 34,893,531 c. y. The remaining amount includes increase of 6,408,560 c. y. over estimate of Sept., 1903, due to widening canal north of Pedro Miguel Lock to form basin, adding thereby 932,572 c. y., and to allowing 5,475,988 c. y. for slides and breaks, as new ones developed during year. Previous to fiscal year movement of material into prism due almost entirely to slides caused by movement of top layer of clay upon smooth sloping surfaces of rock or other material harder than clay. In addition, several breaks occurred in banks. Of the slides proper, most important at Cucaracha. Total area embraced since commencement of operations, 47.1 acres. Prior to July 1, 1909, 1,125,017 c. y. material removed from this slide, and 639,239 c. y. removed during fiscal

year. Next largest slide is on west bank where New Culebra was located, caused by movement of large French dump into canal. Area involved, 7.3 acres. Prior to July 1, 1909, 118,024 c. y. removed, and 327,540 c. y. removed during year. Third slide covers 4.6 acres, and is on east bank directly opposite Whitehouse yard. Prior to July 1, 1909, 50,800 c. y. removed, and 110,000 c. y. re-removed during present year. Fourth slide covers 1.7 acres on east bank of the Obispo diversion at La Pita Point, where west slope of a hill broke away and commenced to slide toward Obispo diversion; 15,608 c. y. taken away. Three bad breaks occurred during year. On west bank at Culebra break covers 10½ acres, and during year 1,500,388 c. y. removed, making a grand total of 1,650,000 c. y. since break began. Second largest break, directly opposite that just described, covers 11½ acres on east side of canal; during year 314,184 c. y. removed, making total from this locality 420,202 c. y. Third break was at La Pita Point, and permitted waters of the Obispo diversion to flow into canal for three days, drowning out some shovels at north end. Break aggregates 40,000 c. y. Flume constructed to carry flow of diversion past break. Total removed from slides and breaks in central division during year, 2,649,563 c. y., or 15 per cent of amount removed from Culebra Cut.

Floods seriously interfered with progress of work, and one of Dec. 26 overflowed dike separating cut from Chagres, cutting channel 200' long and 21' deep. Steps taken to rebuild it; accomplished, and dike maintained through flood of Dec. 30. Subsequently it was strengthened and carried to elevation of 73 at top of rail. Track on dike connects relocated line at Gamboa with main line of Panama R. R. at Matachin. Pump with capacity of 18,000 gallons a minute ordered to be added to those already in north end of cut to handle water accumulating.

During year 17,749,306 c. y. deposited in various dumps. Most important of these at Tabernilla, relocated Panama R. R. between Gamboa and Caimito, Miraflores, and at Balboa. In addition, over 1,150,000 c. y. removed from Culebra Cut taken to Gatun and deposited in toes of dam. Several dumps opened in Chagres section. Material deposited at Tabernilla and Miraflores outside of relocation of railroad wasted. That dumped on Panama R. R. relocation is used for filling trestles and for raising embankments; 2,351,334 c. y. useful for this purpose. Material deposited at Balboa is useful in that land is reclaimed from ocean, which will be valuable; 108 additional acres reclaimed, making total of 253 acres.

Breakwater started from Balboa toward Naos Island with object of cutting off silt-bearing currents from excavated channel in Pacific, thereby reducing cost of maintenance, and

making navigation easier by protecting vessels from cross currents. During year trestle extended 1,123', giving a total length from shore of 2.4 miles. End of trestle was within 4,900' of Naos Island, and the filling extended to within 400' of end. Trouble experienced in extending outer end of dike, due to sliding of bottom when weight of stone filling was dumped from trestle. Sliding has taken place at every foot of the last 4,000' of dike, and continual settlement of roadbed for 2 or 3 months, after which it gradually diminishes.

Empire shops: On Nov. 5, 1907, a force of mechanics was organized to work in the cut at night in repairing steam shovels. Repairing of steam shovels and manufacture and repair of steam-shovel parts for entire canal transferred to central division, Oct. 1, 1909, when Empire shops were transferred from mechanical division and all other mechanical work formerly handled at Empire shops transferred to Gorgona shops.

Municipal work: Road 8' wide constructed from Empire to Las Cascadas plantation, 2.6 miles, completed Oct. 31. Road between Empire and Paraiso continued, 75 per cent completed June 30. Road between Empire and Gorgona 52 per cent completed. Suspension bridge at Empire completed July 31, 1909. Sanitary work consisted of constructing 17,149 linear feet of ditches, regrading 116,028 linear feet of ditches, cleaning 1,453,741 linear feet of ditches and 56,441 linear feet of concrete drains, laying 7,289 linear feet of tile drains, constructing 56,441 linear feet of concrete gutters, and clearing 123,597 sq. y. **P-10**, 14-20.

1911. Chagres district: The material which remained to be removed July 1, 1911, in Point 1, consisted of gravel and sand washed in by the Chagres River; 20,455 c. y. removed and taken to storage piles. Point 2: Of gravel and sand, 46,102 c. y. removed. Point 3: 91,278 c. y. washed away by freshets. Point 4: 828,462 c. y. removed by steam shovels. Point 5: 438,241 c. y. removed, completing section. Point 6: Section completed Oct., 1910, by which time 112,238 c. y. had been removed by steam shovels. At East Mamei: 598,213 c. y. removed by steam shovels; work at this point completed Mar., 1911. At Mamei: 10,066 c. y. removed by steam shovels, July, 1910, completing work. At Tabernilla: 51,970 c. y. removed in Feb. and Mar., 1911. At Caimito: 731 c. y. removed in Mar., 1911, completing work. Of contracts, that between San Pablo and Bohio completed by removal of 13,832 c. y. making total removed, 170,808 c. y. Contract for removal of 202,140 c. y. from prism between Tabernilla and Bohio still in progress, contractor removing 105,532 c. y. during year. Contract entered into Dec. 6, 1910, for excavating 112,450 c. y. from canal prism between stations 28-1000 and 28-2300. Work begun Dec., 1910; by close of year 68,904 c. y. removed. Total removed from Chagres sec-

tion during the year aggregated 2,301,020 c. y., leaving on July 1, 1911, to complete this portion 533,921 c. y. Excavation in Chagres River section 95.68 per cent completed June 30, 1911. Clearing, grubbing, and burning trees in channel of Gatun Lake by hired labor commenced at beginning of dry season; 182 acres of trees and brush cut in vicinity of Chagrecito and Bohio; completes all clearing of channel throughout central division. In connection with lighting and buoying canal this division cleared 373.5 acres and cut 67,550' of trocha for running profiles.

Culebra Cut: During the year 16,221,672 c. y. excavated; estimate again increased over that reported a year ago by 4,676,278 c. y., to allow for slides developed beyond the limits assumed in the preparation of former estimates. Total removed during the year outside of slope lines and because of slides aggregated 4,879,378 c. y., or 30.07 per cent of total amount of material removed from cut, as against 15 per cent during previous fiscal year. Thus far 10,757,658 c. y. of material due to slides removed. In addition to the slides, breaks have occurred, notably on both sides of the cut at Culebra. Rational method of treatment seemed to be to relieve or reduce the pressure as much as possible, and work along these lines was directed in the latter part of the dry season on the west side of Culebra Cut, and has been so successful that a point has been reached so that the shovels at the bottom are not interfered with, and are enabled to move ahead without bulging due to pressure from this side. Intermediate benches along the slope are cut so as to distribute the top weight and reduce amount of material that may have to be removed. Work was started similarly on east side along same lines. Geological formation of the Isthmus is very irregular and the character of material encountered in the cut is constantly changing, so that it is impossible to determine in advance where slides and breaks are liable to occur, or, when they do occur, the slopes which they will ultimately assume. Estimate of the amount remaining due to slides may not be reached; it may be exceeded. To be noted that 6 of the good-sized slides which have given trouble in the past now quiet, with no indication of further movement, and the work of deepening the cut and widening the lower reaches has progressed satisfactorily with less interruption or interference on account of slides than at any time since trouble with them began. Increases in estimates of material to be removed made necessary by the slides will cause no increase in the total estimated cost for Culebra Cut, due to the reduction in the unit cost of the work; no indication that such increases will delay time of completing the work, because progress greater than expected, and by working on the upper reaches of the slopes the output maintained. The slide of greatest

importance was that at Cucaracha, 47.1 acres. To July 1, 1911, 2,722,164 c. y. removed, and there remain 400,000 c. y. Last shovel cut at foot of Cucaracha slide made in first part of June, 1911, on the permanent berm at 95' level, since which time there has been no sign of any movement, the slide apparently being "dead." Next largest slide was the Culebra slide, first reported as covering 7.3 acres; now covers 46.6 acres; at present most troublesome. On east bank opposite Culebra estimated 2,329,784 c. y. had been removed, and there remain 1,864,350 c. y. On west bank 3,714,662 c. y. have been removed and there remain 3,391,300 c. y. The other slides have diminished in importance.

The summit of drainage in the cut at Empire, and water entering to the south of this point drained into Pacific Ocean by pumping from sump at Pedro Miguel. Eight pumps of various types available on the Isthmus utilized having capacity of 38,250 gallons per minute. Arrangements in progress for draining through center culvert of Pedro Miguel Locks, which will eliminate pumps at this end, and gravity drainage south of summit will result. Dike separating cut on north side from Chagres River remained intact. Additional pump installed and water flowing to north of summit drained to sump at Bas Obispo end of cut, from which it was pumped into Chagres River. There are 8 pumps of various types, having total capacity of approximately 59,290 gallons per minute. As already noted, Obispo River broke into the canal through break at La Pita Point; at that time water checked and handled through a wooden flume, until Jan., when reinforced concrete flume 7' high, 22' wide, and 400' long was commenced and completed in Apr. Flume has maximum discharge capacity of 3,000 cubic feet per second, or 15 per cent more than the greatest recorded flow at this point. Slide on east side of canal opposite White House, in Oct., 1910, broke back to Obispo diversion dike. New channel cut through a saddle so as to carry waters about 1,000' farther from canal at this point, necessitating excavation of 22,416 c. y.

As depth of the cut has increased, egress for dirt trains more and more limited, resulting in decrease in dumps that could be economically utilized. Trains run from south end of cut at Pedro Miguel to dumps at Balboa and Miraflores, and from north end of cut to Gatun Dam, Tabernilla, and over the Gamboa Bridge to dumps on Panama R. R. relocation. Several new dumps of limited capacity opened in Chagres section to take care of local excavation. Tabernilla dumps closed after Dec. 12, 1910, and on them were wasted 1,003,098 c. y. during part of the year; at Miraflores, 3,478,706 c. y. wasted; and 4,646,841 c. y. dumped at Balboa in reclaiming land from ocean and in raising

part of area previously reclaimed. Additional 62 acres reclaimed during year, making total area 315 acres. Material delivered at Gatun for the dam, back fill for the locks, and large stone for the concrete, 2,230,438 c. y., car measurement, and consisted of "run of the cut." Greater part of material hauled out on relocation of Panama R. R. between Caimito and Gamboa wasted; 3,509,221 c. y. disposed of over this section. Average haul to dumps, 12 miles. Two new methods of disposing of material devised; one by washing material to cause it to slide into Chagres River, which washed it away; and the other by so dumping from trestle as to utilize current of river in carrying away material dumped therefrom.

During year breakwater trestle extended 2,008' so that trestle was 2,737' from Naos Island. Filling extended to within 1,500' of end of trestle, or 4,237' from island. Trouble experienced in extending outer end of dike, due to sliding of bottom caused by weight of material dumped from trestle. This sliding encountered at every foot of last 4,000' of dike and resulted in settlement of roadbed, which continued for first two or three months, after which it gradually diminished and finally ceased. The work of material benefit to channel.

At close of year Culebra Cut was 73.25 per cent completed. Empire shops continued under charge of the central division, making shop repairs and manufacturing repair parts for the steam shovels in use on the canal. Shovels repaired during year, 35. Night gang for field repairs maintained. Two oil furnaces installed in blacksmith shop.

Municipal work: Road between Empire and Paraiso, in progress during previous year, completed Oct. 1, 1910, resulting in highway 12' wide and 18,800' long. Road between Empire and Gorgona completed June 28, 1911, giving highway 12' wide and 16,810' long. Reinforced concrete bridge constructed to carry road over Mandingo River near Bas Obispo. It is 12' wide and 196' long, containing 556 c. y. concrete. As result of this work wagon road opened up from Panama City to Gorgona. Apr., 1911, work commenced on Empire-Chorrera road. One mile of subgrading, with necessary culverts, completed. Road from West Culebra to Cowpens, 3,200' started in May, 1911, and by June 30 about 75 per cent completed. In Golden Green, a settlement between Empire and Culebra, 1,600' of street macadamized. Sixty miles of trails cleaned and drained, the labor being done by natives working out poll taxes. Repairs made to existing roads and cinder paths. Water pipe laid, removed, and relaid aggregated 24,684', and sewers laid, removed, and relaid aggregated 8,827'.

Sanitary work consisted of digging 7,177 lineal feet of ditches, regrading 291,474 lineal feet of ditches, cleaning 1,707,517 lineal feet of ditches, laying 1,762 lineal feet of tile drains,

constructing 5,445 lineal feet of concrete gutters, clearing 99,515 lineal feet of concrete drains, and clearing 58,501 sq. y. of brush and grass. P-11, 15-21.

1912. In Point 1,91,300 c. y. were removed, of which 27,632 c. y. were taken from prism. Gravel removed was stored for use as ballast and in concrete work. Total in storage at close of year, 110,000 c. y. At Point 4-B 56,380 c. y. removed; of this, 44,184 c. y. taken out by contract. Contract entered into Dec. 6, 1910, for excavating 112,450 c. y., but little done. Work begun Dec., 1910, and on May 16, 1912, after removing 108,992 c. y., contractor signified his inability to finish. Work was taken over and 12,196 c. y. removed by central division. At San Pablo completion of channel required removal of bed of old line of Panama R. R., which could not be done until line was abandoned. Work commenced Jan., 1912, completed in May by removal of 305,291 c. y., which finished prism. At Tabernilla excavation commenced Mar., 1912, and finished same month by removal of 22,893 c. y. At Buena Vista 100 c. y. removed in Mar., completing this part. At Bohio steam-shovel excavation commenced Feb., 1912, and finished Mar.; 6,997 c. y. removed. At Pena Blanco 48 c. y. removed Mar., 1912. Contract for removal of 202,140 c. y. between Tabernilla and Bohio entered into Mar. 21, 1910. Work commenced Oct., 1910; contract completed Apr., 1912, by removal of 207,132 c. y., of which 101,600 c. y. removed during year. Excavation of Panama R. R. embankment across anchorage basin south of Gatun commenced Mar., 1912, and finished to grade 35' above sea level in following month; required removal of 39,568 c. y. Small force engaged in blasting stumps and trees in Gatun Lake Channel. Prior to Aug. 31, 1911, this division also did clearing work for first division in connection with lighting channel. Total clearing, 652.7 acres, involving running 49,547' of profile and cutting 163,310' of trochas. Subsequent to Aug. 31 this work handled by forces under the first division, O. C. E. Total removed in Chagres section during year, 560,509 c. y., leaving 151,000 c. y. of wet excavation remaining.

During year 16,476,769 c. y. removed from Culebra Cut. Amount remaining again increased over that reported a year ago by 3,595,000 c. y., in order to allow for slides already existing at the beginning of the fiscal year and for excavation along the upper levels of the banks of the canal, where slides had developed or were anticipated, and outside of prism lines. Total removed during year outside of slope lines and because of slides aggregated 5,915,000 c. y., or 35.90 per cent of total amount removed from cut as against 30.07 per cent during previous fiscal year. Total due to slides so far removed aggregates 16,671,000 c. y.

Work in cut retarded on account of slides and breaks in its banks which increased as cut was deepened. At the Cucaracha slide, practically at rest for over a year, the angle of repose is somewhat steeper than 1 on 5, while Culebra slide on west bank, where the material is still moving, present slope is about 1 on 5. In the slide on west bank just north of village of Culebra, moving material is of stratified rock moving in mass on layer of lignite which has an inclination of 1 on 7. This slide developed early in dry season. These very flat slopes of the bank in the deepest portions of the cut explain the large amount of material added by slides and breaks over original estimates. Relatively small slides developed as cut deepened, but the largest one now in motion is that which results from a break in west bank at Culebra, an area of about 63 acres. From this slide 2,710,000 c. y. removed during year, making total thus far taken out of 6,765,000 c. y. Next largest slide lies on east side of the cut, opposite Culebra, an area of 50.7 acres. From this slide 1,960,000 c. y. removed during the past year, making total of 4,290,000 c. y. taken out since 1907.

Work, begun Jan., 1911, of decreasing pressure on banks where breaks might be expected continued throughout year; 3 steam shovels kept continuously at work terracing west bank in vicinity of Culebra, and the same number during greater part of year on similar work on opposite bank.

Increases in estimates of material to be removed, made necessary by slides, will cause no increase in total estimated cost of Culebra Cut. None of the slides which occurred during the year would have interfered with the passage of ships had the canal been in operation.

Aug. 15, 1911, arrangements perfected for draining through the central culvert of the Pedro Miguel Locks. Dike separating cut on north side from Chagres River remained intact, and pumping plant previously described continued in service to handle water which drains to north from summit.

Diversion channel on east side of cut, for carrying Obispo River and tributaries, gave trouble during year. In Mar., 1912, cracks appeared to south of Empire suspension bridge, indicating motion of material lying between diversion and cut. Steps were taken to relocate this part of the diversion farther to the eastward. Excavation in Apr.; in all, 26,168 c. y. removed; new portion 1,970' long and located 510' east of old diversion at its most distant point. Empire-Paraiso wagon road and railroad reconstructed on west bank of new diversion. When water was turned into new channel weight of threatening bank lightened by removing material between old portion of diversion and face of cut. Slide on east side of canal, opposite Whitehouse, threatened to break into Obispo diversion at that point.

Movement of material slow, but it was deemed safer to relocate diversion about 100' eastward of location, and work with this in view undertaken toward close of year.

Trains loaded in cut were hauled out at either end to dumps. Dumps used for wasting material from canal proper after Feb. 15, when service to Gatun was discontinued, were those at Miraflores and Balboa for trains run to south, and relocation dumps for trains run to north over Chagres River bridge. Material from high levels on both sides of canal wasted on local dumps, with exception that a few of Lidgerwood trains serving shovels at Rio Grande and Culebra were run over Panama R. R. to dumps at Miraflores and Balboa. For finishing work at San Pablo, 3 old dumps reopened and 2 new river dumps utilized. Tabernilla dumps reopened and used during Mar., 1912, for wasting material excavated at that point. Between Balboa Y and Ancon and Sosa Hills 72 acres of marshy land that could not be drained filled in, 1,022,591 c. y. from canal being used. Of spoil hauled from central division, 1,585,184 c. y. sent to Gatun for use on dam in back fill of locks; 2,872,950 c. y. wasted at Miraflores; 3,930,543 c. y. used at Balboa, partly in reclaiming swamp, partly in extending breakwater and the rest wasted; 5,268,890 c. y. dumped along relocation between Caimito and Gamboa.

In addition to amount wasted on central division dumps—15,259,391 c. y.—1,883,676 c. y. were furnished other divisions. Material previously wasted at Miraflores, Balboa, and on relocation dumps having settled firmly, found more economical to place new layer or form new dump on top of them than to start new ones.

Prior to June 30, 1911, the Naos Island trestle had been constructed for 2.78 miles. During year this trestle extended 1,360', giving total length of trestle to June 30, 1912, of 16,051', or 3.04 miles. The length of the trestle on June 30, 1912, was 1,320' from Naos Island, and fill extended to within 2,000' of its end, or 3,320' from island. Total vertical settlement at one locality on the dike during the year aggregated 125'. Elevation of top of trestle 14' above mean tide, and average depth of water for last mile of trestle constructed is about 15' at mean tide, giving total height of trestle of about 29' above original bottom. When rock is dumped from trestle it begins to settle as soon as it attains a height of a few feet, displacing adjacent material which, pushing up, forms parallel ridge of mud. By the time rock fill completed, these parallel ridges are about 80' from center of track. To lessen difficulties and to spread foundations as much as possible, suitable material removed by dredges in channel dumped in front of trestle and spread on either side of center line. A board appointed to submit a plan for hastening progress on the construction of this breakwater recommended building double

trestle, dumping on either side, thereby spreading fill and continuing fill to mean tide out to the island, thereby saving the trestle, which is to be made more substantial than formerly. When fill has been extended to island it is to be carried to full height, commencing at the island; should a break occur in the trestle, there would be considerable length of it left to fill over. This was approved, and double trestle built.

Empire machine shops continued making shop repairs and manufacturing repair parts for steam shovels until close of year, when they were transferred to mechanical division. Twenty steam shovels repaired in shops. Night-repair gang continued for field repairs on shovels; average number repaired in the cut each night, 14.

Empire-Chorrera Road, commenced Apr., 1911, continued. On June 30, 1912, macadam had been laid and rolled on 11,230 lineal feet. In addition to this, subgrading, including necessary concrete culverts and drains, completed for 12,450 lineal feet. This is a 16' macadam road and will extend from village of Empire to zone boundary, 6 miles; Panama Government has promised to extend it to Chorrera. Empire-Paraiso Road relocated for 2,480' and reconstructed; made necessary by slide on the east bank. In village of Culebra 1,400' of road reconstructed, on account of slides on west bank. In village of Golden Green 1,650' of road constructed.

In Dec., 1911, realized necessary to install auxiliary pumps in Chagres to assist reservoirs in furnishing a sufficient amount of water for general use in the central division until such time as the rainy season should replenish supply. Purchase made of two 3-stage centrifugal pumps, belt driven, with rated capacity of 2,000,000 gallons under working pressure of 150 pounds; installed under Chagres River bridge; put into service Jan. 24, 1912, acting as feeders for mains on east and west banks of canal. During latter part of Feb., on account of draining off supply in Carabali Reservoir, Chagres River pumping station operated to supply water to Gorgona shops for mechanical purposes. On Mar. 12 a 6-inch line completed connecting Gorgona and Gamboa systems, supplying water to Panama R. R. tank at Matachin, town of Matachin, Jamestown, and engine house at Gorgona shops. On Apr. 13 additional piston pump installed on Sardanilla River, which increased supply for canal purposes at this point to 400,000 gallons per day. On June 8 piston pump, having capacity of 1,500 gallons per minute under a working pressure of 250 pounds, procured from Atlantic division and installed by the date supply in Camacho Reservoir was exhausted. An underwriters' fire pump procured from subsistence department also installed in Chagres River.

Sanitary work consisted of digging 5,763 lineal feet of ditches; regrading 311,061 lineal feet

of ditches; cleaning 1,613,820 lineal feet of ditches; laying 550 lineal feet of tile drains; constructing 11,650 lineal feet of concrete gutters; cleaning 341,214 lineal feet of concrete drains; and clearing 6,536 sq. y. of brush and grass. P-12, 24-30.

1913. Excavation for prism during year confined to Culebra Cut, and 12,582,124 c. y. removed. In addition, 155,376 c. y. excavated in changing portions of Obispo diversion and 35,888 c. y. outside of canal prism for auxiliary work; total handled by central division, 12,773,388 c. y., of which 10,098,099 c. y. rock; 46.67 per cent removed from cut due to slides, against 35.90 per cent during previous year. Amount remaining to be removed again increased at close of year; an increase for central division of 9,280,237 c. y. over estimate in last report. Of this total remaining, 1,324,944 c. y. inside prism lines and 6,860,500 c. y. estimated for slides, which includes benching back of banks to relieve pressure which, crushing underlying strata, may either increase extent of slides or cause new ones. Total material due to slides so far removed, 22,570,200 c. y., or increase of 2,304,200 c. y. over estimate in last report.

Predictions of geologist with reference to Cucaracha slide, that "the end of the activity of this slide is now well in sight," have not been realized. Jan. 20 basalt rocks broke and there slid into cut approximately 2,000,000 c. y. Work continued on slide during year, for purpose of maintaining tracks on 67' level open. Slide at close of fiscal year had area of 50 acres. Total removed since July, 1905, when it began moving, 3,859,500 c. y., leaving approximately 1,500,000 c. y. still to be removed. From West Culebra slide 1,922,700 c. y. removed; making total from Oct., 1907, of 8,687,600 c. y.; leaving approximately 2,390,000 c. y. Slide covers 68 acres. At East Culebra slide 1,676,300 c. y. removed; making total of 5,966,200 c. y. removed since Jan., 1907; estimated 2,000,000 c. y. remain; covers 55 acres and extends from north side of Gold Hill for 5,500'.

Break occurred Aug. 20, 1912, north of one previously reported at La Pita Point, which turned Obispo diversion into canal, flooding it and stopping steam-shovel work to north. Shovels removed, earth dam built across cut south of break to protect cut between it and summit, area then freed from water by pumps, and temporary channel constructed for diversion. After new channel had been excavated for Obispo diversion slide was attacked, and 181,100 c. y. removed.

On east side of cut, north of Gold Hill, there is a French dump included within East Culebra slide. Crack developed Apr. 1, 1913, parallel to cut and 635' distant from its edge. Steps taken with steam shovels to bench this portion of bank and arrangements made for slicing as much as possible into valley to east.

Summit of drainage in cut continued about opposite Culebra until two shovels cutting to grade on bottom produced one cut through at grade June 28, 1913. Water south of summit drained into Pacific through central culvert of Pedro Miguel Locks. Dike separating cut on north side from Chagres River remained intact and pumping plant previously described continued in service to handle water which drains to north from summit, with addition of two French centrifugal pumps, 17" discharge, added after break north of La Pita Point.

With the opening in spillway at plus 50, with upper gates at Pedro Miguel not complete, feared heavy freshet might top dike at Gamboa and do injury to locks. Decided to raise Gamboa Dike to elevation 78.2, carrying this elevation along west dike which separates west diversion channel from cut. Material utilized for this purpose aggregated 37,080 c. y.

As cracks developed in sides of Obispo diversion, giving the appearance of additional slides which, if they occurred, would let water of diversion into cut, decided to relocate diversion farther to east; done opposite Whitehouse, opposite the division office at Empire, and around break north of La Pita Point. This necessitated handling 128,076 c. y.

Lirio drainage channel changed farther to the west, and in making change 27,300 c. y. handled.

All trains loaded in the cut were hauled out at either end to the dumps. On account of the grades that had developed due to deepening cut, it was necessary to use an average of 7 engines per day as pusher engines to get these trains out in carrying the loaded trains up the inclines at either end. With contracted area of operation, steam shovels placed closer together and necessitated an average of 6 locomotives daily to handle the trains to and from the shovels, besides those used in hauling the trains to the dumps.

Due to development of slides and beginning Feb. 20, 1913, split-shift system inaugurated on shovels working in slides and on upper benches, to secure 12 hours' work per day. This increased cost, but it was more than justified, after decision had been reached to admit water into the cut in Oct., in order to remove as much of remaining rock in dry as possible.

Dumps in use during year were those at Miraflores, Balboa, along line of railroad relocation north of Gamboa, swamp lands in the vicinity of Ancon, and a new dump opened along the line of the Panama R. R. south of Pedro Miguel. Necessary to abandon old line of Panama R. R. in the vicinity of Miraflores Locks to permit construction of spillway, and subsequent to Mar. 4 trains had to be operated over the single track through the tunnel. This reduced trains that could be operated to south and caused opening up of Pedro Miguel dump. Material taken from upper benches on east side of cut wasted partly in extending

dump north of Gold Hill started 2 years ago, and remainder dumped at Miraflores, Ancon, and Balboa, operating over Gold Hill cut-off of Panama R. R. That taken from upper benches on west side wasted on old dump at Culebra and on dumps to the south. 284,755 c. y. dumped on east side of cut. At Miraflores 1,288,262 c. y. wasted; 3,985,129 c. y. used reclaiming swamps at Balboa and wasted on Balboa dump; 440,725 c. y. used for filling swamp lands northeast of Ancon Hill; and 4,376,080 c. y. on Panama R. R. relocation dumps between Caimito and Gamboa. During year 90 acres filled in at Balboa, making a total of 474 acres in all reclaimed at this point. Between Balboa Y and Sosa Hill 54 acres marshy land filled during year. In addition, 487,108 c. y. waste furnished other divisions and the Panama R. R.

On June 30, 1913, Naos Island trestle entirely completed and filled, with exception of stretch about 600' long. Total used, 653,242 c. y. Soft material was pushed out and up, forming a ridge of mud, intermixed with stones that had been dumped in and carried up by soft material, parallel to breakwater and 100' from it. Total removed from central division since American occupation up to close of year, 107,139,181 c. y., at average cost of \$0.7105 per c. y. Of this, 93,305,975 c. y. removed from Culebra Cut.

Empire-Chorrera Road completed; convict labor employed on it transferred to other work, and small force of paid labor established for placing screenings and doing other work necessary for completion of road to zone boundary. On Nov. 27, 1912, 16' macadam road from Gamboa to a point on Las Cascadas plantation road, about 3,600' from east end of Empire suspension bridge, undertaken. Road will have a length of over 5 miles. Stockade erected at Gamboa to house prison labor engaged on it. Empire-Paraiso Road relocated and rebuilt for 5,608', due to slides. In village of Culebra 2,370' road reconstructed on account of slides. At Lirio camp 253' of road constructed. For preservation of the roads and comfort of public oiling of highways during dry season authorized; treatment applied to 27,000 linear feet of road in villages of Empire and Culebra. Necessary to resurface 16,323 linear feet of Gorgona-Bas Obispo Road.

For maintenance of water supply to shops and for other construction purposes, additional pumps installed and operated at Lirio, Sardanilla River, Gamboa, and Gorgona shops. Sanitary work consisted in digging 4,986 linear feet of ditches, regrading 602,578 linear feet of ditches, cleaning 1,327,676 linear feet of ditches, laying 6,426 linear feet of tile drains, constructing 3,852 linear feet of concrete gutters, cleaning 847,852 linear feet of concrete ditches, and cleaning 908,331 sq. y. of brush and grass. P-13, 23-28.

1914. With admission of water into Culebra Cut by blowing up of Gamboa Dike on Oct. 10, 1913, central division was abolished. Remaining dry excavation in the territory covered by this division was placed under a resident engineer reporting to the chief engineer; all surveying work and dredging were placed under the sixth division of the chief engineer's office, and the transportation forces, with those of the first, fifth, and fortification divisions, were concentrated under a superintendent of transportation and placed with the second division of the office of the chief engineer; the central division's property accountability was transferred to the quartermaster's department. P-14, 2.

Chagres River. (See Gauging; see Nos. 38, 136, 178, pp. 2362, 2464, 2365 of this Index.)

Chagres Valley.

Profile showing probable conditions south of Gatun Spillway, P-08, 196, pl. 166.

Chain Anchorage. (See Anchorage; Fenders.)

Chain Fenders.

Sump pumps, P-14, 113.

General plans, locks, P-10, pl. 95.

Chains.

Tests, P-14, 71.

Chairman and Chief Engineer. (See Nos. 217, 218, p. 2366 of this Index.)

Duties of, P-08, 1.

Status of canal work, P-05, 139.

Chalcedony.

Deposits, zone, P-13, 578.

Chamber, Valve. (See Valves.)

Channellers, Rock.

Working, Bas Obispo, P-07, 48, pl. 25.

Channels. (See Beacons; see No. 195, p. 2365 of this Index.)

Atlantic division, P-09, 54.

Atlantic entrance, P-11, 132, pl. 7.

Beacons, concrete, P-13, 110, pl. 17.

Clearing, Central division, P-13, 152.

Clearing, Lake Gatun, P-09, 80; P-12, 158.

Dredge Corozal in, station 2210, P-12, 204, pl. 58.

Drainage, Culebra Cut, P-12, 170, pl. 37, 35.

Diversion channel, Culebra division, P-07, 48; P-08, 40.

Depths, consideration of, P-05, 295.

Excavation, San Pablo, P-09, 90; P-12, 170, pl. 38.

Gamboa Bridge, near, P-13, 160, pl. 32.

Gatun to Atlantic Ocean, P-12, 111.

General map of excavation, P-10, pl. 98; P-12, pl. 78.

Gorgona, near, P-11, 156, pl. 39.

Straightening, near Mamel, P-11, 156, pl. 37.

Views of canal channel, P-11, 156, pl. 38; P-13, 160, pl. 32.

Widths, Culebra slides, P-14, pl. 56.

Chapel.

Ancon, **P-07**, 80, pl. 94.

Charges, Plant.

Absorption in costs of canal work, **P-10**, 233.

Charts. (See Nos. 230, 277, pp. 2366, 2368 of this Index.)

Excavation and expenditures, **P-09**, 180, pl. 76; **P-10**, pl. 124; **P-11**, pl. 119; **P-12**, pl. 95; **P-13**, pl. 103.

Organization charts. Beginning with 1907 (omitting 1908) charts accompany each annual report, showing the layout of the organizations or departments. A list of the charts for the years referred to is found in the list of Contents of each report.

Chauffeurs, P-14, 265.

Chemistry. (See Rocks; Water supply.)

Chief Draftsman. (See Draftsman.)

Chief Engineer. (See Nos. 64, 125, 141, 142, 217, 218, pp. 2363, 2366 of this Index.)

John Findlay Wallace, elected May 6, 1904, **P-04**, 37.

Chief Hydrographer. (See No. 262, p. 2368 of this Index.)

Chinese Labor. (See No. 162, p. 2364 of this Index.)

Chlorine.

Chart, Miraflores Lake, **P-14**, pl. 93.

Chords.

Deflection of, emergency dams, Gatun Locks, **P-14**, pl. 93, 94.

Driving pin for eyebar of top chord, emergency dam, Pedro Miguel, **P-13**, 110, pl. 10.

Chutes, Coal, P-07, pl. 91.

Las Cascadas, **P-07**, 82.

Pedro Miguel, **P-07**, 82; **P-08**, 120, pl. 53.

Circulars.

Outlining organizations by divisions and bureaus, **P-05**, 146.

Circuits. (See Courts.)

Circuits, Electrical. (See Electricity.)

Cities. (See Towns.)

Hydraulic filling, Colon, **P-12**, 306.

Improvements, Colon, **P-13**, 136.

Street improvements, tropical cities, **P-07**, pl. 47-73.

Civil Administration. (See No. 225, p. 2366 of this Index.)

Annual Rs. usually present; lists of tables relating to stamps, mail, letters and parcels, money orders, customs operations, distillation taxes, saloon licenses, rents, administration of estates, postal savings, police and prisons, arrests, convictions, crimes, prisoners, deaths, accidents, water consumption, schools, teachers, school gardens, revenues, expenditures, balances, courts, supreme court, circuit courts, district courts, legislation, ordinances, steamboat licenses, fires, population, etc.

1909. Organization: Consists of the executive branch, which includes the divisions of posts, customs and revenues, police and prisons, schools, fire protection, public works, and the office of the prosecuting attorney; and of the judicial branch, which includes the supreme, circuit, and district courts of the zone. The head of the department represents the Isthmian Canal Commission in its relations with the Republic of Panama and foreign representatives accredited to Panama.

Legislative acts, etc.: Congressional legislation for the zone includes the provision in the sundry civil act Mar. 4, 1909, in regard to the use of local revenues of the zone, and act Feb. 27, 1909, relative to the use, control, and ownership of lands in the zone. Executive order Nov. 7, 1908, makes changes in the provision respecting appeals from the judgment of the district court. Order of Aug. 14, 1908, amends the Penal Code of the zone by repealing the minimum limit of punishment for grand larceny. Order of Jan. 6, 1909, extends to the zone the provisions of the acts of Congress respecting the use of safety appliances on railroads. Subsequently modified by Executive order June 11, 1909. Isthmian Canal Commission, an. of Sec. of War, under the Executive order of Apr. 15, 1907, adopted amendments to the regulations governing the sale of liquor, the water regulations, and the regulations governing the collection of taxes; and enacted an ordinance requiring the muzzling of dogs.

Beyond-zone relations: Relations with Panama satisfactory, and with other countries. Among matters taken up with Panama were sanitary work in cities of Panama and Colon; removal of sand from Panaman territory; purchase of land at Porto Bello, and stationing there zone police; legislation prohibiting soliciting of labor on the Isthmus of Panama; enforcement of decree prohibiting soliciting of labor.

Posts, customs, and revenues, etc.: Sale of stamps, \$74,241.87, an increase of 2.2 per cent over preceding year. Money orders exceeded those of last year by \$480,064.48 in value; 167,664 registered letters and parcels sent. Postal facilities increased; 193 vessels entered Ancon; tonnage, 485,076; 195 cleared with 485,997 tonnage. At Cristobal 208 vessels with tonnage of 432,250 entered; 207 cleared with tonnage of 429,363. No fees. June 30, 1909, 2,103 leases for lots, land, etc. Rents, \$26,969.88. Act Congress, Feb. 27, 1909, provides for leases of public lands in the zone for a period not to exceed 25 years. Act also provides for survey of land if desired; funds for survey not available, leases made as in former years. Triangulation for a general survey of the Isthmus started. \$93,970.86 collected on account of general taxes and licenses; 50 estates settled.

Police and prisons: Force, June 30, 1909, 245 employees. Arrests of year, 6,275. (See Courts, below.) New stations opened at

several points. Annex to penitentiary completed; 117 convicts confined in penitentiary at close of year; convicts generally employed on road work; 3 men executed.

Schools: Reorganized and systematized; 12 schools for whites, 17 for colored. Enrollment Oct. 1, 1908, 622 whites and 1,073 colored. Two high schools; 1 at Culebra and 1 at Cristobal.

Fire protection: New volunteer companies organized; at close of year there were 19 volunteer companies with membership of 380; drilled twice a month by paid fire department. Alarm system extended; 92 fires—21 in Panama. Total loss from fires, \$2,739.92; value endangered, \$316,593.65.

Public works: On June 30, 1909, 1,292 water and sewer connections in Panama, and 87 applications pending. Rentals over \$60,000. In Colon there were 464 connections, and 27 applications pending. Collections, as rental, over \$60,000. In zone, June 30, 1909, 272 water and sewer connections. New public market built at Cristobal. Public markets at 8 places. Public slaughterhouses at Empire and Gorgona.

Prosecuting attorney: Information filed against 398 persons; 204 convicted.

Courts: Supreme court held 13 sessions. Confirmed decision of circuit court in 3 criminal cases; reversed 1 case; 8 civil cases filed; 5 decided. In the circuit courts, 398 filings in criminal cases; 204 convicted, and 55 acquitted. Cases against 114 were dismissed; 25 cases pending; 163 civil cases disposed of during year, and 122 were pending. In the district courts, 6,025 cases filed; 770 acquitted; 219 discharged; 5 pending. Civil cases filed against 749; 732 disposed of; 17 pending.

Zone funds: At the beginning of the fiscal year \$242,694.73 on hand in the treasury; \$393,734.41 collected. Expenditures, \$412,102.86 for public improvements, schools, maintenance of administrative districts, and contingent expenses in the postal service. P-09, 26, 27, 28, 29.

1910. Important Executive orders promulgated prescribe penalties for murder in first and second degrees; penalizing recruitment of labor in the Canal Zone for service in foreign countries; defining powers and functions of counsel and chief attorney and prosecuting attorney, amending the existing provisions of law respecting the filing of informations and the execution of criminal process; providing for charging an equitable proportion of cost of sanitary improvements to property owners in the district in which sanitary improvements made; board of local inspectors for examination and licensing of masters, mates, engineers, and pilots of steam vessels navigating the waters of the Canal Zone. Executive secretary abolished by Sec. of War, May 24.

Matters taken up with Republic of Panama and adjusted are stationing of zone police at

Nombre de Dios in Republic of Panama; adoption of sanitary regulations; amendment of agreement with Panama for maintenance and operation of Santo Tomas Hospital; maintenance of insane of Republic of Panama in Commission hospitals; verification of survey of Canal Zone boundaries; and enforcement of Executive decree of Panama prohibiting recruitment of labor in cities of Panama and Colon. Relations of Isthmian Canal Commission with Republic of Panama and with foreign representatives continue satisfactory.

Posts, customs, and revenues: The postage sales for the fiscal year amounted to \$83,847.10, an increase of \$9,519.70 over the preceding year. Convention was concluded Aug. 1, 1909, for direct exchange of postal money orders between Martinique, the French West Indies, and the Canal Zone. 237 vessels entered at Ancon, with total tonnage of 400,910, and 238 vessels cleared, with tonnage of 399,690. At Cristobal 235 vessels entered, with tonnage of 636,191, and 232 vessels cleared, with tonnage of 625,958. No duties or customs fees collected; 2,783 leases in force, 1,892 for building lots and 884 for agricultural lands, an increase of 686. Rents collected during year, \$27,282.29, slight increase. Appropriation of \$75,000 made by Congress for a general land survey of Canal Zone. On account of general taxes and licenses, \$107,642.58 collected, an increase of more than \$8,000; 38 estates were settled.

Police and prisons: On June 30, 1910, the police force consisted of 259 employees. Reorganization made Feb. 1, 1910; zone, for police purposes, divided into 4 districts. Arrests, 6,947, an increase of 672. Of those arrested 5,467 were subsequently convicted, 1,211 dismissed, 40 confined in insane asylum at Ancon, 22 turned over to military authorities, 14 fugitives from justice delivered to Panama Government, and 148 persons arrested, at Porto Bello, in the Republic of Panama, turned over to that Government for trial. On charge of murder, 18 arrests were made; 5 were convicted, 8 acquitted, 1 dismissed, 1 confined in the insane asylum, and 3 awaiting trial; 138 convicts confined in penitentiary at Culebra; kept at work on public roads, grading, etc.; 8 pardons granted during year and 2 sentences commuted.

Schools: 12 schools for white children and 15 for colored children maintained, and on Oct. 1, 1909, there was an enrollment of 745 and 1,067, respectively. School gardens maintained in connection with colored schools.

Fire protection: Paid fire company established at Gatun and fire-alarm system installed; 2 new volunteer companies organized at Gatun, and 1 volunteer company discontinued at Ancon. 19 volunteer companies, with membership of 324. 123 fires; 12 were in Panaman territory. Value of Government property involved, as reported by the fire chief, was \$1,174,017.19; total loss, \$2,796.04.

Public works: 201 sewer and water connections made in Panama, total on June 30 being 1,493, with 84 applications pending. Collections from water rents from private consumers for the first three-quarters of the year, \$50,159.15; net amount of bills rendered for quarter ended June 30, 1910, \$16,384. In Colon 84 connections made, total June 30 being 548, with 28 applications pending. Total collections of water rents from private consumers and from the Commission and the Panama R. R. Co. during the first three-quarters of the year, \$56,477.45; net bills rendered for fourth quarter, \$19,507.90. Extension of water, sewer, and paving systems in Panama and Colon authorized by Congress will require amendment of existing agreements with Panama for collections of water rents; new contracts will be submitted. 244 private sewer and water connections made in zone, total now being 516.

Prosecuting attorney: Attorney filed 251 informations against 313 persons; resulted in 205 convictions; also represented the U. S. in 71 criminal cases appealed to the circuit courts.

Courts: Supreme court held 19 sessions. Confirmed decision of circuit court in 2 criminal cases, and reversed decision of that court in 1 criminal case. 3 civil cases pending at beginning of year, 13 filed, and 10 disposed of. In circuit courts 382 criminal cases filed; 249 convictions secured and 39 acquitted; 68 cases dismissed, and 26 cases pending. Of 397 civil cases filed during year, 301 were disposed of and 96 were pending at close of year. In district courts, 6,732 criminal cases filed; 5,215 convictions secured and 812 acquitted; 366 cases appealed, and 9 cases pending. 1,123 civil cases filed, 1,055 disposed of, and 68 pending at close of year. P-10, 41-44.

1911. Only congressional legislation affecting zone during the year, other than change in employer's liability act noted, was act approved June 25, 1910—"To further regulate interstate and foreign commerce by prohibiting transportation therein for immoral purposes of women and girls, and for other purposes."

15 Executive orders having effect of law issued. More important of these to establish rules and regulations to facilitate and protect canal work; prescribing the jurisdiction of Canal Zone courts in civil cases where both defendant and plaintiff are nonresidents of the Canal Zone; respecting the conveyance of real estate by married women; providing a method of executing and recording deeds; respecting the arrest and discharge of deserting seamen; collection of distillation tax in the Canal Zone.

8 ordinances enacted by Isthmian Canal Commission relating principally to licensing automobiles, chauffeurs, and bicycles; rates for coach hire; keeping the watersheds free from contamination.

Of matters taken up with Republic of Panama and satisfactorily adjusted are modification of agreement by which Panama permitted to increase import taxes on certain articles from 10 to 15 per cent; charging of consular fees by consuls of Panama for certification of documents covering shipments consigned to Isthmian Canal Commission and Panama R. R. Co.; withdrawal from entry by Panama of lands situated in Republic which will ultimately be covered by waters of Gatun Lake; conveyance in certain cases of American citizens in city of Panama in need of medical attention to Ancon Hospital for treatment; fire protection in Panama and Colon; construction of roads in zone and continuation thereof in Republic; enforcement of laws prohibiting recruiting of labor on Isthmus; uniform coach rates for zone and Panama and Colon; uniform laws providing for collection of distillation taxes in the Republic and in Canal Zone; public improvements in Panama and Colon; suppression of white-slave traffic through Panaman ports and in Panama and Colon; revision of contracts between Republic and Isthmian Canal Commission for amortization of cost of waterworks, sewer system, and paving in cities of Panama and Colon. Relations of Isthmian Canal Commission with the Republic of Panama and foreign representatives satisfactory.

Steamboat-inspection service: Local inspectors issued 56 licenses to pilots; 7 to masters, 4 of which issued as joint master-pilot licenses; 12 to mates; and 11 to engineers. Rules for navigation of canal and all waters under Isthmian Canal Commission drafted and approved. Duties of board extended to include the general inspection of all floating plant of Isthmian Canal Commission and Panama R. R. Board also to examine and license chauffeurs of automobiles.

Posts, customs, and revenues: Postage sales. \$82,893.72; a decrease of \$953.38. There were in the post offices of zone on June 30, 1911, unpaid money orders aggregating \$332,141.60 drawn to order of remitter and payable at office of issue, indicating extent to which post offices are used as depositories. Convention for direct exchange of money orders between zone and Costa Rica concluded Apr. 1, 1911. Effective Jan. 9, 1911, post office established at Toro Point. Agreement entered into between the postal systems of zone and U. S. for reciprocal payment of indemnity. Postal service also authorized to pay indemnity of 50 francs for loss of registered articles between zone and Postal Union. 264 vessels entered Ancon, with tonnage of 457,746; and 263 vessels cleared, with tonnage of 454,572. At Cristobal 263 vessels entered with tonnage of 722,870, and 264 vessels cleared with tonnage of 727,955. No duties, tolls, or customs fees collected, 2,251 leases in force, of which 984 were building lots and 1,261 for agricultural lands,

a decrease of 530, due largely to cancellation of leases in Miraflores and Gatun Lake areas. Leases for agricultural lands covered 3,534 acres. Rents collected amounted to \$23,469.22 \$123,876 collected on account of general taxes and licenses. Of this, \$2,353.88 for distillation taxes, \$68,400 for licenses for sale of liquor, \$512.59 for license fees from insurance companies doing business in zone, and \$1,057 for 38 licenses for motor vehicles in zone.

Police and prisons: Force consisted on June 30, 1911, of a chief and assistant chief, 5 clerks, 2 inspectors, 4 lieutenants, 8 sergeants, 20 corporals, 117 first-class white police officers, and 116 colored officers. Arrests during year, 5,959, of which 5,500 males and 459 females; 80 per cent convicted. 143 convicts confined in penitentiary at Culebra. Prisoners used in public improvements wherever practicable, especially on road and street maintenance. Deportations of undesirable characters from Canal Zone, 111 persons; 2 pardons granted and 3 sentences commuted.

Fire protection: Organization consists of 1 chief, 1 assistant chief, 1 clerk, 1 messenger, 7 captains, 7 lieutenants, 41 firemen, 1 engineer, 1 electrician, and 1 lineman, constituting the paid fire force. Two volunteer companies disbanded. New volunteer company organized at Toro Point. Fire station opened at Mount Hope. At Gatun, one-story building constructed to provide quarters for paid firemen. New site selected for station at Cristobal. Station at Culebra moved to new site on account of slides. 252 alarms of fire responded to during year, 14 of which false; 1 in Panama and 8 in Colon; 147 in U. S. property and 36 in property of Panama R. R. Co. Value of U. S. and Panama R. R. property involved, \$2,162,938.31. Total loss estimated at \$17,433.42 for U. S. property and \$5,123.07 for property of Panama R. R. Co. Largest fire in Colon on Mar. 23, 1911; loss to the Isthmian Canal Commission, \$14,394.93.

Public works: Organization consists of 1 superintendent, 1 assistant superintendent, 6 clerks, 1 inspector and messenger, 2 inspectors of plumbing, 1 inspector of meters, 1 market inspector, 3 engineers, 6 foremen, 11 masons, 12 pipefitters, 10 laborers, and 1 carpenter. In Panama 1,809 connections made with water mains and sewers and 42 applications pending. Water rents, total for year, \$78,606.45. The Republic required to pay \$4,316.06 in order to liquidate proportionate part cost of water, sewer, and street systems for year. In Colon 559 connections made and 64 applications pending. Collections in Colon, \$76,433.10. Republic required to pay \$2,748.83 to liquidate proportionate part of capital cost of water, sewer, and street systems due for year. On Sept. 30, 1910, new agreements or contracts entered into with Panama providing for quarterly adjustment of all payments due by Republic under plan of amortization of cost of water, sewer, and street systems in

the two cities. Under new agreements total amount due from Republic to U. S. is taken as capital cost at that time. One-fourth of capital cost due at close of each quarter is taken as installment of such capital cost to be paid as of that date, and added thereto is interest on the capital cost for the quarter, together with the quarter's charges for maintenance and operation. Applied to the payment of these items is the total amount collected on account of water rents during the quarter. If a difference remains in favor of the U. S., Republic pays it; but if difference is in favor of the Republic, the amount is credited to capital cost due. In the zone 615 connections made. From 9 public markets in operation revenue of \$4,786.67 derived.

Schools: Organization consists of 1 superintendent, 2 clerks, 1 supervisor of upper grades, 1 supervisor of primary grades, 2 supervisors of children, 1 principal of high school, 5 principals of grammar schools, 61 teachers, and 1 gardener temporarily employed. Oct. 1, 1910, there was an enrollment of 1,837 children; 931 in the white and 906 in colored schools. Highest monthly enrollment was in June, when 1,410 pupils enrolled in white schools and 1,568 in colored schools. Schools at Colon Beach, Las Cascadas, and Corozal consolidated with those at Cristobal, Empire, and Ancon, respectively. Pupils carried to and from schools either over Panama R. R. or by system of brakes or carryalls. Schools in operation throughout the year, 10 for white children and 15 for colored children. Additional white and 2 additional colored schools in operation for part of year. Zone high school transferred from Cristobal to Gatun, and branch high school established at Ancon. June 30, 1911, 11 schools for white children and 16 for colored children.

Courts: Supreme court held 16 sessions. It affirmed decision of circuit court in 3 criminal cases and reversed decision in 2 criminal cases. At beginning of year 6 civil cases pending, 9 filed, and 11 disposed of. In circuit courts 374 criminal cases filed; 234 convictions secured and 78 acquittals; 43 cases dismissed, and 19 cases pending at close of year; 339 civil cases filed during year, 231 disposed of, and 108 pending. In district courts 5,862 criminal cases filed, 4,464 convictions secured, 847 acquittals, 243 cases dismissed, 304 appealed to circuit courts, and 4 cases pending; 948 civil cases filed, 918 disposed of, and 30 pending. P-11, 48-54.

1912. Five ordinances enacted for night-quarantine inspection of vessels at port of Colon; market regulations for zone, and reciprocal license tax upon motor vehicles licensed in zone and in the Republic. Negotiations with Republic included the following: Fees by Panama consuls in San Francisco for certification of manifests covering shipments designed for port of Ancon; laws and regulations by Republic governing navigation of waters under its jurisdiction uniform with

those of zone; occupancy of public lands of Republic by persons forced to vacate lands in Gatun Lake area; exercise of zone jurisdiction over Gatun Lake areas lying within territory of Republic; operation of Chinese-exclusion law in Republic and zone; adjustment of automobile license taxes; interference with U. S. mails in Colon; transfer by Panama R. R. Co. to Republic of certain lots in exchange for land situated opposite Hotel Tivoli; operation of schools for Panaman children by Republic within zone; extradition to U. S. of persons charged with carrying on white-slave traffic; extradition from zone to Panama of persons charged with crime; deportation of gamblers and other undesirable characters living in Panama and Colon; operation of saloons in Colon near zone line; enforcement of laws of Republic prohibiting recruiting of laborers; attempted exercise of police authority on zone territory by police officers of Republic; administration of estates of citizens of Panama who die in zone; marriages in Republic by Protestant ministers; customs inspection of baggage at Panama City R. R. station by Republic; repatriation of alien patients in Ancon Insane Asylum at expense of Republic; construction of buildings, streets, sewers, and other improvements; and maintenance of proper water service in Colon and Panama. Relations of Isthmian Canal Commission with Republic and with foreign representatives satisfactory.

In last report recommendation made for depopulation of zone. June 23, 1908, population was 50,003, but the accuracy of this questioned; thought advisable to take a new census. Census, taken as of Feb. 1, 1912, resulted in the following: Zone population (including the territory of the Canal Zone, the Commission settlements at Porto Bello and Nombre de Dios, Colon Beach and Taboga Sanitarium), 62,810. Employees of the Isthmian Canal Commission, Panama R. R. Co., and various canal contractors numbered, as of Feb. 1, 1912, 42,174. Of the 62,810 persons enumerated in zone, 1,521 Colombians and 7,363 Panamanians; of total 9,157, 4,870 males.

Local inspectors issued 34 licenses to pilots; 9 to masters, 4 of which were issued as joint master-pilot licenses; 10 to mates; and 11 to engineers—a total of 64. 15 certificates of seaworthiness to launches. Licenses issued to 97 chauffeurs. Postage sales for year, \$87,694.41; increase of \$4,800.69 over previous year.

Postal-savings system established Feb. 1, 1912. At close of year on deposit in postal-savings banks, \$356,947. Unpaid money orders aggregated \$332,141.60.

327 vessels entered Ancon, with total tonnage of 619,422; same number of vessels cleared, with tonnage of 622,023. At Cristobal 284 vessels entered, with tonnage of 784,156; and 282 vessels cleared, with tonnage of 775,445.

In force, 858 leases, of which 575 for building lots and 258 for agricultural lands; a decrease of 1,383. Rents collected, \$16,033.54.

\$122,674.54 collected from general taxes and licenses. 60 estates were settled.

7,055 arrests; 6,452 males and 603 females. 79 per cent convicted. 141 convicts confined in penitentiary at Culebra. Stockade erected on Mandingo River for temporary housing of convicts building Empire-Chorrera Road. Slides made necessary demolition of penitentiary buildings at Culebra.

In division of fire protection a discharge of 1 fireman and employment of a motor engineer. Concrete fire station at Cristobal completed. Small station at Balboa removed. Tivoli station altered to accommodate 1 of the 2 new combination automobile fire engines and hose wagons purchased during year. 333 alarms of fire, 18 of which were false; 6 were in Panama and 2 in Colon; 196 were in U. S. property and 21 in property of Panama R. R. Co. Value of U. S. and railroad property involved, \$1,755,685.58. Total loss, \$4,538.58 for U. S. property and \$101 for property of Panama R. R. Co. Largest fire on zone totally destroyed 2 private frame dwellings at Miraflores and caused loss of \$5,000. Year's fires resulted in 12 injuries from burns; 2 deaths occurred, 1 from explosion of gasoline fumes and 1 from explosion of alcohol.

In Panama 1,985 water connections made to date, and 35 applications pending. Water rents from private consumers for the first three-quarters of year in Panama, \$67,491.75; and bills rendered for last quarter aggregated \$25,436.25. For the second and third quarters of fiscal year water collection exceeded requirements by \$4,293.26, which amount was placed in the amortization fund to be applied to reduction of cost of waterworks, sewers, and pavements. In Colon 731 connections made with water mains, and 45 applications pending. Collections in Colon, first three-quarters, \$58,631.20; net bills rendered for fourth quarter, \$20,623.80. Republic paid \$10,943.11 to liquidate proportionate part of cost of water, sewer, and street systems. In zone 691 water connections. From 8 public markets a revenue of \$4,183.95 derived. School year opened Oct. 1, 1911, with enrollment of 2,105 children—1,174 whites and 931 blacks. On June 30, 1912, 26 buildings used—11 for white schools and 15 for colored schools. Medical inspection of pupils, inaugurated during preceding year, continued. Supreme court held 12 sessions. Affirmed decisions of circuit court in 4 criminal cases and reversed ruling of that court in 1 criminal case; 4 civil cases pending in supreme court, 6 were filed, and 8 disposed of. In circuit courts 567 criminal cases instituted; 353 convictions, 126 acquittals, and 84 dismissals, leaving 23 cases pending. 541 civil cases filed during year; 414 disposed of, 127 pending. In the district courts 7,128 criminal cases instituted; 5,183 convictions secured, 1,063 acquittals, 350 dismissals, 528 appeals to circuit courts, leaving 4 cases pending. 1,305 civil actions brought; 1,280 disposed of and 25 pending. P-12, 58-62.

1913. Seven acts of Congress and 4 joint resolutions affecting the Panama Canal and zone enacted, most important being Panama Canal act, approved Aug. 24, 1912, providing for opening, maintenance, protection, and operation of canal and sanitation and government of zone. Four ordinances enacted, most important of which amended certain rules governing navigation of canal and approaches. Resolution adopted that no further licenses be granted for sale of intoxicating liquors in zone.

Negotiations carried on with Republic include following: Arrest by Panaman police of Isthmian Canal Commission employees while engaged in performance of duties in Colon and Panama; reciprocal licensing of carts and wagons used in transportation of merchandise in Republic and zone; municipal and sanitary improvements in Colon and Panama; superior right of U. S. under treaty to use rivers and streams of Republic; deportation to Republic of ex-convicts who have served terms of imprisonment in zone; admission of merchandise shipments consigned to Isthmian Canal Commission, Marine Corps, Tenth Infantry, and wireless stations, without intervention of Panaman customs officials; delay in customs release covering shipments consigned to Isthmian Canal Commission and Panama R. R. employees; collection of customs duties on parcel-post packages coming through post offices of zone; establishment of uniform schedule of rates to be charged for transporting passengers by automobile between points in zone and Colon and Panama; collection of tax by Panama upon steamship tickets covering passage to foreign ports; and tax upon steamship agencies doing business in zone and Republic. Relations with Republic and with foreign representatives satisfactory.

Local inspectors issue 88 licenses to pilots; 41 to masters, 19 of which issued as joint master-pilot licenses; 22 to mates; and 58 to engineers—total of 209 licenses. Certificates issued to 94 vessels, of which 18 were over 100 gross tons burden. 162 licenses as navigators of motor boats granted. Licenses issued to 120 chauffeurs.

Postage sales for fiscal year, \$100,804.38; an increase of \$13,109.97 over previous year. At close of year there was on deposit in postal savings banks \$645,690. There were unpaid money orders aggregating \$156,928.

281 vessels entered Ancon, with tonnage of 553,767; and 283 vessels cleared, with tonnage of 556,306. At Cristobal 280 vessels entered, with tonnage of 849,702; and 283 vessels cleared, with tonnage of 858,703.

319 leases, of which 312 were for building lots, 1 for land, and 6 for buildings. Rents amounted to \$4,792.95. \$53,855.95 collected from general taxes and licenses. 470 estates were settled.

Reorganization of police and prisons on Sept. 1, 1912; strength of force reduced from 274

to 247. 6,827 arrests; 6,079 males and 748 females; 77 per cent convicted. 133 convicts in penitentiary. Stockade on Mandingo River closed during the year and all convicts transferred to new stockade.

In division of fire protection there was actually a reduction of 15 men as compared with the number in service at close of previous year; made necessary by a cut in appropriations. 2 automobile fire engines, made possible discontinuance of 1-man stations at Balboa and Mount Hope, consolidation of 2 Ancon stations, and sale of 6 fire horses. Equipment in buildings at Gorgona removed upon abandonment of that settlement and most of it installed in buildings reconstructed at Corozal and Balboa. 220 alarms of fire; 18 false; 1 was in Panama and 7 in Colon; 104 were in U. S. property and 20 in property of Panama R. R. Co. Value of U. S. and Panama R. R. property involved, \$834,077.44; loss estimated at \$12,173.77 for U. S. property and \$501.75 for property of Panama R. R. Co. Largest and most serious fire in zone at Toro Point, causing loss to Isthmian Canal Commission of \$11,326.98. 5 injuries from burns.

All municipal improvements in Panama undertaken under appropriation of \$80,000 which were completed turned over to this division for maintenance. On June 30, 1913, 2,101 water connections had been made in city of Panama; 22 applications pending. Water rents from private consumers for the first 3 quarters of the year in the city of Panama, \$81,727.75, and bills for last quarter aggregated \$32,583.75. For first 3 quarters of year collections exceeded requirements by \$13,219.69, which was applied to reduction of cost of waterworks, sewers, and pavements. In Colon 866 connections had been made with water mains; 55 applications pending. Collections in Colon for first 3 quarters, \$64,058.15; net bills for fourth quarter, \$24,168.80. For Colon, Republic paid \$9,675.05 to liquidate proportionate share of cost of water, sewer, and street systems for first 3 quarters of year. In zone 695 water connections made. From 8 public markets \$3,805.50 derived in rent.

Division of schools consisted of 1 superintendent, 1 supervisor of upper grades and high schools, 1 supervisor of primary grades, 2 clerks, 2 supervisors of children, 1 principal of high school, 6 principals of grammar schools, and 72 teachers. School year opened Oct. 1, 1912, with 2,199 children—1,157 whites and 1,042 blacks. At close of year 29 school buildings in use; 14 for whites and 15 for blacks. Medical inspection continued and 1,044 pupils treated.

Supreme court held 26 sessions; affirmed decisions of the circuit courts in 2 and reversed decisions in 2 criminal cases. 2 civil cases pending in supreme court, 22 filed, and 18 disposed of. In circuit courts, 533 criminal cases instituted, out of which 369 convictions, 93 acquittals, and 67 dismissals, leaving 4

cases pending. 858 civil actions brought, 750 settled, and 108 pending. **P-13**, 61-65.

1914. Civil function under direction of executive secretary, **P-14**, 4. (See No. 271, p. 2368.)

Civil Affairs.

Division of, **P-14**, 409.

Civil Cases. (See Counts.)

Civil Procedure.

Code of, Executive order relating to, **P-12**, 610.

Civil Service.

Rules of, not desirable, **P-05**, 120.

Isthmian Canal Commission employees eligible for retention on general register, **P-13**, 616; **P-14**, 601.

President directs that every appointment within the executive service at Washington be made either from the lists of the Civil Service Commission or from the lists of the board of employment, except where specific exemptions are made by the President, **P-05**, 247.

Claims.

Adjustment and settlement of, **P-11**, 488; **P-14**, 558.

Disposal of, without suits, **P-14**, 523.

Due to rise of Lake Gatun, **P-11**, 492.

Injured and dead employees, **P-11**, 392, 404, 405; **P-12**, 415; **P-13**, 415, 621; **P-14**, 329.

Clapets. (See Barges.)

Classes. (See No. 158, p. 2364 of this Index.)

Classification.

Employees, **P-07**, 139.

Material in warehouses, **P-13**, 393.

Work, headings for cost compilation, **P-10**, 241.

Clay.

Apparatus used for testing, **P-08**, 196, pl. 105-106.

Deposits, zone, **P-13**, 577.

Clearings.

Aids to navigation, **P-13**, 108.

Anchorage basin, Gatun, **P-09**, 80.

Channel, Lake Gatun, **P-12**, 158.

Dredging, **P-14**, 240.

Range lights, **P-12**, 101.

Sites, terminals, **P-13**, 195.

Sixth division, **P-13**, 189.

Clearwater Basin. (See Basin.)

Clerks. (See Employees; see No. 158, p. 2364 of this Index.)

Clerical bureau, executive department, **P-14**, 405.

Five permanent classes made, removing all inequalities of payment, **P-06**, 12.

Climate. (See Meteorology; see Nos. 7, 167, pp. 2361 and 2365 of this Index.)

Panama route, details, **P-06***, 16.

Clinics. (See Hospitals.)

Closures. (See Terminals.)

Clouds. (See Meteorology.)

Clubhouses. (See No. 247, p. 2367 of this Index.)

(See Employees.)

Attendance, **P-11**, 535.

Activities, **P-11**, 532.

Bureau of clubs, **P-14**, 405.

Cristobal, **P-07**, 96, pl. 123, 124.

Culebra, **P-07**, 8, 96, pl. 1, 122.

Executive councils and advisory committee,

P-10, 435; **P-11**, 535; **P-12**, 559.

Educational work, **P-13**, 557.

Equipment, **P-10**, 435; **P-11**, 532; **P-12**, 557.

Finances, **P-10**, 438; **P-11**, 535; **P-12**, 559;

P-13, 559.

Membership, **P-10**, 436; **P-11**, 532; **P-12**, 557;

P-13, 555.

Refreshments, **P-13**, 558.

Women, privileges for, **P-10**, 438; **P-11**, 535.

Clubs. (See Orders, Executive.)

Coal and Coaling.

"Ancon" coaling, **P-07**, 48, pl. 35.

Atlantic terminals, **P-13**, 205.

Coaling, central division, **P-11**, 151.

Coaling, Cristobal, **P-14**, pl. 123, 124; **P-14**, 40, 229.

Coaling, Balboa, **P-14**, 203, pl. 116, 117.

Coaling plants, **P-13**, 215, 217.

Chutes, Las Cascadas, **P-07**, 80, 82, pl. 91.

Chutes, Pedro Miguel, **P-07**, 82; **P-08**, 120, pl. 53.

Consumption of, **P-09**, 82; **P-12**, 166.

Consumption, Culebra division, **P-07**, 45; **P-08**, 40.

Consumption, central division, **P-10**, 156; **P-13**, 155.

Deposits of, zone, **P-13**, 578.

Excavation, coaling plant, Balboa, **P-13**, 254, pl. 55.

Equipment, coaling plant, **P-14**, 180.

Pacific terminals, plants, **P-13**, 196.

Piers for cranes, Balboa, **P-14**, pl. 27.

Pockets, Balboa terminals, **P-14**, pl. 27.

Stations for coaling, Balboa, **P-14**, 36.

Stations for coaling, Telfer Island, **P-13**, 192.

Stations for coaling, Cristobal, **P-14**, pl. 31, 32.

Subsidiary plant, terminals, **P-12**, 216.

Terminals, **P-12**, 216; **P-13**, 209.

Codes.

Civil procedure, **P-12**, 610.

Cofferdams.

Gatun Locks, **P-12**, 142, pl. 22, 23.

Pacific terminals, **P-13**, 198; **P-14**, 200.

Cold Storage.

Cristobal plant, **P-09**, 230, pl. 97.

Cole, H. E. (See No. 255, p. 2368 of this Index.)

Collections. (See Civil administration, No. 225, p. 2366 of this Index.)

Colliers.

Terminal plant, **P-14**, 188.

Colon. (See Nos. 39, 156, pp. 2362, 2364 of this Index.)

Surveys of construction of outer harbor, direct entrance to canal, inner harbor, and completion of Gatun diversion. Bids invited for widening and deepening Colon end of the canal for reception of construction material. Bids too high. **P-05, 12.**

Town on a swamp. Difficult to sanitate. Temporary measures taken until line of canal terminus is fixed. **P-05, 43.**

1910. Colon and Panama: Municipal improvements originally undertaken in cities of Colon and Panama restricted to certain portions of the towns. Extension of Colon eastward of improved section prevented by sanitary regulations; additional area for building purposes considered necessary and advisable. Certain districts in Panama built up without extension of paving and of sewer and water mains, and Isthmian Canal Commission in 1908 submitted to Congress an estimate of \$1,200,000 for extending municipal improvements in the two cities. Act Mar. 4, 1909, making appropriations for canal included an item of \$800,000 for extending improvements, and arrangements made for undertaking work during dry season of 1909-10. Amount thus appropriated will be added to that already expended in two cities and refunded at end of the 50-year period from collection of water rents.

Colon: Work in Colon consists of construction of D Street storm sewer. At close of year work about half finished; 6,473 c. y. excavated, 1,628 c. y. concrete laid, and 1,081 c. y. of back fill made.

Panama: Streets graded and macadamized, and sewers, water mains, and concrete curbs and gutters placed as follows:

| | Paving. | Curbing. | Sewer mains. |
|-------------------------|----------------|-----------------|-----------------|
| | <i>Sq. ft.</i> | <i>Lin. ft.</i> | <i>Lin. ft.</i> |
| Cocoa Grove district... | 70,130 | 3,920 | 1,683 |
| Guachapali district... | 195,354 | 8,171 | 7,535 |
| Avenue B..... | 36,607 | 2,220 | 1,937 |
| Santa Cruz district... | 91,116 | 5,062 | 8,078 |
| District I..... | 24,240 | 1,275 | 1,496 |

| | Sewer laterals. | Water mains. | Water laterals. |
|-------------------------|-----------------|-----------------|-----------------|
| | <i>Lin. ft.</i> | <i>Lin. ft.</i> | <i>Lin. ft.</i> |
| Cocoa Grove district... | 872 | 2,494 | 1,185 |
| Guachapali district... | 1,952 | 8,289 | 4,012 |
| Avenue B..... | 665 | 1,847 | 788 |
| Santa Cruz district... | 1,952 | 7,692 | 4,058 |
| District I..... | 628 | 1,195 | 677 |

P-10, 29-30.

1911. Colon: During year the D Street storm sewer, extending from the sea at Beach Road on the north to Folks River on the south, with outlets at either end and with the summit elevation at Eighth Street, practically completed; 12,881 c. y. excavated; 5,000 c. y.

concrete installed; and 7,235 c. y. back fill placed. Fill started Oct. 31 with 20" suction dredge and continued throughout year; 501,786 c. y. made. Drainage system south of Ninth Street completed. Paving on D Street completed, except half a block. Sections south of Ninth Street covered with rock. Rock to extent of 10,918 c. y. used in street paving. 23,800' curb and gutter placed.

Panama: Of amount appropriated by Congress, \$250,000 allotted for improvements in city of Panama, included within districts of Guachapali, Santa Cruz, Cocoa Grove, Avenue B, and District I. Work consisted of grading and macadamizing streets, laying concrete curbs and gutters, together with sewers and water mains. Work completed. In addition, La Neveria graded and paved, and intercepting sewer laid to prevent flooding of Central Avenue and adjacent property. Survey and plans made for developing district bounded by Zone Line Road, B Street, Fourth of July Avenue, and West Sixteenth Street. **P-11, 27-29.**

1912. Colon: Work continued during fiscal year, suction dredge continuing operations until Aug., 1911, when it had added 129,939 c. y. to that laid during the previous year. Total fill actually placed, 585,527 c. y. Fill was for lots as well as streets, the former paid by property owners. In addition to fill, 9,826 linear feet water mains and 9,603 linear feet sewer lines laid, 3,931 sq. y. macadam added in surfacing D Street, 40,794 sq. y. macadam laid in improved areas, including 1,560 sq. y. of resurfacing on other streets, 21,440 linear feet of curb and gutter built, 1,590 sq. y. concrete alleys, and 1,341 sq. y. sidewalk constructed. 2,015 linear feet curb and gutter replaced.

Panama: Panama unable to pay for some improvements proposed last year, and as improvements were required for sanitary purposes, and as there was an unexpended balance of the amount allotted for work in Panama, authority given to make improvements; work performed comprised grading and macadamizing streets, placing concrete curbs and gutters, and laying water mains and sewers in portions of city. **P-12, 38-39.**

Colon Division. (See No. 134, p. 2364 of this Index.)

Colon division: Covers all works of technical engineering and construction pertaining to the canal from Bohio to the Caribbean Sea. During period of the report, made surveys, borings, did dredging, repair and construction of floating equipment, and a lot of track work; the latter transferred later to the Panama R. R. Supervision of wharf and dock work for a time in this division. An old French ladder dredge kept continuously at work dredging channel at mouth of canal. Contracts made for 2 modern dipper dredges—1 for La Boca and 1 for Colon—

both ports being kept open by 2 old French dredges which had been repaired. Work on this division has been delayed owing to lack of material of all kinds. **P-05, 114.**

Division divided into 2 sections—Cristobal section, from sea to Mindi, and Gatun section, Mindi to Bohio. Miscellaneous surveys, borings, plans for dredges, fitting up of shops, repair of plant, installation of new floating plant units, etc., representative of work of the year. 866,500 c. y. dredged from Colon Harbor. **P-06, 82.**

(See Atlantic division and Central division.)

Color.

Deaths by. (See Health.)

Comber, W. G. (See Nos. 256, 264, p. 2368 of this Index.)

Commerce.

U. S. occupation of zone beneficial to local interests, **P-05, 53.**

Usefulness of terminal plants to, **P-14, 187.**

Commerce, Special Report on Probable. (See Nos. 9 and 24, p. 2361 of this Index.)

Advantages of canal at Isthmus twofold—Industrial and commercial. Canal would assist wide range of industries in every section of the U. S.; would remove restrictions in obtaining cheaper raw material; and would increase ability of the U. S. to compete with other nations for world trade. Pacific coast industries would benefit also, especially through a probable reduction in freight rates. **P-99, 161.**

Domestic coal traffic would be increased. There would be notable favorable effects upon eastern and southern parts of the U. S. Railroads connecting the Mississippi Valley with Pacific ports would probably feel canal competition most. Sailing craft would continue giving way before steam craft, but they would not be eliminated. Isthmian Canal expected to produce large results in developing industries and commerce of Pacific Ocean countries. New route would give U. S. a decided advantage over other nations in this trade. Canal at Isthmus would probably place U. S. on equality, in distance, with Europe, in trade with the Orient and Australasia. **P-99, 162-163.**

Probable cargo tonnage which would choose canal route at 1899 (were canal existing), over 6,702,541, **P-99, 163.**

Expected that increase of about 25 per cent a decade would raise traffic of 5,000,000 in 1899 to 7,000,000 tons in 1914, and that a growth of about 62 per cent during the succeeding 10 years would make a tonnage of 11,375,000 in 1924, **P-99, 164.**

Traffic through canal would depend in part on tolls. In fixing these, the principal of maximum revenue could not wisely be followed. Revenue subordinate to promotion of industrial and commercial aspect of U. S. progress. Annual traffic of 7,000,000 tons at 1914, at \$1 a ton, equals revenue of \$7,000,000. As cost of operating and maintaining of Panama route

estimated at about \$2,000,000 per annum; of Nicaragua route, about \$3,300,000; revenue annually at \$1 per ton would not permit a return on the capital invested. Annual traffic would increase steadily. Rates on Suez Canal about \$2 a ton; not probable that Suez Canal would find it profitable to reduce its tolls to compete with an Isthmian Canal. It might be expedient to reduce tolls on an Isthmian Canal to cover only the cost of operating and maintenance. **P-99, 164, 165.**

Relative commercial advantages of Nicaragua and Panama routes: Distance for American commerce generally would be less by Nicaragua route. From Europe to western South America, distance less by Panama. From Europe to North Pacific, Nicaragua route shorter, 12 hours required for passage through Panama route; 33 hours through Nicaragua route; which would slightly offset the nearness of the two opposite coasts of U. S. through Nicaragua. Latter route better for sailing ships (not an important factor). **P-99, 165, 166.**

Comparison of benefits to U. S. and Europe: U. S. would derive greater benefits. Benefit to Europe only of a commercial nature; to U. S., commercial, political, and industrial. **P-99, 166.**

REPORT ON THE INDUSTRIAL AND COMMERCIAL VALUE OF AN ISTHMIAN CANAL: Emory R. Johnson, Ph. D. Member of the Isthmian Canal Commission, professor of transportation and commerce, etc. **P-99, 515.**

The information in this report secured mainly during 1900 and 1899. Main purpose of the report to give results of investigation to determine comparative values of the Nicaragua or Panama route. **P-99, 515.**

Scope and methods pursued in the investigation, **P-99, 516.**

Effect of canal on industries and trade of the southern portion of U. S., **P-99, 519.** Cotton industries, **P-99, 519.** Iron and steel trade, **P-99, 521.** Exportation from Southern States of forest products, **P-99, 522.** Fertilizer trade, southern U. S., **P-99, 523.** General commerce of Gulf ports, **P-99, 524.**

Effect of canal on industries and trade of north-eastern parts of U. S.: Characteristics of this region, **P-99, 527.** Textile business, **P-99, 528.** Commerce of the North Atlantic ports, **P-99, 529.**

Effect of canal on Central West: Industrial resources of this region, **P-99, 533.** Existing routes of shipment, **P-99, 534.** Industries of Cleveland, **P-99, 524.** Cincinnati and the Isthmian Canal, **P-99, 535.** Indiana trade, **P-99, 536.** Trade of Illinois and Wisconsin, **P-99, 536.** St. Louis traffic, **P-99, 537.** Effect of canal on transportation facilities of the Central West of the U. S., **P-99, 537.**

Effect of canal on Pacific Coast States: On California, **P-99, 538.** On the lumber and grain traffic of Oregon and Washington,

- P-99**, 540. On the Pacific coast fisheries, **P-99**, 541. On the hops, wool, and mineral business of the Pacific coast, **P-99**, 541. On the trade of Pacific ports of U. S. and Canada, **P-99**, 542, 543.
- Relation of an Isthmian Canal to coal supply for the commerce and countries of the Pacific: Effect of the canal on the coal trade of the U. S., **P-99**, 544. Sources of coal consumed on the Pacific, **P-99**, 544. Puget Sound coal, **P-99**, 546. Fuel supply of California, **P-99**, 546. Prices and costs of coal in different portions of U. S., **P-99**, 549. River transportation of coal from Pennsylvania, West Virginia, and Alabama, **P-99**, 551. Marketing of Appalachian coal west of the Isthmus Canal, **P-99**, 552.
- Effect of Isthmian Canal on iron and steel trade of the U. S.: U. S. as an exporter of iron and steel products, **P-99**, 555. Canal should lower cost of transportation in favor of U. S. in much foreign trade; transportation expense one of the vital factors against existing iron and steel trade of the U. S., **P-99**, 556. Trade of U. S. in steel, etc., with Pacific Ocean countries, **P-99**, 556. A marked increase in U. S. trade in iron and steel looked for through Isthmian Canal, and special benefit to the southern portion of the U. S., **P-99**, 557.
- Effect of an Isthmian Canal on the shipbuilding and maritime interests of the U. S.: Increase of steamships probable, and decrease of sailing ships; larger coasting trade expected; more consequent activity of shipyards, **P-99**, 558. Ownership of ocean vessels by exporters would probably increase, **P-99**, 559. Isthmian Canal expected to exert only one of the influences required to be favorable to the upbuilding of an American merchant marine, **P-99**, 560.
- Effect of an Isthmian Canal on sailing vessels: Tableshewing decline in seagoing sail tonnage of world, **P-99**, 561. Advantage of sailing ships for some classes of freight through Isthmian Canal, **P-99**, 563. Merits of sail ships and steamships compared, **P-99**, 565. Extent to which canal might be used by sail ships, **P-99**, 566. Saving which sail ships could effect through use of canal, **P-99**, 568.
- Effect of canal on U. S. railways: Statistics of transcontinental U. S. traffic not available (railroads ceased recording it), **P-99**, 571. Probable attraction to the canal route of all kinds of freight save perishable freight and quick-dispatch stuff, unless rates were met. Ordinary freight service of railroads "will be only a few days shorter than the service by the faster steamers using the water route," between the two seaboard, **P-99**, 572. Competition expected to be keen, **P-99**, 572. Diverging views as to the effect of the canal on the Atlantic roads, **P-99**, 573. Canal can only increase traffic of the southern roads, **P-99**, 574. No notable effect on railways of Central West expected, though the canal expected to prove profitable by some, **P-99**, 575. Effect of isthmian waterway on Pacific railways expected to be drastic by some; rates will have to be reduced, crippling railroads affected; routes of some materials reversed, wheat, for example, going toward Pacific rather than toward the Atlantic; local traffic could not well be affected save favorably, which would prove beneficial largely to the railroads, **P-99**, 575.
- Effect of Isthmian Canal on the trade and industries of western South America, **P-99**, 578. Area and population of North and South America compared, **P-99**, 578. Outline map of South America, **P-99**, 578. Trade zones of South America, **P-99**, 579. Inadequate transportation facilities of western South America, **P-99**, 579. Dependence of western South America upon foreign capital and large organizations of capital, **P-99**, 580. Isthmian Canal would give U. S. shipping a peculiar advantage in South American trading through a heavy traffic both ways, instead of merely one way, a phenomenon rarely met with in international commerce, **P-99**, 581, 582, 583. Geography, resources, and industries of Chile, **P-99**, 583. Interest of U. S. in trade with Chile valuable, **P-99**, 585. Description of tropical section of western South America, **P-99**, 586. Peruvian coast, its industries, and effect of canal, **P-99**, 586. Andean system comparable with Rocky Mountain system of U. S.; its immense wealth and its greater development would be affected most favorably through isthmian traffic; valuable mines awaiting development; railroads needed, **P-99**, 587. Industries of Pacific slope of Ecuador and Colombia, **P-99**, 591. The Cauca Valley, in the Colombian Andes, **P-99**, 591. U. S. trade with western South America would grow steadily through isthmian communications, and ultimately to important dimensions, **P-99**, 592. Effect of isthmian communications on Atlantic South America not of large character, **P-99**, 593.
- Japan and the Isthmian Canal, **P-99**, 594. Standing of Japan as a manufacturing and commercial country, **P-99**, 595. Analysis of Japanese trade with reference to its effect on an Isthmian Canal on American Continent, **P-99**, 596. An isthmian route to Japan would benefit U. S., taking advantage from European countries, **P-99**, 596.
- China and an Isthmian Canal: Geographical divisions of China, **P-99**, 597. Resources and trade of north China, etc., **P-99**, 598. Resources and trade of central China, etc., **P-99**, 599. Of southern China, **P-99**, 600. The foreign trade of China, **P-99**, 601. Trade of U. S. with China, and specific effects of an Isthmian Canal, **P-99**, 601. \$19,000,000 in year ending June 30, 1903—100 per cent growth in decade. Growth of U. S. trade with China remarkably rapid. As to possibility of China serving its own needs industrially very soon, not depending on U. S. traffic, but little fear, as general experience

indicates that U. S. trade is greatest with those countries which have developed most industrially. **P-99, 602.**

Effect of an Isthmian Canal on the industries and trade of Australasia: Australian industries require a large foreign trade, and U. S. exports to there of increasing importance. U. S. distances to Australia through and not through the isthmian route. **P-99, 603.** General geography of Australia, pastoral and agricultural character, **P-99, 604.** Mineral resources rank high; product about one-tenth of the world, **P-99, 605.** Isthmian Canal should remove large handicaps existing to commerce of U. S. with Australia, **P-99, 606.** New Zealand also agricultural; imports machinery and other manufactures; Isthmian Canal would bring U. S. into favorable competitive zone, **P-99, 607.**

Isthmian Canal, and the Philippines and Hawaii: Geography and industries of the Philippines, **P-99, 608.** Growing importance of traffic between U. S. and Philippines, **P-99, 609.** Canal, while not greatly decreasing distance, would give an additional route, probably more economical, thereby gaining somewhat on the favorable facilities possessed by Europe, **P-99, 611.** Location of the Philippines with reference to trade routes from the U. S., **P-99, 611.** Soil and climate of the Hawaiian Islands, and resources, **P-99, 612.** Agriculture prevailing. Large and rapidly increasing foreign trade, **P-99, 613.** Islands considered as a part of the Pacific coast with regard to the isthmian waterway, **P-99, 614.**

An Isthmian Canal, and Central America and western Mexico, P-99, 615. Population and general geography of Central America, **P-99, 615.** Industries, **P-99, 615.** Isthmian Canal would increase share of trade controlled by U. S., **P-99, 616.** Western Mexico, description, **P-99, 617.** Agricultural in resources; rich mines; manufactured imports needed; eastern section of U. S. will be between 1,000 and 2,000 miles nearer western Mexico by canal than to San Francisco and Seattle. Isthmian Canal may mean elimination of other than U. S. commerce with these regions. **P-99, 620.**

Distances by an Isthmian Canal and other routes, P-99, 621. Table of distances via Nicaragua and Magellan routes between eastern ports of U. S., and ports of the west coast of North, Central, and South America, **P-99, 621.** Table of distances from Europe to Pacific ports via Nicaragua Canal and Straits of Magellan, **P-99, 622.** Table of distances in nautical miles from Atlantic American ports to Yokohama, Shanghai, and Hongkong via Nicaragua and Suez routes, **P-99, 623.** Table of distances, in nautical miles, from American Atlantic ports to Manila via Nicaragua and Suez routes, **P-99, 623.** Table of distances, in nautical miles, between the eastern seaboard of the U. S. and Australia via the Nicara-

gua and Suez routes, **P-99, 624.** Table of distances from Liverpool to the East by the Suez and Nicaragua routes, **P-99, 625.** Table showing comparisons of distances, in nautical miles, from New York and Liverpool to Australasian and Asiatic ports via the Nicaragua and Suez routes, **P-99, 625.** Table showing comparison of distances, in nautical miles, from American and European Atlantic ports via the Nicaragua and Panama Canal routes, **P-99, 626.** Table comparing distances, in nautical miles, from American and European ports to Pacific ports via the Nicaragua and Panama Canals, **P-99, 626.** The following table makes a brief comparison:

| | Nicaragua. | Panama. |
|-----------------------------|------------|---------|
| From New York to— | | |
| San Francisco..... | 4,921 | 5,299 |
| Yokohama..... | 9,457 | 9,835 |
| Hongkong..... | 11,366 | 11,744 |
| Sydney via Tahiti..... | 9,676 | 9,852 |
| Wellington via Tahiti..... | 8,716 | 8,892 |
| Iquique..... | 4,393 | 4,021 |
| From New Orleans to— | | |
| San Francisco..... | 4,118 | 4,698 |
| Yokohama..... | 8,654 | 9,234 |
| Hongkong..... | 10,563 | 11,143 |
| Sydney via Tahiti..... | 8,873 | 9,251 |
| Wellington via Tahiti..... | 7,913 | 8,291 |
| Iquique..... | 3,590 | 3,420 |
| From Liverpool to— | | |
| San Francisco..... | 7,651 | 8,038 |
| Yokohama..... | 12,187 | 12,574 |
| Hongkong..... | 14,096 | 14,483 |
| Sydney via Tahiti..... | 12,406 | 12,591 |
| Wellington via Tahiti..... | 11,446 | 11,631 |
| Iquique..... | 7,123 | 6,670 |

P-99, 627.

Tonnage at 1898-1899 which might use an Isthmian Canal, P-99, 628. Difficulty of obtaining full or complete statistical data concerning traffic tonnage at ports, etc., **P-99, 628.** Method pursued in constructing data groups or tables, **P-99, 629.** Discussion of the average values of the cargo ton, **P-99, 637.** Tonnage of the commerce between Europe and the west coast of South and Central America and British Columbia and Hawaii, **P-99, 638.** Diagram of tonnage, 1888 and 1895-1899, sailing vessels, and steamships, **P-99, 640.**

Tonnage of vessels which would have used an Isthmian Canal, 1899, P-99, 641. Method of determining, **P-99, 641.** Diagram, 1888 and 1895-1899, steamships and sailing vessels combined, **P-99, 642.** Importance of Chilean commerce, **P-99, 643.** Vessel tonnage of European trade with western Central America and Mexico, **P-99, 644.** Trade of the west coast of the U. S., British Columbia, and Hawaii with Europe, **P-99, 645.** U. S. Atlantic coast tonnage with Pacific countries, **P-99, 645.** Vessel tonnage engaged in existing traffic across Isthmus of Panama, **P-99, 648.** Coasting trade of the U. S. available for the canal, **P-99, 649.** Table showing

summary of entrances and clearances, commerce of Europe with Pacific America, and commerce of eastern seaboard of the U. S. with Pacific countries, **P-99, 649.**

Traffic investigations made by the New Panama Canal Co., and comparison of the results of three different investigations relating to traffic probabilities by way of an Isthmian Canal, **P-99, 650.**

The New Panama Canal Co. divided that part of the world's commerce capable of being affected by an Isthmian Canal into the four groups adopted, 1890, by the Commission d'Etudes appointed by the receiver of the Compagnie Universelle du Canal Interocéanique: (1) Between Europe and the Pacific coast of the American Continent; (2) between Europe and the Far East; (3) between the Atlantic and Pacific coasts of America; and (4) between the Atlantic coast of America and the eastern countries of group 2, **P-99, 650.**

Concerning use of American canal by commerce of Europe with Orient, shipping may go by Suez and return via Panama, etc., **P-99, 652.** Evidence of increasing number of round-the-world voyages, **P-99, 653.** Tonnage of available canal traffic, **P-99, 654.** Growth of traffic, 1888-1898, **P-99, 654.** Rapidity and extent of substitution of steamships for sailing vessels, **P-99, 655.**

The three different investigations to measure the probable value of an Isthmian Canal confirmatory of each, although made without reference to each other. Two were made by Isthmian Canal Commission, and one under direction of New Panama Canal Co. **P-99, 657.**

Probable growth of canal traffic, 1899-1914, and 1914-1924, **P-99, 658.** Rate of increase shown by tables of the Panama Canal Co., **P-99, 658.** Increase in trade between Europe and western coast of America, **P-99, 659.** Growth in trans-Pacific trade of the west coast of the U. S., **P-99, 659.** Probable available canal traffic, 1914, **P-99, 660.** Estimate of growth of traffic during the first decade of the use of the canal, **P-99, 661.** Table showing graphically the growth in the tonnage using the Suez Canal, 1870-1899, **P-99, 662.** Estimate of growth for 1924, **P-99, 662.**

Tolls, **P-99, 664.** Tolls charged on Suez Canal, **P-99, 664.** Table showing number and size of vessels, with receipts from tolls, Suez Canal, **P-99, 665.** Table showing increase in number and size of vessels, and receipts, Suez Canal, quinquennial periods, 1875-1899, **P-99, 665.** Effect of tolls on volume of traffic of Suez Canal, **P-99, 667.** Tolls of an Isthmian Canal, and Chilean traffic, **P-99, 667.** Isthmian tolls, and Australian trade, **P-99, 669.** Tolls of Isthmian Canal, and Philippine trade, **P-99, 670.** "In the foregoing discussion a toll of \$1 a ton (net) has been made the basis of reasoning because that represents a maximum beyond which the charge ought not to go. A tariff much higher than

that would in all probability so restrict the tonnage passing the canal as to reduce the revenue derived from the tolls. Such a restriction would unfortunately limit the industrial and commercial value of the canal. The lower the tolls, the greater the traffic of the canal and the larger the industrial and commercial benefits. It is believed that a toll of \$1 a vessel ton net register would yield an income sufficient to pay the expenses of operation and maintenance and a moderate return on the capital invested. Should the U. S. prefer to levy tolls sufficient only to cover the cost of operation and maintenance, a tariff of one-third of a dollar a ton would probably suffice." **P-99, 671.**

Plates relative to commercial data: World routes for steam and sail, **P-99, pl. 74, 75.** Resources and industries of Chile, **P-99, pl. 76.** Resources and industries, northwest South America, **P-99, pl. 78.** Resources and industries, Japan, **P-99, pl. 79.** Resources and industries, China, **P-99, pl. 80.** Resources and industries, East Australia, **P-99, pl. 81.** Resources and industries, New Zealand, Philippine Islands, Central America, Mexico, **P-99, pl. 82-85.** Map of Transportation Divides, **P-99, pl. 86.**

Commissary. (See No. 94, p. 2363 of this Index.) Interior, **P-11, 384, pl. 74.**

Local source of supplies of no value. 17,000 men to feed. Local commissary stores opened. Panama R. R. steamers equipped with refrigerating plants, etc. Refrigerator cars purchased. Line of refrigeration established from the markets of the U. S. to the commissary stations of the Isthmus. Management of local hotels assumed by Isthmian Canal Commission. Laborers fed for 30 cents per day; gold employees for 90 cents per day. **P-05, 8.**

Cost of living not as great as supposed. Adequate food for West Indian laborers a problem; their efficiency affected by lack of proper nourishment. Commissary established. Refrigerator service line from U. S. established. Hotels and boarding camps maintained and operated by the Isthmian Canal Commission No. 3. **P-05, 46.**

Commissaries opened for silver employees (tropical denizens); objection of local merchants; full publicity given to reasons by Isthmian Canal Commission; opinion of zonal inhabitants favorable to action of the Isthmian Canal Commission; coupons issued to employees; acceptable by merchants; probable restriction of commissary to actual necessities of the silver employees, **P-05, 48.**

Commissary stations, hotels, and eating houses under auspices of the Isthmian Canal Commission effective in producing more satisfaction among employees, **P-05, 123.**

Fourteen hotels and mess houses for white employees. Profit of \$5,000 for period ending June 30, 1906, as opposed to a former deficit. **P-06, 3.**

(See No. 224, p. 2366 of this Index.)

Commissioner, Water. (See No. 120, p. 2363 of this Index.)

Commissions.

Directing commission, canal work, organization proposed, **P-04**, 13.

Joint commission (U. S. and Panama), **P-07**, 146.

Committees. (See Clubhouses.)

Mechanical committee, for consultation, shops, **P-11**, 231.

Companies.

Work of mechanical division for, **P-14**, 253.

Compensation.

Act, compensation, injured employees, **P-11**, 568, 569, 581.

Act, payments to retired officers, Army or Navy, **P-11**, 573.

Executive order, compensation, injured employees, **P-13**, 620, 625.

Injured employees, **P-10**, 355.

Completion of Canal. (See Canal.)

Compression.

Tests, Gatun Locks, apparatus, **P-09**, 47.

Compressors. (See Air.)

Subdivision, air compression, **P-11**, 240.

Concrete Work. (See Costs.)

Amount placed, Miraflores, **P-13**, 170, 173.

Asphalt concrete, plant, **P-14**, pl. 29.

Asphalt concrete, roads of, **P-14**, pl. 30.

Barge of, **P-10**, 196, pl. 49, 50, 115.

Beacon, **P-13**, 110, pl. 17.

Caissons, Balboa, **P-13**, 254, pl. 60, 61.

Cost of. (See No. 250, p. 2367 of this Index.)

Coaling plant, Balboa, **P-14**, 203.

Culverts, Panama R. R., **P-09**, 142, pl. 73; **P-10**, 204, pl. 60, 61.

Dock, Balboa, **P-12**, 204, pl. 57.

Erection work, **P-14**, 96.

Forms, Miraflores, **P-11**, 165; **P-12**, 179; **P-13**, 171.

Forms, Pedro Miguel, **P-10**, 168; **P-11**, 162; **P-12**, 175.

Foundations, Pacific terminals, **P-13**, 200.

Gatun Locks, **P-10**, 121; **P-11**, 115; **P-12**, 124; **P-13**, 117.

Laying, Miraflores Locks, **P-11**, 192, pl. 55.

Machinery, installation of, **P-13**, 98.

Material for, Gatun, **P-11**, 114; **P-12**, 123; **P-13**, 120.

Mixing plant, Gatun, **P-11**, 114.

Performance, plant, Pedro Miguel and Miraflores, **P-13**, 174, pl. 100.

Piers, shells, **P-13**, pl. 105, 106.

Piles of, **P-11**, 117, 298.

Placed, amount, **P-14**, 74.

Placed, Pacific Locks, **P-12**, 179.

Placing, Miraflores, **P-10**, 171; **P-11**, 164; **P-12**, 177; **P-13**, 167.

Placing, Pacific terminals, **P-14**, 216.

Placing, Pedro Miguel, **P-10**, 167; **P-11**, 159; **P-12**, 173; **P-13**, 163.

Plant, auxiliary, **P-11**, 161, 165; **P-12**, 174, 178; **P-13**, 164, 170.

Plant, handling, **P-10**, 162; **P-12**, 176; **P-13**, 167.

Pouring, quay walls, Balboa, **P-14**, pl. 21.

Power house, Miraflores, **P-10**, 196, pl. 47.

Progress, Miraflores, **P-11**, pl. 114; **P-12**, pl. 90; **P-13**, pl. 99.

Progress, Pedro Miguel, **P-10**, pl. 112; **P-11**, pl. 110; **P-12**, pl. 89; **P-13**, pl. 97.

Progress, Gatun, **P-10**, pl. 99.

Reservoir, Naos Island, **P-10**, 196, pl. 53.

Rock for, local, **P-07**, 130.

Sand for, **P-08**, 60; **P-09**, 101; **P-10**, 178; **P-11**, 170; **P-12**, 185.

Setting temperature, Gatun, **P-10**, 122.

Spillway, Miraflores, **P-13**, 173.

Spillway, near Camacho Reservoir, **P-11**, 156, pl. 42.

Stairway, range towers, **P-12**, 108, pl. 18.

Stone and sand for, **P-08**, 60, 66.

Temperature curves, Gatun, **P-10**, pl. 98; **P-11**, pl. 100.

Terminals, **P-13**, 203.

Wagon bridge, Mandingo River, **P-11**, 156, pl. 41.

Weights of fixed irons embedded in, lock gates, **P-13**, 81.

Condemned Material. (See Material.)

Condensed Water Plants. (See Water.)

Plant, Gatun waterworks, **P-10**, 127.

Conductors.

Conductor slot material, locks, **P-14**, 108, 109.

Conduits. (See Tunnels.)

Congress. (See Acts.)

Connections. (See Floors; Culverts.)

Consolidated Expenditures. (See Expenditures.)

Consolidations.

Panama R. R. with Isthmian Canal Commission, **P-11**, 501.

Construction.

By contract. (See No. 163, p. 2364 of this Index.)

Construction and engineering, classification of accounts, **P-09**, 153.

Department of. (See Nos. 40, 145, 251, pp. 2362, 2364, 2368 of this Index.)

Expenditures and cost. (See Costs.)

Material, handling, floating equipment, **P-09**, 50.

Status of, canal, **P-05**, 134, 139. (See Nos. 141, 142, 143, p. 2364 of this Index.)

Construction and Engineering. (See Nos. 40, 145, 163, pp. 2362, 2364, 2365, 2366 of this Index.)

1909. First division, O. C. E.: Under Lt. Col. H. F. Hodges, assistant chief engineer. Has charge of design of the locks and dams and their appurtenances. Considers and reports upon all questions of a civil engineering character "that may arise in the progress of the work."

Locks: Designs for upper locks at Gatun and the locks at Pedro Miguel finished. Locks in pairs; separated by a wall 60' thick, are 110' wide, with 1,000' usable length.

Locks, filling and emptying: Longitudinal culverts in the side walls used, operated by Stoney valves; from these valves the water

passes through laterals under the floors and perpendicular to the axes of the locks, from which openings upward admit water to or draw it from the lock chambers. A longitudinal culvert is placed in the center wall also, connected with the lock chambers by laterals; but in this case, while the water in the main culvert is governed by Stoney gates, flow through the laterals is controlled by cylindrical balanced valves capable of withstanding pressure from either direction. The arrangement permits the passage of water from one lock to the other of any pair.

Gates: Double-leaf, double-sheathed, straight, mitring gates were adopted. Two barriers must separate high levels from the level next below in locks. Horizontal rolling gate abandoned in favor of another set of mitring gates with a chain barrier controlled by capstans in the wall. As over 95 per cent of the vessels of the world are less than 600' long, intermediate gates introduced as a feature, dividing the lock chambers into two parts suited to vessels of 550' and 350' length, respectively; also protected by a chain barrier.

Guide piers: Both up and down stream.

Towing: Electric towing machines being designed.

Emergency dams: Swing bridge from which girders and wickets are to be lowered, to be provided. **P-09**, 2, 3.

1910. Description of locks, as well as drawings of designs for upper locks at Gatun and for locks at Pedro Miguel published in report for 1909. During year drawings prepared as were needed by working forces engaged in construction of locks. General features of intermediate and lower locks at Gatun and Miraflores adopted.

South approach wall at Pedro Miguel designed of massive concrete, and larger part of it is constructed. Northeast wing wall to be of massive concrete, and reinforced concrete walls designed for northwest, southeast, and southwest wing walls in same locality. Designs for approach wall at Pedro Miguel and Gatun and Miraflores tentatively prepared.

Description and drawings of valves for controlling flow of water into and from locks given in last report. Contract entered into Mar. 2, 1910, for all the frames for gate valves to control main culverts for upper Gatun and Pedro Miguel Locks; delivery begun. Contract entered into July 10, 1909, for frames and moving parts for two sets of Stoney valves. 40 cylindrical valves contracted for July 10, 1909; 90 per cent delivered. Substitution of cast iron for steel. Bids asked for remainder of ironwork for valves for main and lateral culverts.

General and detailed drawings of lock gates for all gates required to fully equip the locks completed. Bid of McClintic-Marshall Construction Co., Pittsburgh, Pa., accepted. Prices 3.785 cents per pound for structural steel erected, 2.62 cents per pound for structural steel not erected, and \$5,374,474.82 for entire work. McClintic-Marshall Construc-

tion Co. bind themselves to complete work by June 1, 1913.

Design of machinery for Stoney gate valves main culverts completed. Valves will be operated electrically. In order to try out machinery as designed, before purchasing large number required, specifications prepared and bids invited for two machines each class.

Study given to question of machinery for operating gate leaves. As result, recess in wall modified to permit freer exit of water around miter post when gate is near position rest, and type of machine adopted in which the force applied increases and the rate of motion decreases near the beginning and end of the movement. Crank-shaft motion chosen. It has been thought desirable provide on gate leaves a positive lock. The vice adopted will be tried carefully before being applied.

Design for spillway dam at Gatun completed. The trace of the dam is a semicircular arch which secures not only necessary development of crest, but also partial neutralization of energy of converging stream that will flow over it. To help destroy energy flow, two rows of baffle piers placed on axis of circles concentric with dam. Crest of dam divided into 14 bays 45' wide, by 13 piers and 2 abutments, closed by Stoney gates. Ample provision made to take care of flood even should there be any negligence or delay in the operation.

As spillway channel must be used for discharge of the Chagres during building of main dam construction of spillway dam will be one of last parts of work completed. Piers about 20' apart therefore built from the foundation projecting above low water; stop planks can be placed between them, thus forming a cofferdam, under the protection of which concrete can be placed. Design also contemplates construction of 4 low-level culverts regulated by Stoney valves and 1 by cylindrical valve. By their aid lake level can be regulated during construction of remainder of dam, concrete being kept ahead of slowly rising lake surface. Culverts will subsequently be filled with concrete.

General plan of machinery used in raising and lowering Stoney gates on crest of spillway prepared.

Design prepared for electric locomotive to take vessels through locks and have full control of them from approach until locked through. Work on movable or emergency dams continued; various details settled, and drawings being prepared to invite bids for delivery of material and erection in place.

Investigation of expenditure of water from Gatun Lake as affected by design for locks carried on. Results indicate that in ordinary years there will be a considerable surplus of water, and that water supply of worst-known dry season for last 19 years, 1903, would be sufficient to maintain through canal an average daily number of passages three or four.

times as great as average number passing Suez Canal.

Water supply is ample for canal as planned, and separation of locks into single lifts would have carried with it a great increase in expense to bring about an unnecessary saving in water supply. Analysis of effect of use of different lock chambers upon water supply, levels, and lifts. **P-10, 2-5.**

1911. Scope of division increased to add design and construction of aids to navigation, inspection of manufacture and erection under contract or otherwise of lock gates, operating machinery, gates and valves, emergency dams, and of placing of such concrete in locks as must be omitted until machinery is installed.

General plans of all locks practically completed. Designs for approach walls at all locks, with exception of south middle approach wall for Miraflores, prepared.

Contracts for valves, frames, and bulkheads practically completed. New contracts entered into, or advertisements issued, for remaining frames, valves, snubbing hooks, spillway gates, spillway bridges, and all fixed steel for completed locks. 954 tons of castings for structural material made at Isthmian Canal Commission shops at Gorgona.

With view of ascertaining friction coefficient and leakage under working conditions, tests of rising stem or Stoney valves undertaken at Gatun. Tests for determining coefficient and leakage under working conditions being made. One of the cylindrical valves tested for leakage at Pedro Miguel under head of 65.

Material under contract for fixed parts pertaining to miter lock gates delivered. Work in progress under contract June 21, 1910, for construction of gate leaves proper; shops had completed on June 30, 1911, ready for shipment, practically all material for 8 leaves 54' 8" in height, comprising upper guard gates in Gatun and Pedro Miguel Locks; 8 leaves 77' high for the upper and middle gates in the upper lock at Gatun nearly completed, while 8 more leaves 77' high for safety and lower gates in same lock about half done. Shipments, about 7,000 tons. Output of shops has reached about 900 tons per week, or nearly 1½ leaves.

Under the contract, erection of gates to begin on Jan. 1, 1911, at Gatun, and on Mar. 1, 1911, at Pedro Miguel. Contractor's erection plant practically ready on dates mentioned, but actual erection not begun until later, due to delays. By end of year skeletons of 4 leaves at Gatun were in position for a height of 4 panels and those on east chamber completely riveted.

Fender chains to be placed about 500' above and 230' below the upper and lower guard gates, respectively, in the locks at Gatun, Pedro Miguel, and Miraflores, and also at points 80' and 100', respectively, above the hollow quoins of the middle and safety gates

in the Pedro Miguel Lock, and in the upper chambers at Gatun and Miraflores. Study of the device had made sufficient progress to determine type of first sample machine to be bought. Trial with sample chain will determine character of the remainder to be installed.

To permit examining, cleaning, painting, and repairing lower guard gates, and access in the dry to sills of the emergency dams, proposed to provide floating caisson gates; design of the molded ship type prepared. Alternative design of type now used for dry docks in U. S. under consideration. Caissons will be equipped with electric motor-driven pumps for use in pumping out caissons and for unwatering locks.

Bids for operating machinery for valves not satisfactory and rejected. New bids issued; contract made for purchase of two machines of each type for trial. Motors and limit switches for two machines purchased. Bids invited for purchase of machines for operating and locking the gates.

Plans for emergency or movable dams completed in Dec., 1910, and work of constructing and erecting them in place advertised on Jan. 14, 1911. Contract awarded to U. S. Steel Products Co. for sum of \$2,238,988.40, lowest bidder. Time pledged for completing erection of the dams as follows: At Gatun, Aug. 15, 1912; at Pedro Miguel, Jan. 15, 1913; and at Miraflores, June 15, 1913. Machinery for raising and lowering wicket girders of emergency dams and gates which close openings between these girders designed and included in the above-mentioned contract.

Study given to electrical system for operation of canal. Contemplates hydroelectric station on Gatun Dam with reserve generating station at Miraflores operated by steam. Two stations to be connected by transmission line. Specifications for equipment of hydroelectric plant ready for issue.

Detailed drawings for Gatun Spillway and general plan of Miraflores Spillway completed, as well as drawings for steel footbridge to span gate openings at spillways, and for caissons which replace defective gates and permit repairs.

Scheme for lighting canal prepared and adopted. Contemplates range lights for establishing direction on longer tangents, and side lights about a mile apart to mark side of channel. Light and fog signal located on west breakwater in Limon Bay, and gas and nun buoys will be placed to mark channel to Mount Hope Dry Dock. Three types of lighted beacons will be used, of reinforced concrete. Project contemplates 34 tower beacons, 67 beacons, 57 gas buoys, 76 spar buoys, and 7 nun buoys. Reference targets for marking ranges where lights not used and for fixing location of gas buoys will be erected. Sailing lines marked by

range lights, except at entrances to canal, will be so placed that all ships will follow course 125° to their starboard of axis of canal; two passing ships, on their ranges, will have center line 250' apart. For locating and referencing gas buoys, and providing unrestricted view of range and reference targets, 1,000 acres of land must be cleared. Work begun Apr. 20; at close of year 375.5 acres cleared, 148,000' of trochas cut, and 16,000 lineal feet profile taken.

In the report of the Isthmian Canal Commission for 1899-1901, Mr. S. H. Woodard discussed the effect upon the lock gates of the difference in densities between the water on the two sides of the gates of the lowest locks. In the course of the design of the lower portion of the lock flights at Gatun and Miraflores it appeared that the pressures might prevent the opening of the gates, or even under possible conditions bring such pressure on the downstream side as would expose the operating apparatus to reverse stresses, etc. Questions considered by board; board reported it possible to find for a given condition of density, depth of water, and location of culvert, an elevation for outlets of culverts at which there will be no resultant unbalanced pressure on the gate leaves due to difference in density of water on the two sides after flow through the culvert has ceased. Applying analysis to known conditions at lower gates at Gatun and Miraflores, board determined positions for the outlets of culverts and recommended they be placed at these elevations in horizontal plane of roof of culvert, thus directing flow upward. It also recommended placing of valves in lower guard gates to provide against pressures due to tidal action. As a result, a design for outlet of culverts in lower locks adopted. **P-11, 2-5.**

1912. General plans for lower portion of lower locks at Gatun and Miraflores completed and approved, as well as plans for south middle approach wall at Miraflores and for uncompleted portion of south middle approach wall at Pedro Miguel, which was changed from solid type already built to reinforced cellular type for remainder. In addition, all drawings required for decking over various machinery chambers in the lock walls, snubbing posts, and spring buffers prepared, so that all detailed plans for locks completed and approved.

Chambers prepared for rising stem gate valves by lining up fixed irons, and 12 completed at Gatun and 2 at Pedro Miguel during the year; at Gatun 12 valves placed in position. In addition, 6 bulkhead gates placed in side-wall intakes and 6 in center-wall intakes at Gatun. Three rising stem gate valves and 1 cylindrical valve placed in Gatun Spillway. Cylindrical valves placed in all the locks during construction and all of them in position. To determine probable leakage around rising stem valves, also force required to start valve

and maintain motion, test made on set of two valves installed in upper valve chamber of west side culvert at Gatun. Entrance to culvert closed by water-tight bulkhead, and culvert between bulkhead and valves, with well above valves to top of wall, filled with water. By this arrangement there was greater head against valves than will obtain when lock is pumped dry for examination, and considerably greater than the usual operating head. It had been assumed at 81,750 pounds in design of machinery which was intended to exert a lifting force of 60,000 pounds, including all friction and weight of valve and accessories. Probable that both friction and leakage will be reduced in subsequent valves, as certain improvements in detail and workmanship are found in those of later construction.

Cylindrical valve in locks at Gatun tested for leakage from exterior by constructing bulkhead across entrance to valve chamber, which was then filled with water. When head reached 60' leakage found to vary from a quantity too small to measure to about 0.25 of a cubic foot per second. Average was about what was to be expected from the tests made at Pedro Miguel and described in last report. Examination indicated that leather seal or gasket sufficiently rigid to hold up movable portion of valve and prevent seating properly. Segments which clamped leather seal removed and edge beveled slightly to allow easier bending of gasket. After this was done leakage found by measurement to be about 0.015 of a cubic foot per second, or about one-tenth of that previously measured. Segments for all valves being beveled in manner indicated.

Two rising-stem valve machines furnished under contract tested and found to be satisfactory; contract entered into Dec. 5, 1911, for furnishing all parts for 114 rising-stem gate-valve machines without motors. After successful test of first two cylindrical valve machines, contract awarded, Oct. 25, 1911, for 118 additional cylindrical valve machines without motors and 12 auxiliary culvert valve machines without motors. Up to June 30, 1912, 21 rising-stem valve machines (except valve stems and thrust screws), 34 cylindrical valve machines, and 3 auxiliary culvert valve machines received. Delays in shipment occurred, caused by strike of stevedores at Baltimore.

Owing to the peculiar climatic conditions on the Isthmus, involving tropical heat and extreme humidity, and deteriorating effect of these conditions on insulation of electrical machinery, was necessary to investigate different kinds of insulation. 16 sample motors purchased, 2 from each company offering bids for motors required. 8 of these were sent to the machine contractors for operating tests on valve machines, and the other 8 shipped direct to the Isthmus, where they were subjected to extreme conditions specified in specifications accompanying the invitation

for bids, to test insulation. They were first placed in storehouse at Gatun and exposed to ordinary conditions of climate for about 2 months, during which time condition of insulation was determined periodically by inspection and tests. They were subjected to steam test, in which the extremes of temperature and humidity mentioned might be reproduced. In order that conditions of all motors might be identical, motors were placed in small building erected for the purpose and tests performed on all motors simultaneously, so that motors were subjected to same humidity and temperature. Tests consisted of filling building with steam, maintaining temperature of 50° C. for period of 10 days, making potential tests and measurements of insulation throughout this period. In addition to steam test, motors which survived were immersed by filling case with water at 30° C. and maintaining this condition for 5 hours, during which time observations of insulation resistance made continuously. 8 motors which were first shipped to the machine contractors were, after reaching Isthmus, subjected to the immersion test, but not steam test. Tests were conducted without the presence of any representative of manufacturers.

Relative standing of various types of insulation definite and choice of most suitable insulation clear; however, in view of the number of motors tested, it was desirable to obtain a numerical basis of comparison. A schedule of the various stages of the tests was therefore prepared and a number of points assigned for the survival of each of these stages. Contract awarded on basis of tests as above outlined.

Series of tests also made on sample limit switches purchased under similar conditions as motors and award made. Satisfactory progress made in manufacture of these switches, and at end of year 50 reported shipped.

Lock gates being constructed and erected under contract dated June 21, 1910. During year shop drawings for different heights of gates completed and approved. Total steel plates and shapes accepted at mills, about 52,322 tons, which practically comprised all rolled material required, excepting that for spare parts. Three-quarters of castings made, machined, and accepted. Specified chemical and physical tests carried out and contract requirements as to quality of material fully met. Only change in material made in bushings for the pintles at the bottom of certain leaves that will always be in sea water. Certain leaves operated in brackish water are to be protected from erosion by use of zinc rings placed close to bronze bushings.

Total shipment of structural material to end of year 1912, about 39,000 tons, or 76 per cent of amount required. Of the total, about 32,000 tons shipped during year, so that on June 30, 1912, 13,000 tons remained to be forwarded—

about half the material for the gates in intermediate locks at Gatun, the upper locks at Miraflores, and all material for gates in lower lock at Miraflores.

On June 30, 1912, erecting gates on Isthmus in progress on 23 gates. They comprised all gates in upper lock and intermediate gates in lower lock at Gatun and all gates at Pedro Miguel, excepting lower guard gate in west chamber. No material placed at Miraflores. Total steel in place in several gates at end of fiscal year, 19,631 tons, or about 34 per cent. With exception of 412 tons previously reported, all this material erected during year. Total number of field rivets driven to June 30, 1912, 963,500 out of 5,750,000, or only 17 per cent of total.

Completion of several gates fallen considerably behind dates specified in contract. Close and continuous inspection maintained; believed that completed gates will meet fully the standard laid down in specifications. Tests for water-tightness in first gate at Gatun indicate excellent workmanship.

First two miter gate-moving machines and first miter forcing machine completed and satisfactorily tested. Miter gate-moving machines installed in respective places, and one tested in regular service of swinging gate in dry. Operation successfully performed in 1 minute and 48 seconds, or 12 seconds less than estimated time. Contract for remaining 90 miter gate-moving machines made Feb. 11, 1912. Award for motors for these machines made.

Contracts entered into for delivery of one fender, except the chain, which was built at U. S. Navy Yard, Boston. To determine best form of emergency resistance valve, elaborate series of tests made in power plant of Prudential Insurance Co., Newark, N. J. Three types of valves tested; two satisfactory. Chain the only part of apparatus shipped.

Material for structural steel covers by which the electric locomotive track is supported over lock-gate recesses in masonry provided for, and erection of steel let by contract July 7, 1911. Erection of all covers in Gatun and Pedro Miguel Locks practically completed.

Bids for electric-towing locomotives invited. Contract entered into for delivery of one locomotive complete. Under contracts for materials in connection with locomotive tract, 95 per cent of structural parts completed. Delivery of steel rack sections 44 per cent completed. There was delivered on the Isthmus 60 per cent of malleable-iron supporting brackets for conductor-slot covers, but these rejected on account of general irregularities. Contract for malleable-iron cover plates and washers completed. Bids for crossovers and turnouts rejected. On readvertisement, contract entered into.

Specifications issued Sept. 9, 1911, covering main generating equipment for hydroelectric station, containing three 2,000-kilowatt units, to be located adjacent to spillway in Gatun

Dam. Equipment to consist of three 2,250-kilowatt water turbines, 3 head gates, 3 penstocks, 3 governors, 3 draft tubes, three 2,000-kilowatt generators, 3 direct-connected 50-kilowatt exciters, two 100-kilowatt motor-driven exciter sets, one 30-ton electric crane, and 1 lubricating system. Contract entered into Dec. 2 for hydraulic equipment. Contract entered into on same date for electrical equipment. One generator completed and ready for test. Only material delivered on Isthmus, 60 per cent of penstocks.

Sufficient water from storage in Lake Gatun to warrant installation of 6,000 kilowatts in generating capacity, including reserve. Maximum water diverted for hydroelectric development approximately 7 per cent of minimum water supply and is excess not required for lockages, evaporation, and leakage.

Spillway-gate machine designed to raise and lower, in 10 minutes, Stoney crest gate for controlling water levels of Gatun and Miraflores Lakes. Consists essentially of two counterweights, connected to gate by a screw and chain; screws driven simultaneously; counterweights practically balance weight of gate. Contract awarded for 22 spillway-gate machines.

Jan. 31 specifications issued for apparatus for remote control and indication of the lock machinery and spillway gates. Bids opened Mar. 15 and contracts awarded.

For supplying electric current to operate lock machinery, 16 transformer rooms provided in locks at Gatun, 8 at Pedro Miguel, and 12 at Miraflores. Power taken at 2,200 volts from hydroelectric station and transformed to 220 volts. Each room is to contain two 190-kilowatt power transformers. All equipment in duplicate. Transformer room will also contain 25-kilowatt lighting transformer, bank of 9 or 10 oil switches, 7-panel, low-tension switchboard, and miscellaneous cable and terminal equipment. Every effort made to render operations simple and fool-proof.

General features of lock illumination fixed. Exterior lighting concrete lamp standards will be erected on coping of locks throughout length of each wall—211 lamp standards at Gatun, 131 at Pedro Miguel, and 169 at Miraflores. Standard supports reflector 30' above the coping. For interior lighting of operating tunnels and machinery rooms, deck lights arranged. For use at night, artificial illumination provided by ordinary 16-candlepower carbon filament lamps mounted in specially designed reflectors set in concrete. 7,000 lamps will be installed in all locks.

Erecting lock machinery begun at Gatun Sept., 1911, and at Pedro Miguel Jan., 1912. Schedule of erection not adhered to in all cases, but installation and erection progressing as fast as deliveries. 9,414' towing track, including conductor-slot channels, assembled, lined up, and tested, and 2,348.9 c. y. con-

crete laid in connection with towing track and miter gate recess covers.

Of emergency dams, 2,786 tons material shipped from U. S. Shipments to Isthmus delayed; only 1,700 tons received. False work and erection cranes for east dam at Gatun completed.

Contracts made for emergency dams and gate and girder hoisting machines; also for electrical equipment for operating machines. Satisfactory progress made; first machine of each type tested and other machines advanced. Tests of worm gearing carried out.

Work on drawings for floating caisson gates continued. Plans for various decks drawn out and detailed study made of pumps and piping.

Contracts aggregating \$3,683,306.29 entered into during year for various irons in connection with locks, electric locomotives, tracks, machines, pumps, electrical equipment; for all necessary appliances for completely equipping the locks for satisfactory operation, except machinery for guard valves, and material for transmission line which will connect hydroelectric station at Gatun with locks of Pacific division.

Prolongations of range light tangents so covered by brush and timber that trochas had to be cut; 809.85 acres cleared.

Field forces organized and work begun on range towers at Pacific entrance Sept. 1, 1911. The towers, of concrete, being constructed by means of steel forms. Eleven of the towers completed—Nos. 5 and 6, Atlantic section; Nos. 2, 9, 11, 13, and 14, Pacific section; Nos. 1, 21, 24, and 25, Gatun Lake section. In their construction 805.88 c. y. concrete used. 60 gas buoys located, referenced, and checked, and 3 beacons in Gatun Lake section located. For floating buoys and for 23 towers and beacons in inaccessible places, compressed acetylene adopted. White lights will be used; all range lights, beacons, and buoys will have individual characteristics formed by flashes and combinations of flashes of light and dark intervals. Candlepower of lights will vary from 2,500 to 15,000. Most powerful ones will be those marking sea channels at Atlantic and Pacific entrances, visible from 12.5 to 18 nautical miles. Beacons and buoy lights will have 950-candlepower. P-12, 2-12.

1913. Designing work for locks, including drawings needed by working force in the field, as well as for spillways, approach piers, and wing walls, completed. After performing some work for second division on coaling plants and canal terminals, force in charge of designs disbanded June 1, 1913.

Complete installation for a set of rising stem valves requires setting valves, placing stems, roller trains, crossheads, motors, and control panels. Fixed ironwork for guiding valves and forming water seals required correction before installation begun. For valves at

Gatun and all but 2 at Pedro Miguel corrections made by chipping and grinding with pneumatic hand tools; for 2 at Pedro Miguel and all valves at Miraflores done by specially designed milling machine. 94 per cent of fixed irons corrected at close of year. During year 102 rising stem valve chambers prepared, including 50 at Gatun, 28 at Pedro Miguel and 24 at Miraflores, and 104 valves, including trains and sealing devices, placed in position in locks. Of this latter number, 48 at Gatun, 28 at Pedro Miguel, and 28 at Miraflores.

Tests made on 39 rising stem gate-valve machines at Gatun, 20 at Pedro Miguel, and 8 at Miraflores.

Six side-wall intake screens placed at Gatun, and bulkheads to center-wall intakes removed and placed in outlet. At Gatun 4 lower side-wall bulkhead gates also placed.

Guard valves provided as duplicates to upper rising stem valves in emergency, or for use in closing intakes in side-wall culverts for unwatering culverts to permit access to other valves for painting and repairs. Design of machinery for these valves completed Aug., 1912. Design determined by cramped position in which machines had to be placed; because of infrequency of operation, as well as slow speed, simpler and cheaper than for rising stem valve. On Nov. 14, 1912, contract awarded for 18 complete machines, excepting motors, limit switch, counterweight bases, and counterweights; 50 per cent of machines delivered before close of year.

Last of cylindrical valve machines under contract delivered Jan. 15, 1913. Mechanical installation of 120 cylindrical valves completed June 1, 1913, and electrical work of installing control panels and cables with necessary conduits for these machines 41.6 per cent complete for all locks. As result of tests, decided to regrid all valves. Operating machinery is same for both cylindrical valve and auxiliary culvert valve machines, except 60" and 36" strokes are required for 60" and 36" auxiliary culvert valves, respectively, instead of 32" stroke of cylindrical valve. Test made to determine time required to open various types of valves; cylindrical valves required 10 seconds, 60" auxiliary culvert valve 16 seconds, and 36" auxiliary valve 10 seconds.

Tests of discharge made on cylindrical valve and 3 rising stem gate valves in spillway.

During year 14 gates and 1 caisson for spillway at Gatun and 8 gates and 1 caisson for spillway at Miraflores erected. Gates at Gatun installed in position on dam. Miraflores spillway under construction. Draft tubes for hydroelectric station on east side of spillway dam at Gatun completed.

All spillway gate machines and pumps for unwatering counterweight pits delivered and test made of first machine. Device for shifting gate upstream a slight distance after it is clear of the water and mechanism for raising roller train out of water operated properly.

Mechanical work started on 12 of 14 machines at Gatun and 71 per cent of mechanical work on all machines completed.

Construction and erection of lock gates continued under contract with McClintic-Marshall Construction Co. dated June 21, 1910. Shop drawings completed, as was manufacture of all material for gates, aggregating 57,500 tons; final shipment made in Apr. In addition, 2,100 tons structural work for spare parts built and delivered on Isthmus. Spare parts comprise sufficient material for partly or completely rebuilding any 2-gate leaves on canal. Erecting lock gates proper began at Gatun May 17, 1911, at Pedro Miguel Aug. 7, 1911, and first work at Miraflores done Sept. 10, 1912. At beginning of year work in progress on half the total number in all locks; none had been completed. Total steel assembled only 19,361 tons, or about 34 per cent of total. Field rivets numbered 963,000, or about 18 per cent of a total of over 5,700,000. Work allowed to drag; completing it within reasonable time hopeless. Contractors decided upon change in local management and, Sept. 1, installed additional machinery, increased force, and arranged for efficient supervision. Improvements in organization became manifest; high degree of efficiency reached, with large increase in work. Some idea of improvement may be judged from fact that during Mar. 660,000 rivets driven, while the highest number driven in any one month prior to Sept. 1, 1912, was 213,000. On June 30, 1913, over 97 per cent of material assembled in gates. All leaves in west chamber at Gatun and in east chamber at Pedro Miguel stepped on pintles, and all leaves in west chamber at Miraflores excepting 2 leaves of operating gate in lower chamber. All guard gates complete except at lower end Miraflores Locks; and guard gates at both ends Gatun Locks permanently closed at end of year. Those at upper end put in service July 20, 1912, and lower guard gates closed June 11, 1913.

Supplemental contract entered into with contractors Jan. 14, 1913, by which certain restrictions governing payments modified, as original provisions proved unnecessarily severe and more speedy completion would be assured by relaxing. Modification provides for successive partial payments on each gate when assembling, riveting, finishing, and painting completed and accepted. Further supplemental agreement, signed May 20, 1913, gave extension of time. Delays occurred for which contractors could not be held responsible, due to shipwrecks and strikes, as well as delays caused by Isthmian Canal Commission. Rate under which liquidated damages to be computed increased, while new and later dates fixed for completion of several gates. June 1, 1913, fixed for upper guard gates at Pedro Miguel, and June 15 for guard gates at lower approaches to Gatun and Pedro Miguel and upper approach to Miraflores Locks. Lower-guard gates at Miraflores to

be finished Sept. 1, 1913, and all other gates necessary to permit lockage through one side of each flight, ocean to ocean, must be completed not later than Oct. 1, 1913, while date of final completion for all remaining gates fixed at Jan. 1, 1914, for Gatun and Pedro Miguel, and Mar. 1, 1914, for Miraflores. From progress made dates will be anticipated. Total weight of all gates on canal, excluding pumps, floats and float switches, motors and conduits, and other electrical apparatus, castings for attaching operating struts, and miter forcing machines, 57,552 tons. Castings and structural parts to be embedded in masonry in part furnished under contract for lock gates and erected by Isthmian Canal Commission in connection with concrete construction.

Entire shipment of miter gate-moving machines completed during May, 1913, but work handicapped by nonreceipt of parts necessary to embed in concrete and about which erection of whole machine hinges. At end of year 86 per cent of all machines installed. Electrical work in connection with these machines 24.2 per cent completed at close of year.

Miter gate-moving machines installed complete on upper guard gates at Gatun, and test made of machinery July 31, 1912. Gate-moving machines adjusted. Limit switches adjusted so that the gate traveled from its full miter position to opposite position in recess, at which point machine again on dead center. Operation of one leaf 1 minute and 51 seconds and for other 1 minute and 50½ seconds. Operation completed second time. Mitering of leaves perfect. Gates also had installed miter-forcing machine, tested out on same date. One leaf left in closed position and other opened 2'.

Miter-forcing machine brought gate to within ¾" of perfect miter. Another trial, with opening of 3½", brought gate to ⅝" from miter. Several changes made, and new proposals invited. Under new contract all machines delivered. Installation delayed on account of noncompletion of work on structural gate parts.

Under contract entered into Nov. 4, 1911, all material for trial tender delivered. Erection begun about Jan. 1 and completed Mar. 1, 1913. During Mar. and Apr. tests made. Results seemed to warrant belief that vessel, unless of great size or moving at excessive speed, can be checked or stopped without breaking the chain. Great tidal range below Miraflores Locks made modified design necessary. Same system of cylinders used and machinery practically same, but chain is stretched across the lock at either of two levels, according to stage of tide. Chain is endless.

Plans and specifications for floating caissons completed and invitation for proposals issued May 23, 1913. Caissons will be used for closing upper and lower entrances to lock chambers when unwatering them, and will contain

pumping plant for pumping out locks. Pumping system will include 4 centrifugal pumps of volute type with 20" discharge, besides small auxiliary pump. Flooding of caissons done by gravity and 2 of the 4 large pumps arranged for pumping them. All remaining parts of towing track material delivered. Total delivered, 53,950 linear feet, and at close of year 36,908 linear feet installed complete with concrete, and 11,168 linear feet distributed and bolted up ready to be aligned and concreted. Installation of most of return track performed by Atlantic and Pacific divisions.

Bids invited for towing locomotives on design prepared by electrical subdivision, and contract entered into for locomotive. Locomotive delivered Jan. 25, 1913, and ready for operation Feb. 7, after which it was tested. Test developed defects. As a result, order placed for required number of locomotives on design submitted by General Electric Co., abandoning design of Isthmian Canal Commission.

Tests made in Limon Bay on ships of Panama R. R. fleet, at various speeds of acceleration, to serve as check on basis used for design of locomotives. Ships ranged from 3,500 tons to 10,400 tons displacement. Tug used which could exert maximum pull at standstill of 15,000 pounds. Readings taken of dynamometer pull, tug speed, angle of tow line with center line of tug, angle of tow line with ship, and ship's bearings, at intervals of 30 seconds throughout the run.

Insulated cable on order to date for all classes of work on locks and hydroelectric station, including underground lines from hydroelectric station to locks, aggregates 2,372,110', of which 1,394,600' lead-sheathed cable and remainder rubber-covered double-braided wire and cable. 93 per cent of total required delivered. 462,729' of lead-sheathed cable pulled into ducts, and large part of remaining ducts rodded, cleaned, and wired with fish wires for pulling in remainder. Cable pulled in ducts by special winch made on Isthmus.

Control scheme for various locks completed; contemplates control of every piece of machinery in lock walls from central station. In house is located control switchboard connected with every local control panel and indicating mechanism. Switchboard so arranged that indicator and control switch of each gate or valve machine is placed in same relative position to other indicators and control switches as that occupied by actual machines, so that by means of red and green lights and small models of gates and valves operated by synchronous transmitting mechanisms operator in the control tower on locks is able to tell at a glance condition in any part of locks from switchboard indications. Expected first board will be shipped by Aug. 1. Hollow concrete pole with concrete bracket arms and reflectors designed by architect for supporting lamps for exterior illumination of locks and grounds. Poles arranged in 4 rows

along length of locks, spaced 100' apart, with lamps 30' above coping level. Lighting units used, 110-volt, 500-watt Mazda lamps.

Generating equipment for hydroelectric plant delivered, including main generators and turbines, exciter sets, traveling crane, penstocks, head gates, and operating machinery. Steel-work for hydroelectric station purchased, and delivery completed. Erection of penstocks complete and turbines set. Balance of installation dependent upon completion of building for housing electrical equipment.

Decided to install for transmission line overhead system of 44,000 volts, from Balboa to Cristobal, connecting Gatun hydroelectric power station with present Miraflores steam power station. Four substations provided—at Cristobal, Gatun, Miraflores, and Balboa. Complete line consists of duplicate 3-phase lines.

Remaining shop drawings for emergency dams completed and approved. Tests made upon gates prior to shipment. Structural material for turning and wedging machinery for emergency dams shipped to Isthmus. Assembling of east dam at Gatun begun July 1, 1912, and completed Mar. 1, 1913. Erection of west dam begun Nov. 9, 1912, and practically completed in 5½ months, or Mar. 1, 1913. Material for west dam at Pedro Miguel received in time to begin erection Feb. 1, 1913; all material assembled. Work begun Apr. 1, 1913, on east dam, and by June 30 over 50 per cent of material assembled in structure and 30 per cent of riveting completed. Delivery of material for east and west dams at Miraflores began May 1, 1913, and to end of fiscal year about 840 tons received. Erection of east dam begun June 1, 1913, and of west dam June 13, 1913. On May 20 contractor began final tests of dam on east side at Gatun, total time for closing, first test, being 1 hour 1 minute and 30 seconds. Second part of test started, consisting of operating turning and wedging machinery for 20 days, at intervals depending upon heating of motors. Tests were made principally for limbering up turning and wedging machinery. After completing second part of tests, 3 additional complete operations made; the last completely closed passage in 42 minutes and 17 seconds—19 minutes and 13 seconds less than time of first test.

12 range towers completed, of reinforced concrete, with heights from base to focal plane varying from 28' 10" to 87' 10". 3 skeleton tower beacons, marking edges of channel, Balboa to Miraflores, completed. 18 concrete-steel reference and range targets completed in Gatun Lake section. There will be approximately 32 of this type, by means of which gas buoys may be located from previously determined angles. At Bohio, Pena Blanca, Caimito, Mamei, Juan Grande, and Bas Obispo these reference targets also form unlighted ranges which mark axis of short tangents at those places. Reinforced concrete caisson for west breakwater light and fog signal, begun in June of last year, completed to height of 25'

and was sunk at inner end of Limon Bay in 20' of water, where it will remain until its riprap foundation at outer end of breakwater has reached settlement. Plans for west breakwater light and fog signal revised under supervision of architect and revised structure superseded one shown in last report. 51 concrete buoy sinkers 48 by 48 by 26" and forty-five 24 by 24 by 18" constructed at Balboa plant of lighthouse subdivision. Reinforced concrete wharf 70' long and 30' wide, adjoining small boat landing at Gatun, built for lighting establishment of canal by Panama R. R., to be used for storing, painting, and repairing gas and spar buoys belonging to Gatun Lake section. Experiments made with tungsten lamps having spirally wound filament concentrating the light source to spheres of ¼" for 100-watt and ⅝" for 150-watt lamps, as that type of lamp will be used throughout for all electrically lighted range towers and beacons. Experiments made for special flashing devices and lamp shifters for electrically lighted towers and beacons.

250 acres of prism from San Pablo to Pena Blanca cleared of trees and brush, and approximately 180 acres of land were cleared of trees in the vicinity of Mamei for the dredging division. P-13, 2-13.

(See p. 2368 of this Index.)

Construction, Plan of. (See p. 2365.)

Outline of, as proposed by John F. Wallace, before Board of Consulting Engineers, 1906.

Unit costs and time. P-06*, 364-371.

Terminal channels should be dredged to permit receiving material; Colon Harbor should be protected from northers; embankments to be thrown up on each side of the canal with dipper or clamshell dredge as far inland as possible, to keep flood waters out of canal section, to retain material excavated from the canal by hydraulic dredges, and to provide roadbed for the Panama R. R.; this location of the railroad would do away with the construction and maintenance of bridges; operation of canal will increase traffic of railroad; should be operated with electric power got from Gamboa Dam; track necessary perhaps on west side in central division; dredgeable section through the lowland between La Boca and Miraflores to be constructed in like manner; two end sections of the canal to be completed as soon as possible, "in order that dredges might work as far inland as practicable to assist in the attack on the principal excavation through the divide. This work can be performed by dipper dredges of from 5 to 10 c. y. capacity, loading the material on seagoing barges, and dumping it in deep water beyond the harbor limits."

Various unit prices estimated for soft dredging, rock work, etc.

"The limit of time that it will require to complete the canal or put it in operation will depend upon the removal of the 8 miles of central excavation, containing approximately

100,000,000 c. y., for canal section 200' in bottom width, 50' berms, and slopes of 1 on 1."

"The time required to do this work is dependent upon the excavating units which can be installed and the capacity per unit, which in turn is dependent upon the promptness with which empty cars are furnished to the steam shovels and loaded cars removed. The efficiency of the entire operation rests upon the plan of tracks, the quality and amount of motive power; the number, capacity, and character of the cars; the provision of adequate and proper dumps, and dumping facilities."

10 steam shovels operating Jan., 1906; 37, Jan., 1907; 58, 1908; 82, 1909, would bring output up to 16,400,000 c. y. annually. Same rate during 1910, 1911, 1912, and 1913, excavation would amount to 111,400,000 c. y. at the end of 8 years from Jan., 1906. "In the meantime the excavation of other portions of the central excavation outside of the 8 miles could be carried on partly by steam shovels, etc." Canal could be opened for navigation within 8 years and completed in 10—at most, in 12 years.

Sketch showing typical cross section of canal, on the terrace plan.

Dumps: Existing dumps and tracks practically those of the French company; "lack of track material, labor, and other appliances prevented any material changes being made." Wallace finally had 4 distinct main track railway systems leading from the excavation to distant spoil banks, 2 at each end of the central excavation and 1 on each side of the canal axis; these track systems to consist of 2 or more main running tracks as requirements might determine, using the Panama R. R. as a base; part of this plan consisted of a main double-track railroad leading from the Culebra excavation to the Gamboa Dam site, over which excavated material could be delivered at the site of the dam for construction purposes; main track systems to be ballasted with stone and maintained in first-class condition for rapidity of movement; ample side track facilities to be provided; trackage provided and arranged so that it should not be necessary for a steam shovel to wait for a car; lock tracks to be at the dumps; high and low dumps to receive study; location of dumps such that after the first mile an extra haul of 10 miles should cost but 2 cents per c. y. for transportation alone.

In the preparatory work the first step to remove the slippery clay formation overlying the Culebra excavation, during the dry season; slides afterward can be controlled, "in the opinion of the writer"; central drainage excavations at both ends of the cut; extraordinary efforts to be made to sink the central excavation to the greatest possible depth.

60 cents per c. y. estimated for removing central 5 or 8 miles of excavation; increase of 10 per cent over previous estimate of 50 cents due to 8-hour law, "and by the conclusion

which he has also reached, that to obtain efficient and economical results it will probably be necessary to contract this work, on account of the delays and difficulties which surround the prosecution of the work the details of which are carried on under direct Government control." P-06*, 364-370.

Construction, Status of. (See p. 2364 of this Index.)

Inspection of condition of work after resignation of Chief Engineer Wallace, made by Isthmian Canal Commission No. 3, P-05, 5.

Outline of conditions when Chief Engineer Stevens took charge, covering operations from Feb. 1 to June 30, 1905, P-05, 124.

June, 1904, to Mar., 1905, the work in connection with the investigations and surveys relating to the construction of the canal carried on as outlined by the commission in 1904. The assistant engineers appointed prior to July, 1904, reported direct to the chief engineer, but after the investigations intrusted to them neared completion and the work expanded, divisions were organized and different residencies placed under the charge of the division engineer. June 30, 1905, the engineering department comprised 5 divisions and 8 so-called bureaus. P-05, 124.

Report of Gen. Hains and Maj. Harrod, members of Isthmian Canal Commission No. 3, dated July 17, 1905, as to what had been accomplished under Chief Engineer Wallace. Records of latter's office examined, works along the line examined, and engineers in direct charge of work consulted. List of reports found on file. Outline of what had been done on Culebra division, Colon construction division, by bureaus of water works, sewers, and roads, of architecture and building, and of machinery and equipment. Report accompanied by letter, dated July 14, 1905, of W. E. Dauchy, acting chief engineer, showing the amount of work accomplished under Mr. Wallace, and the improving progress made toward organization, with an outline of the vast number of unwonted difficulties which had to be overcome. P-05, 133.

After observation of status of canal work under Mr. Wallace, apparent that good work had been done in preparation. Better, however, if attempt to "dig dirt" at Culebra had not been made. P-05, 145.

Progress made, extent of, at Feb. 14, 1905. Water supply for towns; administration of department of material and supplies satisfactory; entire work of the department of sanitation has been prosecuted in an efficient manner and with gratifying results; needful to make arrangements for increasing forces, and for resulting housing accommodations. P-05, 302.

Preparatory stage virtually past, at date of annual report, for year ending Dec. 6, 1906. Ready to enter upon actual work of canal construction. Thoroughness of preparatory

work testified to by Senate Committee on Inter-oceanic Canals, in its majority report, May 17, 1906, after an investigation covering a period of 6 months, embracing every detail of the work and every act of the canal officials. From this report, "The work authorized by the Spooner Act has been initiated and extensive preparations for a rapid prosecution of it have been made. The Canal Zone has been placed in a satisfactory sanitary condition, adequate shelter for the workmen has been provided, hospitals of very large capacity have been made ready, as is evidenced by the opinions of experts who have testified before the committee, and we are fortunately now in possession of a vast array of facts and figures affecting the prosecution of the undertaking that have not until now been available. This is due to the fact that the preparatory work has for two years been prosecuted with patient, intelligent judgment and earnest effort by those intrusted with the direction and supervision of the work." **P-06, 1, 2.**

Consuls. (See Countries, foreign; see No. 93, p. 2363 of this Index.)

Department of State issued circular note saying that consular officers commissioned to the President of Panama and recognized by him might exercise their function within and with reference to the Canal Zone without recognition from the U. S., **P-05, 48.**

Relations with, **P-07, 153.**

Acts, consular services, **P-13, 607.**

Consultation.

Mechanical committee for, shops, **P-11, 231.**

Contingent Expenses. (See Expenses.)

Contours. (See Maps; Profiles.)

Central division, **P-09, 90, pl. 28.**

Contracts. (See Nos. 23, 163, pp. 2361, 2364 of this Index.)

Buildings built by, and those not, comparison, **P-09, 151.**

Continuous contracts, act authorizing, **P-11, 574.**

Excavation, handwork, **P-11, 148; P-12, 158.**

Equipment, terminals, **P-13, 208.**

Fixed irons, **P-13, 74.**

Handwork, and dumping methods, **P-10, 160, pl. 32.**

Handwork, with old French pushcarts, **P-10, 160, pl. 31.**

Laborers, **P-09, 212; P-10, 311; P-11, 312; P-12, 412; P-13, 384.**

List of uncompleted contracts, **P-13, 110.**

Lock gates and devices, **P-12, 82.**

Lock machinery, **P-10, 53.**

Lock parts, **P-11, 66; P-12, 70, 105.**

Lock valves, **P-10, 48.**

Masonry and lock structures, **P-13, 75.**

Materials, terminals, **P-13, 208.**

Mechanical division and shops, **P-14, 171.**

New construction under, **P-10, 311.**

Roofing, terminals, **P-13, 205.**

System, optional, **P-13, 78.**

Supplies, Panama R. R., act, **P-11, 531.**

Terminals, **P-13, 208, 204.**

Unsatisfactory on U. S. work, **P-07, 19.**

Valves and fixed irons, **P-13, 74.**

Contracts, Construction of Canal by. (See No. 163, p. 2364 of this Index.)

Bids for canal construction asked from large contractors, Oct. 9, 1906, the accepted groups to be paid upon the estimated reasonable cost of the actual construction as fixed by an engineering committee, etc. Bids to be opened Jan. 12, 1907. **P-06, 15.**

Letter of chairman of Isthmian Canal Commission No. 3 to Sec. of War setting forth reasons why construction of canal by contract seems advisable. **P-06, 128-131.**

U. S. will get benefit of the combined efforts of the best and most experienced contractors in the world; will secure cooperation of "those powerful interests" in keeping full the ranks of employees; the U. S. will know exactly what the work costs in every part; plan offers incentive for speedy and economical construction by the penalizing system; * * * "friction will be avoided"; "probable saving to the U. S." **P-06, 130.**

Invitation for proposals to complete the construction of the ship canal upon the Isthmus of Panama between the Caribbean Sea and the Pacific Ocean, Oct. 9, 1906. For 85' lock-level ship canal, having a minimum depth of 41' and a minimum width at bottom of 200', between deep water in the two oceans. Basis of proposal: Qualifications of bidders; bonds; general directions for bidders; information furnished by commission; rejection of bids. Proposal form: Bond form; form of contract. Articles: Work to be done by contractor; extra work; plant and facilities furnished by the commission; functions reserved by the commission; to be supplied by the contractor; obligations to be assumed by contractor; payments; final compensation; method of estimating cost and time of construction of canal; default by the contractor; termination of contract when contractor is not in fault; decision of the chief engineer; definitions; bond for fulfillment of contract. **P-06, 132-150.**

Contract versus hired labor construction direct by U. S.: Sealed proposals invited Oct. 9, 1906, for building canal by contractors. Bids opened Jan. 12, 1907. None satisfactory. Contract work in U. S. generally cheaper; where he does not have to use special plant; illustrated by various instances where U. S. did its own work cheaper than through contractors. To be remembered that U. S. does not seek to make a profit when it undertakes a construction. Doubtful if any U. S. contractor could bring to the Isthmus any better labor organization than could the U. S. itself. No contractor can even attempt to recruit labor from the West Indies; no objection from any Government to their laborers working under the U. S. direct. Experience of the U. S. as a contractor equal to that of any contractor. In case of labor troubles, U. S. can handle the problem better apparently. More likelihood of continuity of construction by U. S. direct con-

struction. Reference made to the fact that in a majority of contracts on public works the time limit has to be extended. "There is no question that there are a number of people who will always believe and contend that any piece work done by the U. S. could have been done as well and more cheaply if undertaken by contract, but an examination of the records will generally disprove such a contention. On the other hand, there is an equally large class who will contend to the contrary and claim, after the completion of the work, that the reverse is true." Questionable if a contractor could get more work out of the laborers of the Isthmus than could the U. S. At Culebra all the plant secured, organization has been built up, labor obtainable; some of the organization composed of former contractors or overseers for contractors. No advantage in letting that section out to contractors. Dredge plant being steadily augmented for prism work. No advantage in seeking contractors' equipment, etc. Dam work intimately connected with rock work at Culebra and dredging elsewhere; no gain discernible in letting such work to contractors. In lock construction, the acquaintance with competent men for this work is more extended on the part of the U. S.; no question but that the U. S. should furnish all the cement; no contractor possesses the necessary plant for handling the enormous quantities of concrete required for these structures. The gates and operating machinery can, it is believed, best be constructed by contract at the proper time. Sanitation could probably be managed better with the whole work under direct construction by the employees of the U. S. "The relative advantages of the contract system, etc., * * * very different to-day from what they were two years ago. * * * 80 per cent of the entire plant needed for the construction of the canal purchased and contracted for. Machine shops have been erected and equipped for making all needed repairs to the machinery now on hand. * * * The U. S. better equipped to carry on the work as advantageously and economically as any contractor. * * * Thousands of employees have been secured, and an effective working organization has been perfected, and the recruiting system put in operation is capable of furnishing more labor than can be advantageously used. The employees are well sheltered and, in general, well fed; the salaries paid are satisfactory and the work is progressing smoothly. A change from these favorable conditions in the method of prosecuting the work would disorganize all existing conditions and would undoubtedly increase the estimated cost and time of completing the canal. The conclusion that the work can be done better, cheaper, and more quickly by the U. S. has been reached only after free and full discussion by the various members of the commission and the higher officials connected with the construction work, and after careful consideration of all sides of the proposition." **P-07, 16-24.**

Control, Lock.

Control and indicating equipment, **P-13, 96.**
Control board, Miraflores, **P-14, pl. 15.**
Control house, Gatun, **P-13, 122.**
Control house, Pedro Miguel, **P-14, pl. 13.**
Switchboards, **P-14, 122.**

Convictions. (See Courts.)

Convicts. (See Orders, Executive.)

Roadmaking, **P-12, 514, pl. 67, 68.**

Coping.

Drainage, locks, **P-11, 81.**

Cores.

Drill cores, filing and preserving, Gatun Dam studies, **P-08, 196, pls. 73, 74, 75, 78, 79, 80, 81.**

Corporations.

U. S. as a part owner, disadvantages, **P-04, 14.**
Executive order relating to conduct of corporations in zone, **P-13, 619.**

Corrals. (See Quartermaster.)

Ancon, **P-10, 322, pl. 67; P-11, 370, pl. 73.**
Cristobal, **P-09, 220, pl. 94.**
View, **P-07, pl. 7.**

Correspondence Tables. (See Clubhouses.)

Corrosion.

Slides due to weathering and, **P-12, 211.**

Corruption.

Executive order, **P-14, 581.**

Cost Keeping. (See 250, p. 2367 of this Index.)

System: Begun July 1, 1907. Monthly statements prepared showing the cost of each principal piece of work. Cost based on engineers' monthly reports, and general expense reports, the first covering engineering proper, and the second covering general expenditures, such as Isthmian Canal Commission direct expense, Disbursing Officer, Examiner of Accounts, etc. Civil administration charges are omitted, "because they are not useful in a comparative statement of the work proper, although necessary to the construction of the canal as a whole, and because they were not incorporated in the estimates of the minority members of the consulting board, whose plans are being executed."

Plant cost: Not included at 1908, because all plant necessary for the completion of the work not on hand.

Building construction: Cost included, except those items chargeable as aforesaid to civil administration.

Balance of cost with funds: "The monthly cost of each piece of work * * * balances with the amount charged to the same work on the books of the disbursing officer." **P-08, 21, 22.**

1909. Purpose to enable a comparison of cost of work between any two periods. Improvement already evident. New system of accounts effective July 1, 1909, expected to give better results. **P-09, 19, 20.**

1910. Effective July 1, 1909, the subaccounts of the Department of Construction and Engineering were contained in (A) construction work, and (B) plant and plant arbitraries established as basis for construction work. By taking up monthly proper proportion of charges for plant and equipment expenditures, plant charges will have been completely absorbed by work on its completion.

Division cost of an item of construction work made up of cost of all labor and material directly applied to work, plant, arbitrary and proper portion of general administration expenses, including expenses of O. C. E. and other general engineering expenses. To division cost must be added proportion of general expenses of the Isthmian Canal Commission, including expenses of Quartermaster's and Subsistence departments, Examiner of Accounts and Disbursing Office, proper share of expenses in U. S., and all other miscellaneous charges, in order to arrive at total cost. **P-10, 34.**

1911. Methods revised from time to time, and that adopted Jan. 1, 1910, continued without change. Cost-keeping accountant, Mr. Ad. Faure, reports directly to Chief Engineer, and his duties consist in supervising and verifying statements of costs furnished by division engineers, establishing accounts for new work, and preparing statistical reports.

In examination of construction expenditures, Central division seems to bear more than its proper proportion of general expenses, due to fact that prior to 1907 but little work done except in this division, so that nearly all overhead charges properly chargeable to it.

Unit costs during year lower. Central division produced lowest cost for excavation, and, as between the terminal divisions, that done in Pedro Miguel Locks lower by 11 cents than in Gatun Locks, but higher by 19 cents than that done in Gatun Spillway. Excavation for Miraflores Locks highest. In preparation of foundations Atlantic division did work for less than Pacific division. High cost at Pedro Miguel partly due to layout of work and partly to changes in designs increasing amount to be done at a time when excavation could not be economically handled.

In dredging, Atlantic division secured lower costs with seagoing suction and dipper dredges, and Pacific division with ladder dredges. In latter division underestimate of quantities resulted in total plant charge being absorbed with accounts for Apr. Masonry laid during year, 1,741,908 c. y. in locks and spillways. In Pedro Miguel Locks the average division cost was \$4.7040 per c. y., and in Miraflores Locks \$4.6826; in Gatun Spillway, \$6.7044; and in Gatun Locks, \$6.5919. Difference between costs in Atlantic and Pacific divisions mainly in cost of cement, sand, and stone. Bulk of cement used in Atlantic division received in barrels at cost of \$1.19 at tidewater in U. S., while Pacific division

received its cement in bags at cost of \$1.60 per barrel, less credits for bags. As 90 per cent of bags were returned, cement in bags cost \$1.01 per barrel at tidewater in U. S. Construction plant in Pacific division also handled large percentage of cement directly from cars to mixer, while nearly all cement of Atlantic division handled through storehouse. Year's operations show difference in favor of Pedro Miguel Locks of \$1.7340 in cost of cement, stone, and sand, and large rock; costs at this locality also lower for forms, placing, pumping, power, repairs, plant arbitrary, and in division expenses, while difference exists in favor of Gatun Locks in mixing and reinforcement. Construction plant at Pedro Miguel in operation from July 15 to Feb. 1, and comparison of costs for 6 months' period, Aug. to Jan., with costs at Gatun Locks for year shows less cost for all items than in Atlantic division except for reinforcement. Noted that mixing by construction plant at Pedro Miguel was \$0.1334 and at Gatun \$0.1749 per c. y. of concrete. Work at Miraflores done with auxiliary plant to advance work at this locality, and not comparable with construction plant. Auxiliary plant at Gatun mixed concrete cheaper than auxiliary plant at Pedro Miguel, due to local conditions, which require constant train service for supplying material at latter place. By use of large rock in Atlantic division, of which 73,609 c. y. were placed, a net saving per c. y. of material laid during year of \$0.2888 secured.

In production of stone, cost in storage bins at Gatun \$2.3403, in storage piles for locks on Pacific side \$0.8443 per c. y. Crushed stone from Porto Bello is transported to Gatun in barges and unloaded by cableways and derricks, while crushed rock from Ancon is transported from quarry by rail to storage and dumped from trestles. There is, therefore, an extra expense attached to Porto Bello, represented by difference between cost of towing and unloading and that of transporting by rail, of \$0.7184 per c. y. If this be deducted from actual cost in storage, it leaves a cost of \$1.6219 per c. y. for Porto Bello stone as against \$0.8443 for Ancon stone for similar items in cost of stone produced at the two places. This is in a measure explained by harder quality of rock, by method of quarrying, and layout of plant at Porto Bello. Noted that cost of production on 8-hour day basis as compared with 12-hour day basis is less for former, both at Porto Bello and at Ancon.

Sand produced at Nombre de Dios at cost of \$0.8795 per c. y. before transportation, or \$1.8565 in storage at Gatun. Pacific division secured sand at Chame at cost of \$0.1788 per c. y.; cost in storage, \$0.8284 per c. y. In both divisions sand was transported by water to point of unloading; 40 miles on Atlantic side and 20 miles on Pacific side. Atlantic division used cableways and cranes

to unload, while Pacific division used electric cranes. Omitting cost of transportation from sand bank to docks, cost to Atlantic division was \$1.3142 and to Pacific division \$0.6015. Less cost secured in Atlantic division when 18" pipe-line dredge was placed in operation at Nombre de Dios.

In connection with division costs, noted that amounts paid for salaries of clerks and supervisory forces, amounted to 26.05 per cent for Atlantic division, 17.8 per cent for Central division, and 22.95 per cent for Pacific division.

Effective July 1, 1910, reports of performance of various parts of plant kept and reported, to secure some data relative to operation of plants. P-11, 38-41.

1912. In addition to those reported a year ago, cost accounts prepared and kept for aids to navigation, terminal facilities at Balboa, fortifications, and installation of lock-operating machinery. Supervision of cost data for construction of the docks at Cristobal and New Washington Hotel at Colon added to duties of office; cost of pieces of work in charge of Panama R. R. not included in this report.

In distribution of general expenses Central division continues to carry larger proportion. Excavation in prism by steam shovels cheapest in Central division, averaging \$0.5101; in Atlantic division lower cost is shown than during previous year—\$0.5952 against \$0.6010—while in Pacific division it is higher—\$0.7527 against \$0.6960—and also greater than in Atlantic division. In preparation of foundations, costs higher in Atlantic division than year ago and lower in Pacific division, while those of Atlantic division higher than in Pacific division.

In dredging, costs higher than for previous year, and for work in channels Pacific division shows lower than Atlantic division; Pacific division dredging does not include any arbitrary for plant, total cost of which was absorbed prior to fiscal year, but on this side increase in depth attended with additional expense because of great tidal variations.

Total of 1,443,570 c. y. masonry laid in locks and spillways during year, as against 1,741,908 c. y. during previous year. Unit costs for masonry were: Gatun Locks, \$7.7552; Gatun Spillway, \$7.0988; Pedro Miguel Locks, \$6.4640; Miraflores Locks, \$4.7675. With decrease in quantity laid of 512,315 c. y. in Gatun Locks, cost of plain concrete last year shows increase of \$0.5398 as compared with previous year. At Pedro Miguel, with decrease in amount laid of 363,609 c. y., there was increase in cost of \$1.0143, due to forms, placing, mixing, and plant arbitrary, the construction plant having been removed to Miraflores, with exception of two berm cranes, operated until Dec. 12, 1911, and Feb. 7, 1912, respectively. With in-

crease of 456,163 c. y., cost of plain concrete at Miraflores shows decrease of \$0.0952. Labor costs for year per c. y. of plain concrete at various locks and spillways show lowest at Miraflores, \$0.5394; next, Gatun Locks, \$1.3840; Pedro Miguel Locks, \$1.4733; and Gatun Spillway, \$1.5425.

Difference between costs in Atlantic and Pacific divisions mainly in cost of cement, sand, and stone. While cement for Atlantic division now handled in bags, it must pass through cement shed, while bulk of cement in Pacific division passes directly from cars to work. In production of stone cost in storage bins at Gatun \$2.4952, while in storage pile for locks on Pacific side it was \$0.7996 per c. y., a difference of \$1.6956. If there be deducted from this difference extra expense attached to Porto Bello stone represented by difference between costs of towing and unloading and that of transportation by rail, \$0.7365 per c. y., and difference in plant arbitraries, \$0.4336, net difference in labor cost in favor of Ancon quarry is \$0.5255 per c. y. Sand from Nombre de Dios in stock piles in Atlantic division averaged \$2.2414 as against sand in stock piles of Pacific division at \$0.7025, or excess of \$1.5389 per c. y. in cost of Nombre de Dios sand over that from Chame. Chame sand delivered in stock pile at Gatun cost \$1.7079, including \$0.7890 for unabsorbed plant charge at Nombre de Dios. Sand secured from Chagres River, May 15 to June 30, cost \$1.2850 delivered in stock pile, including \$0.7671 for plant.

Cost of concrete piling at Gatun \$0.0679 less during year than in 1911, while cost in place \$0.7088 less. Total amount driven, 83,670 lineal feet, at cost of \$1.5719 per lineal foot; in addition, 51,450 lineal feet wooden piles driven, at cost of \$0.6516 per lineal foot. On this basis had wooden piling only been used for south approach pier saving of \$77,001.50 would have resulted. In Pacific division 6,530 lineal feet of wooden piling driven for foundations of northeast wing wall, at cost of \$2.3200 per lineal foot.

In connection with division costs, to be noted that amounts paid for salaries of clerks and supervisory forces in the three construction divisions less in Central and Pacific divisions during 1912 than during fiscal year 1911, while in Atlantic division percentage higher. Percentages as follows: Atlantic division, 26.09; Central division, 17.39; Pacific division, 18.94. P-12, 48-50.

1913. In addition to those reported a year ago, cost accounts initiated for erection of permanent buildings, construction of electric transmission line across Isthmus, and preparation of permanent town sites. Cost accounts of first division, which include erection of lock gates, emergency dams, lock-operating machinery, and aids to navigation, revised so as to furnish better information.

Supervision of cost data for construction of concrete dock at Gatun and of bridge across French canal at Mount Hope to connect with site of Cristobal coaling plant added to duties of the office. These projects, as well as construction of dock at Cristobal and of New Washington Hotel at Colon, in charge of Panama R. R. Co., and their costs not included in this report. Oct. 1 preparation of detailed costs for aids to navigation transferred to this office; on Jan. 1 that for reorganized divisions of former Pacific division and for first division of O. C. E.; and on Apr. 1 that for Atlantic division. Although details of costs have greatly increased in past year, expense of securing data decreased from about \$3,600 per month to \$3,000 per month.

In distribution of general expenses, Central division continues to carry larger proportion. Excavation by steam shovels in Central division shows increased cost over last year of \$0.0410, principal item of increase being in cost of repairs to equipment—\$0.0297.

In Atlantic division costs for dredging in prism lower this year than last, due to larger ratio of material excavated by pipe-line suction dredges. In Pacific division cost higher than last year, due to larger ratio of rock excavation and increased depth, which is attended with additional expense because of great tidal variations.

Hydraulic excavation in channel below Miraflores Locks concluded Nov., 1912, and plant reerected at point north of Gold Hill to sluice top banks to relieve pressure. Operations began June 16, and to close of year 57,274 c. y. material had been removed, at division cost of \$0.1235 per c. y., including arbitrary of \$0.1000 per c. y. for plant. Work being performed by fifth division, O. C. E.

Total of 771,907 c. y. of masonry-laid in locks and spillways, as against 1,443,570 c. y. during previous year. This is inclusive of masonry laid by first division in connection with installation of operating machinery. Costs per c. y. for masonry were: Gatun Locks, \$7.2794; Gatun Spillway, \$8.1227; Gatun power house, \$8.5739; Pedro Miguel Dam, \$5.0240; Pedro Miguel Locks, \$7.5976; Miraflores West Dam, \$4.3330; Miraflores Spillway, \$5.8497; Miraflores Locks, \$5.6445. Plain concrete shows increased cost over last year in all projects, except Gatun Locks, due to reduced quantities of concrete laid and to use of larger ratio of auxiliary mixers. At Gatun Locks plain concrete shows decrease of \$0.5934, principally in cost of sand and stone, in expense for steel forms, and in arbitrary for plant, decrease in cost of sand and stone being due to readjustment of stock prices (revised cross-section measurement of the stock piles having shown more stone in storage than was carried on books), and securing sand from borrow pit at Gatun instead of from Nombre de Dios. At Miraflores Locks plain concrete shows increase of

\$0.4406 per c. y., principally in cement, mixing, wood forms, and placing. Fluctuations in cost of reinforced concrete due to different classes of reinforced concrete laid during the two years.

Dam at Gatun increased by 1,714,367 c. y. of dry fill at division cost of \$0.3755 per c. y., and 169,114 c. y. of hydraulic fill at division cost of \$0.2654 per c. y. At close of year there were in place at Gatun Dam 11,578,268 c. y. of dry fill at cost of \$0.4063 per c. y., and 10,124,082 c. y. of hydraulic fill at cost of \$0.2933 per c. y.

During 1913 no filling for Colon Breakwater secured from Toro Point; 183,762 c. y. large rock secured from Porto Bello quarry placed in breakwater at average division cost of \$4.8250 per c. y. Last year 65,133 c. y. rock placed in breakwater at division cost of \$4.3064 per c. y.

Ancon quarry alone operated during fiscal year and produced 688,301 c. y. crushed stone at average cost of \$0.7795 delivered in storage. To close of year quarry had produced 2,558,578 c. y. crushed rock at average cost of \$0.8572 per c. y. delivered in storage. Porto Bello quarry began operations Mar., 1909, and closed down Apr., 1912; produced 1,921,929 c. y. crushed rock at average cost of \$2.4337 per c. y. delivered in storage. There was secured from Chame sand pit 445,658 c. y. of sand at average cost of \$0.7111 per c. y. delivered in storage. To end of year there was secured from this source 1,741,196 c. y. of sand at average cost of \$0.7666 per c. y. From pit at Nombre de Dios on Atlantic side, opened Mar., 1909, and closed Nov., 1911, there was secured 785,893 c. y. of sand at average division cost of \$1.9176 per c. y. delivered in storage. During year there were secured from borrow pit near Gatun Dam 43,851 c. y. of sand at average cost of \$0.5188 per c. y.

To close of year following amounts had been expended: On spillway gates and caissons, at Gatun, \$73,732.22; at Miraflores, \$40,625.69. On spillway gate machines and their erection, at Gatun, \$91,122.95; at Miraflores, \$64,299.22. On lock gates and their erection, at Gatun, \$2,225,084.30; at Pedro Miguel, \$1,373,537.13; at Miraflores, \$1,233,845.37. On fender chains, at Gatun, \$3,836.95; at Pedro Miguel, \$21.37. On emergency dams, at Gatun, \$316,184.77; at Pedro Miguel, \$512,480.47; at Miraflores, \$38,803.75. On lock-operating machinery, including towing-track system, concrete used in the installation of machines, etc., at Gatun, \$2,592,232.64; at Pedro Miguel, \$1,361,873.92; at Miraflores, \$1,561,817.40. For towing-track system following number of linear feet of return track laid by construction divisions at various locks: Gatun, 10,527, average division cost \$1.3261; Pedro Miguel, 4,333, average division cost \$1.1065; Miraflores, 5,925, average division cost \$2.5637; and by first division at Gatun, 1,449, average division cost \$1.9273; at Pedro Miguel, 2,043, average division cost \$2.3678; at Miraflores, 1,082, average division

cost \$0.6085 per linear foot. Linear feet of track, with rack installed by first division, and average cost per linear foot were: At Gatun, 21,000, average division cost \$2.3128; at Pedro Miguel, 12,199, average division cost \$2.0180; at Miraflores, 14,137, average division cost \$1.2291.

In connection with erection of operating machinery, installation of towing tracks, and decking, first division had laid to June 30, 1913, 36,710 c. y. of concrete, as follows: At Gatun Locks, 16,706 c. y., average division cost \$13.4124 per c. y.; at Pedro Miguel Locks, 10,190 c. y., average division cost \$12.1460 per c. y.; at Miraflores Locks, 9,814 c. y., average division cost \$11.3013 per c. y.

Total expenditures for aids to navigation to close of year, \$377,041.63.

For Cristobal terminals \$14,488.14 expended, and for terminal facilities at Balboa, \$1,943,971.09. There had been excavated in preparation of site 412,707 c. y. at average cost of \$0.5620 per c. y. In filling, 505,419 c. y. used at average cost of \$0.3992 per c. y. Dredged in preparation of inner harbor at latter point 1,771,814 c. y. at average cost of \$0.1547 per c. y. For main dry dock excavated 145,478 c. y., and for coaling station 58,221 c. y., at average cost of \$0.8461 per c. y. In preparing foundations for shops 29,684 c. y. had been removed at average cost of \$1.5607 per c. y.; 7,787 c. y. concrete placed at average cost of \$9.2091 per c. y., 135,442 linear feet of wood piles and 3,060 linear feet of concrete piles driven, at average cost of \$0.4820 and \$3.2358 per linear foot, respectively. In constructing docks 12,435 linear feet of concrete caissons placed at average cost, including excavation, of \$18.4708 per linear foot.

Expended in preparation of permanent town sites \$52,458.77 and in construction of permanent buildings \$55,918.76. In preparation of foundations for administration building 38,073 c. y. excavated, at average cost of \$0.5654 per c. y., and 770 c. y. of concrete laid in foundation sat average cost of \$12.8646 per c. y.

Amount paid for salaries of clerks and supervisory forces during year 19.75 per cent of total amount disbursed for salaries. Last year it was 20.55 per cent, indicating saving in clerical and supervisory forces of \$185,000. **P-13**, 49-53.

Cost keeping formerly done by various divisions of work gradually consolidated under chief accountant, so that at close of year he had charge of all work of this character, with exception of that of Central and Mechanical divisions. **P-13**, 2.

1914. Oct. 1, 1913, time keeping and cost keeping for the Central division and cost keeping for Quartermaster's department transferred to O. C. E. and consolidated with forces already organized under this office to take care of time keeping and cost keeping of other branches of the work. **P-14**, 2.

In addition to those reported last year, cost accounts initiated for Cristobal coaling plant, gravel-reclaiming plant at Balboa, and construction of permanent concrete buildings. In addition to duties enumerated in last annual report, cost accounting for work under jurisdiction of former Central division and that for Quartermaster's department transferred to this office Oct. 1, 1913, and on June 1, 1914, that of Electrical division. Cost-keeping accountant has been engaged preparing permanent accounting systems for operation and maintenance of canal since Apr. 1, and to close of year most of this work completed with exception of minor detailed accounts, which will be initiated as the necessity develops. At close of last year pay roll of office about \$3,000 per month, and there were transferred with accounts of former Central division and of Quartermaster's department employees whose salaries aggregated \$975 per month; pay roll at close of year about \$3,600 per month. This, notwithstanding increase in accounting work for terminals, town site, permanent buildings, and Electrical division, which exceeded by far decrease on account of completion of some of canal units.

General expenses prorated to construction work this year amount to 11.12 per cent of division cost and for period to date to 8.73 per cent. Comparative costs not given this year for all units of construction, as conditions due to completion of work make such comparisons valueless. At Ancon rock quarry there was decrease of 185,503 c. y. in quantity of crushed stone produced and increase of \$0.1179 per c. y., principally in operation of and repairs to crushers.

Sand dredged from Chame Point decreased 246,339 c. y. and cost increased \$0.1154 per c. y., principally in expense of dredging and towing to Balboa.

Cost of large rock in place in Colon breakwater increased \$0.4480 per c. y. as compared with last year, due to increase in charge for plant arbitrary, made necessary by decreased quantity of rock placed in breakwater as compared with estimate.

There was increase of \$0.3154 per c. y. in cost of rock placed in Naos Island breakwater, due to charging this account with expense of quarrying and transporting rock from Sosa Hill and of transporting rock secured from excavation in area of dry dock at Balboa.

To end of year total of \$440,483.46 expended—for terminal facilities at Cristobal, \$390,789.31 for coaling plant and \$49,694.15 for fuel-oil storage plant. For terminal facilities, Balboa, total of \$6,665,446.24 expended—\$1,108,773.31 for surveys and in preparation of site, \$592,971.66 in dredging inner harbor, \$504,320.59 in construction of main dry dock, \$78,312.02 in construction of small dry dock, known as Dry Dock No. 2, \$237,269.17 in construction of coaling plant, \$386,004.07 in excavating entrance basin, \$126.85 in construction of sea wall, \$2,444,462.23 in construction of perma-

ment shops, storehouses, and roundhouse; \$1,212,917.01 in construction of docks, and \$50,289.33 in construction of fuel-oil plant and in dredging berth for oil ships.

In preparation of permanent town sites-\$132,-539.23 expended for La Boca, \$409,116.35 for Balboa, and \$112,349.25 for Pedro Miguel; total of \$654,004.83.

In construction of permanent concrete buildings, \$716,936.09 expended for administration building at Balboa, \$425,210.17 for 28 four-family apartment houses, and \$20,737.76 for 9 two-family apartment houses.

Administrative and general expenses increased \$292,404.07. Of this amount about \$120,000 is apparent only and is due to consolidating time and cost-keeping forces in executive office, expense having previously been borne by construction divisions. Remainder is due principally to heavy charges for repatriation of employees leaving service or discharged for reduction of force, and to expense of moving storehouses at Gorgona and Empire. P-14, 50-52.

Cost of Canal. (See No. 248, p. 2367 of this Index.)

Revised estimate of the cost of the proposed canal submitted at a hearing before the Committee on Appropriations of the House of Representatives in Feb., 1909. 50 per cent more work necessary in order to complete the canal than was contemplated by the original estimate. Unit prices, due to labor conditions, cost of materials, and gratuities given employees, have been increased 20 per cent. New estimate shows total cost of engineering and construction as summing up \$297,766,000, to which, if the purchase price and the estimated cost of sanitation and civil government be added, there results the sum of \$375,201,000 as the total cost of the canal. Isthmian Canal Commission No. 1 estimated \$144,233,358, 1899-1901, including sanitation and police. Minority report of the Board of Consulting Engineers, 1906, fixed the cost for engineering and construction, exclusive of the purchase price, the cost of sanitation and civil government and the interest, at \$139,-705,200. P-09, 31.

Costs. (See Nos. 243, 248, 250, 272, p. 2367, 2368 of this Index.)

Tables are in each annual report showing costs of excavation, foundations, spillway, locks, prism, dredging, masonry, fill, levee, breakwater, concrete work, piling, stone, sand, lighting, buoying, quarries, cableways, derricks, mixers, plant, cranes, unloading, etc.

Auditing to be by Auditor for War Department, P-11, 558.

Administration and general expenses, P-14, 455.

Costs, statement of, 1904-1910, P-10, 244.

Constructions, P-14, 443.

Dredging, P-14, 448.

Divisions of the work, various, P-14, 450-455.

Excavation, hydraulic, P-14, 449.

Dry filling, P-14, 447.

Hostling, P-14, 260.

Headings for monthly reports, P-10, 237.

Masonry, P-14, 446.

Progress and costs, comparisons of U. S. and

Culebra work, P-08, 42.

To be reported annually to the President, P-11, 559.

Report form, P-10, 237.

Statements of, for various parts of the canal work, P-09, 170.

Stone production, P-14, 449.

Sand production, P-14, 450.

Total division costs, P-13, 275, 282.

Units of work, P-11, 290; P-12, 294; P-13, 275, 276, 282; P-14, 444.

Year ending June 30, 1905, P-05, 131.

Cottages.

Labor, P-05, 46.

Councils, Executive. (See Clubhouses.)

Counsel. (See Order, Executive; see No. 252, p. 2368 of this Index.)

Counters, Refreshments. (See Clubhouses.)

Countries, Foreign. (See Consuls.)

Extradition, other than Panama, P-07, 152.

Coupons.

Meal tickets and. (See Subsistence.)

Courts. P-07, 160; P-08, 264; P-09, 268; P-10, 373; P-11, 431; P-12, 472; P-13, 475; P-14, 57, 417. (See No. 117 on p. 2363 of this Index.)

(See Civil administration)

Courthouse, Empire, P-08, 280, pl. 191.

Jurisdiction over nonresidents, P-11, 433.

Panama R. R. cases, P-13, 520, 523.

Procedures, P-05, 96.

Supreme court cases, P-13, 517.

View of first U. S. court held on zone, Ancon, P-05, 68.

Courts (1905).

Judicial authority in zone vested in 5 municipal courts, 3 circuit courts, and a supreme court. Difficulty of obtaining judges speaking English and Spanish. 2,373 cases tried in year ending Oct. 31, 1905, and 358 civil cases tried. Contemplated in organizing the circuit courts they could be utilized as land courts. Property titles on Isthmus uncertain. Court system may make titles more certain. P-05, 67.

Court procedure: Provisional rules and regulations; supreme court; circuit court; municipal courts; appeals; new trial; civil actions; commencement of action; summons; answer, demurrer; further pleading; upon agreement of facts; taking of testimony; witnesses; depositions; appeals; special proceedings; briefs and arguments; judgment; execution; attorneys at law; dockets of supreme and circuit courts; estates of deceased persons; history of a civil cause; criminal cause; fee bill; meeting of circuit courts. P-05, 96.

Covers.

Cast-iron covers, P-12, 92.

Electric lines, P-11, 82.

Recasses, locks, P-12, 82; P-13, 110, pl. 4.

Craftsmen.

Reductions in force, **P-11**, 226.

Cranes. (See Costs.)

Arrangement of, Pedro Miguel Lock, **P-10**,

pl. 109.

Coal, rehandling, Balboa, **P-13**, 99; **P-14**, pl. 27.

Foundry yard, Balboa new shops, **P-13**, 254, pl. 57.

Pedro Miguel Locks, **P-10**, 196, pl. 43.

Miraflores Locks, **P-10**, pl. 111.

Unloading sand, Balboa, **P-10**, 196, pl. 52, 116.

Cranes, Berm.

Miraflores, **P-10**, 164.

Pedro Miguel, **P-10**, 162.

Performances, Miraflores, **P-11**, 165; **P-12**, 177; **P-13**, 168.

Performances, Pedro Miguel, **P-11**, 160.

Removal of, Miraflores, **P-14**, 207.

Cranes, Chamber.

Miraflores, **P-10**, 165.

Pedro Miguel, **P-10**, 164.

Performances, Miraflores, **P-12**, 178; **P-13**, 169.

Performances, Miraflores and Pedro Miguel, **P-13**, pl. 101.

Performances, Pedro Miguel, **P-11**, 160; **P-12**, 174.

Cranes, Floating, P-13, 212; P-14, 45, 190.

"Ajax" and "Hercules," **P-14**, pl. 119, 120.

Equipment, **P-14**, 180.

General description, **P-13**, 213.

Terminals, **P-13**, 209.

Cranes, Mixing.

Pedro Miguel Lock, **P-10**, 196, pl. 44.

Cranes, Wrecking, P-07, pl. 27.**Crank Gear. (See Gear, crank.)****Crest Gates. (See Gates, crest.)****Crimes. (See Courts.)**

Statistics, **P-05**, 95, Table 30; **P-07**, 172; **P-08**, 270. (See Civil administration.)

Cristobal. (See Nos. 35, 156, pp. 2362, 2364 of this Index.)**Crossings. (See Panama R. R.)****Crossovers.**

Turnouts and, locks, **P-14**, 109.

Cable crossovers, pumps and motors, **P-14**, 125.

Cross Sections.

Borings, Gatun Dam, **P-08**, 196, pl. 158-164. Chagres River gauging stations, **P-12**, 104; **P-13**, pl. 120.

Gatun Dam studies, **P-08**, 196, pl. 133.

Experimental dam, Gatun, **P-08**, 196, pl. 139.

Embankments, Panama R. R., **P-11**, pl. 118.

Lock canal, **P-06***, 7.

Sea-level canal, **P-06***, 7.

Typical cross sections adopted for Culebra Cut by Board of Consulting Engineers, **P-06***, 134.

Cross Sections, Geological, **P-13**, 582, pl. 68, 69, 123.

Cruelties. (See Orders, Executive.)**Crushed Stone. (See Stone, crushed.)****Crushers.**

Ancon quarry, **P-10**, 195; **P-11**, 189; **P-12**, 202; **P-13**, 184.

Bas Obispo, **P-07**, 74.

Pedro Miguel, **P-07**, 67.

Performances, **P-11**, 299; **P-12**, 307; **P-13**, 286.

Plant layout, Ancon, **P-09**, 134, pl. 58.

Porto Bello, **P-09**, 66, pl. 23.

Rio Grande, **P-09**, 69.

Culebra Cut. (See Excavation; Slides; see No. 223, p. 2366 of this Index.)

1,000,000 c. y. removed. 2,600 men. **P-05**, 12.

No systematic work can be done here until sea-level or lock plan has been chosen. Each plan requires different method of attacking the cut. **P-05**, 15.

Status, Aug., 1905. Estimated by Mr. Wallace that cost of excavation would be 50 cents c. y. This estimate probably instrumental somewhat in requiring a consideration of the advantages or practicability of a sea-level canal by Isthmian Canal Commission No. 2. Estimate not conclusive, as later excavating would undoubtedly be comparatively expensive. **P-05**, 144.

Excavation: Graphical illustration of practicable yearly excavation which would complete the Culebra Cut in less than 10 years, **P-06***, 7.

Memorandum by Mr. John F. Wallace, to accompany diagrams illustrating tentative method of Culebra excavation, **P-06***, 372-674.

Diagram 1 is an average maximum cross section, and shows in numbers and colors the different phases of steam shovel progress. Diagram 2 shows the A and B sections at kilometer 54.74 on the line of the maximum cross section above elevation 185 with the different phases in colors and numbers. Diagram 3 is a progress diagram showing the relative positions, horizontally, of the different steam shovels which may be installed at elevation 185 and below. It also shows the time of entering and the completion of each phase of the work. Diagrams 4 to 7, inclusive, are diagrams showing a suggested arrangement of tracks and shovels covering the first 5 phases of the work below elevation 185. **P-06***, 372, 373.

Culebra Cut, Views of. (Arranged in order of time.)

View from reservoir, Plate 1, **P-07**, 8; **P-08**, 56, pls., 2, 3, 4, 5, 6.

Between Empire and White House yard, June, 1909, **P-09**, 90, pl. 29.

Looking toward Gold Hill, **P-09**, 90, pl. 30.

Near Paraiso, June, 1909, **P-09**, 90, pl. 31.

Las Cascadas, June, 1909, **P-09**, 90, pl. 32.

Bas Obispo, June, 1909, **P-09**, 90, pl. 33.

Opposite Cucaracha slide, June, 1909, **P-09**, 90, pl. 34.

View of cut, vicinity of Contractors Hill, **P-10**, 160, pl. 22.

View of cut, opposite town of Culebra, after heavy rain, **P-10**, 160, pl. 23.

Empire to Las Cascadas, view of cut, **P-10**, 160, pl. 25.

Bas Obispo, view of cut, **P-10**, 160, pl. 26.

West wall, break, **P-10**, 160, pl. 35, 36, 37.

East bank, breaks, **P-10**, 160, pl. 39.

Cunette angle, north of Empire, **P-11**, 156, pl. 27.

Opposite Paraiso and just north of Panama R. R. bridge 57½, **P-11**, 156, pl. 28.

Opposite Las Cascadas, **P-11**, 156, pl. 29.

At Empire suspension bridge, **P-11**, 156, pl. 30.

Looking north between Contractors Hill and Gold Hill, **P-11**, 156, pl. 31.

South end, looking south from bridge 57½, and showing the partly completed anchorage basin north of Pedro Miguel Lock. Train shown on completed bottom of canal, elevation plus 40. **P-12**, 170, pl. 28.

Looking north from bridge 57½, near Paraiso. Train shown on completed bottom of canal, plus 40. **P-12**, 170, pl. 29.

Looking north from a point south of Contractors Hill, showing quiescent state of Cucaracha slide on right bank. Bottom of lowest steam-shovel cut about 16' above the final bottom of the canal, or elevation plus 56. **P-12**, 170, pl. 30.

Looking south from Empire suspension bridge. Well drills shown in middle of canal about 27' above the bottom, or at elevation plus 67. **P-12**, 170, pl. 32.

Looking north from Empire suspension bridge. Nearest shovel shown, in the lowest cut, is working about 12' above the bottom, or at elevation plus 52. **P-12**, 170, pl. 33.

Looking south from Cunette. Two shovels shown are working at bottom of canal, elevation plus 40. **P-12**, 170, pl. 34.

Looking north from Cunette. Two shovels shown are working at bottom, elevation plus 40. Water in center drainage channel is about 6' below bottom, elevation plus 34. **P-12**, 170, pl. 35.

Looking north from Las Cascadas. Trains standing in the bottom of the cut, elevation plus 40. **P-12**, 170, pl. 36.

Looking south from bend in east bank near Gamboa. Train and shovel shown are on bottom of the cut. Water in drainage channel is about 10' below bottom of the canal, or at elevation plus 30. **P-12**, 170, pl. 37.

Break in east bank of canal. Amount of material involved, 320,000 c. y. Train shown about 35' above bottom of the canal, or at elevation plus 75. **P-12**, 170, pl. 41.

Bas Obispo. Looking south from east bank, June, 1913. **P-13**, 160, pl. 34.

Completion of bottom pioneer cut, steam shovels Nos. 230 and 222 meeting at grade,

looking north from west bank. May 20, 1913. **P-13**, 160, pl. 35.

Looking north from one-quarter mile south of suspension bridge at Empire. Cut completed at bridge. All tracks on completed bottom of canal. June 16, 1913. **P-13**, 160, pl. 36.

Empire. Looking north from suspension bridge, showing cut completed, except toe of slide on right. Drainage ditch is below bottom of canal. June 16, 1913. **P-13**, 160, pl. 37.

Empire. Looking south from suspension bridge, showing terracing on upper levels of east bank to prevent slides. Lower shovels are working on bottom of canal. June 16, 1913. **P-13**, 160, pl. 38.

Culebra. Deepest excavated portion of Panama Canal, showing Gold Hill on the right and Contractors Hill on the left. June, 1913. **P-13**, 160, pl. 39.

Las Cascadas. Looking north from east bank. June, 1913. **P-13**, 160, pl. 40.

Empire. Break in east bank at La Pita (station 1651), taking in Obispo diversion channel, looking north. Aug. 21, 1912. **P-13**, 160, pl. 41.

Culebra. Break in east bank between stations 1746-1758. Steam shovel No. 201 in midst of upheaved material and displaced tracks, looking south. Feb. 6, 1913. **P-13**, 160, pl. 42.

Culebra. Break in east bank between stations 1746-1758. Top view of rear portion of slide, looking north. Feb. 6, 1913. **P-13**, 160, pl. 43.

Culebra. Bottom of canal, steam shovel No. 260 overturned by slide from east slope. June 12, 1913. **P-13**, 160, pl. 44.

Culebra. Looking north from west bank, south of Contractors Hill, showing shovel No. 256 caught in Cucaracha slide. Feb. 7, 1913. **P-13**, 160, pl. 45.

Bottom of cut, **P-14**, pl. 41, 43.

Culebra Division, P-07, 44; P-08, 40. (See No. 139, p. 2364 of this Index.)
Status, P-05, 133, 134.

1904. At the time of the first visit of the Isthmian Canal Commission No. 2 the only work in progress was some excavation here. Outfit consisted of a few French excavators (steam) and dump trains, and a force of about 700 men engaged in blasting, loading cars, removing the excavated material from the track and down the slopes of the fill; neither equipment nor organization adequate; deemed advisable, however, to keep the force (already acclimated). **P-04, 39.**

1905. Division extends from Bas Obispo to Miraflores. Since American control, work of experimental character. Equipment poor. Apparently no definite system followed.

Excavation closed down. Reconstruction of equipment begun. Preparatory work in progress. Actual working year probably only 8 or 9 months, because of rainy season. Future plans dependent on whether sea-level or lock canal is to be adopted. Problem at Culebra one of transportation, including disposal, pure and simple. Surveys made of vicinity. Much miscellaneous work, for other departments, as the furnishing of maps, plats, etc. Location of proper dump grounds under way. New offices for engineering department planned to be located at Culebra and Empire instead of Panama. **P-05, 117.**

1906. No special attempt made to get out yardage, but rather to take out barriers left by the French. Equipment trackage completed, and necessary yards and dumping grounds arranged for. 1,500,000 c. y. excavated at 79.5 cents per c. y. Increase in cost over previous year due to harder material, more rainfall, and 8-hour day. At the beginning of the year 10 shovels ready for work; at the close, 39 shovels, 300 western dump cars, 560 40' flat cars, these being received late in the year. Mining department working at high efficiency. **P-06, 86.**

(See p. 2366 of this Index and Central Division.)

Culverts.

Auxiliary culvert machines, **P-13, 88; P-14, 104.**

Building, Gatun, **P-08, 216, pl. 177.**

Center wall culvert, Miraflores, **P-12, 108, pl. 10.**

Concrete culverts, Panama R. R. relocation, **P-10, 204, pl. 60, 61.**

Curundu River, **P-14, 207.**

Details, Gatun Locks, **P-09, 42, pl. 7.**

Discharge from, Pedro Miguel, **P-14, pl. 2.**

Drop curve in, Pedro Miguel Locks, **P-11, 192, pl. 47.**

Filling, diagram showing sections, **P-14, pl. 71.**

Form, side-wall culvert and laterals, Pacific division, **P-11, pl. 111.**

Panama R. R., **P-09, 140.**

Pedro Miguel Locks, **P-14, pl. 72, 73.**

Tests, cylindrical and auxiliary culvert machines, **P-13, 89.**

T form used for equalizing culvert and floor lateral connections, Pacific division locks, **P-11, pl. 113.**

Transition curve, leading from Stoney gate chamber, Gatun Locks, **P-11, 132, pl. 17.**

Culverts, Floor. (See Culverts.)

Miraflores Locks, **P-12, 204, pl. 52.**

Culverts, Lateral. (See Culverts, above.)

Excavation for, Pedro Miguel, **P-11, 192, pl. 55.**
Forms, Miraflores Locks, **P-10, 196, pl. 45, 46.**

Culverts, Side-wall. (See Culverts, above.)

Gatun Locks, **P-11, 132, pl. 16.**

Pedro Miguel, **P-14, pl. 72, 73.**

Culverts, Standard. (See Culverts, above.)

Concrete arch, Panama R. R., **P-09, 142, pl. 73.**

Rail-top box, pile foundation, Panama R. R., **P-09, 142, pl. 72.**

Vitrified pipe, Panama R. R., **P-09, 142, pl. 71.**

Currency. (See No. 95, p. 2363 of this Index.)

Paying salaries in U. S. money, **P-05, 157.**

Currency stable. Agreement with banks for supply of silver. Scarcity of silver coin. Additional 1,000,000 silver pesos coined. Total in circulation, 4,000,000. **P-05, 49.**

Agreement with isthmian bankers giving them premium for collection of disbursing officer's drafts, ended; direct shipment of U. S. funds to Panama authorized; \$19,815.39 saved thereby, **P-06, 12.**

Current, Electric. (See Power; Electricity.)

Currents. (See Gauging.)

Colon Harbor, **P-14, 156.**

Observations, below Miraflores Locks, **P-14, 159, pl. 111.**

Curves. (See Concrete; Discharge; Materials; Seepage.)

Customs, P-14, 54. (See Importations; see Nos. 27, 110, p. 2362, 2363 of this Index.)

Orders relating to, **P-05, 206, 207.**

Proclamation of President of the U. S. opened, June 24, 1904, ports of Ancon and Cristobal to commerce of the world. Two customs districts established. No tolls, etc., charged. No tariff imposed on shipments for zone only. **P-05, 63.**

Cuts. (See Slides; Breaks.)

Break, rock bank, Empire, which let Obispo diversion through, **P-10, 160, pl. 24.**

Bas Obispo, **P-10, 160, pl. 26.**

During flood, Chagres, 1909, **P-09, 90, pl. 44.**

During flood, Bas Obispo, **P-10, 160, pl. 27.**

Emperador, geology of, Bertrand and Zurcher, **P-06*, 162.**

Cylindrical Valves. (See Valves.)

D.

Dam, Gatun, or Gamboa. (See Dams below.)

Surveys, etc., for a possible dam site across the Chagres at Gatun show that such a structure is not feasible, **P-05**, 300.

Paper by C. D. Ward, member American Society of Civil Engineers. Reprinted from Transactions of A. S. C. E., Vol. LIII, 1904, p. 36. After mentioning a list of authorities and their pertinent writings on the subject, from 1875 to 1902, Ward says: "Neither of these authorities mentions or gives any consideration to the project of a dam at Gatun, nor even condemns it; nor is the writer aware that any soundings or other examinations, looking to a dam at that point, have ever been made." Drawing. Detailed advantages of a dam at Gatun. Estimate of project, with one lock at Gatun and one at La Boca, each of 45' lift, \$155,111,936. (Estimate made by Isthmian Canal Commission with summit level at 90', \$144,233,358.) "If it should appear that such examinations have not been made, it is hoped that this paper will induce those in authority to make such examinations before deciding upon the final plans for the Panama Canal." **P-06***, 279-282.

Upon considering the various factors of seepage, foundations, etc., Board of Consulting Engineers recommended at Gamboa either an earth dam with a heavy masonry core carried down to bedrock, or an all-masonry structure founded at the same depth and upon the same material, **P-06***, 45.

Damages, Land. (See No. 188, p. 2365 of this Index.)

Estimates, **P-09**, 346.

Dam Construction, Lock and.

Department of. (See No. 220, p. 2366 of this Index.)

Dam, Ogee.

Gatun spillway, **P-12**, 142, pl. 27.

Dams. (See Nos. 179, 192, 239, 255, p. 2365, 2367, 2368 of this Index; see Reservoirs; Locks; Spillways.)

Artesian conditions, Gatun, **P-08**, 182.

Bohio, **P-04**, 41; **P-05**, 12. (See No. 37, p. 2362 of this Index.)

Borings, Gatun, **P-08**, 134, 196, pl. 86.

Borings, Miraflores, **P-08**, 65.

Borings, Pacific division, **P-09**, 121.

Borings, Pedro Miguel, **P-08**, 64.

Causeway for track leading to, Gatun, **P-13**, 138, pl. 24.

Chagres Valley, examination, **P-05**, 12.

Change of position, Pacific slope, **P-08**, 63.

Classification of material under Miraflores, **P-09**, 134, pl. 53.

Classification of material under Pedro Miguel, **P-09**, 134, pl. 52.

Clay studies, Gatun, **P-08**, 196, pl. 105, 106.

Comparative cross sections, Gatun Dam studies, **P-08**, 196, pl. 133.

Comparison of drill samples, **P-08**, 196, pl. 74, 75.

Comparison of existing and proposed dams, **P-06***, 7, pl. 14.

Concrete placing, Miraflores, **P-11**, 164.

Concrete placing, Pedro Miguel, **P-11**, 159; **P-13**, 163.

Construction, **P-07**, 6; **P-08**, 57-70, 129; **P-14**, 6. (See No. 220, p. 2366 of this Index.)

Control of Chagres floods, **P-05**, 297.

Costs, Gatun, **P-11**, 122; **P-12**, 133; **P-13**, 127.

Cross section of experimental dam, showing hydraulic slopes for different heads, **P-08**, 196, pl. 139.

Cross sections, Gatun Dam studies, **P-08**, 196, pl. 133.

Cross sections showing borings, Gatun, **P-08**, 196, pl. 158-164.

Designs, **P-09**, 42.

Diagram showing effect of variation in material on hydraulic slope, Gatun, **P-08**, 196, pl. 167.

Difficult to build, Bohio, **P-05**, 300.

Diversions, Miraflores, **P-09**, 96.

Drawings made, **P-10**, 48.

Dredges, output of, per month, Gatun, **P-11**, 120.

Dredging, Miraflores, **P-09**, 96; **P-10**, 170.

Drill cores. (See Cores.)

Drilling gang at work, Gatun; Gatun Dam studies, **P-08**, 196, pls. 76, 77.

Drilling methods, Gatun; Gatun Dam studies, **P-08**, 156.

Drills, Gatun, **P-08**, 196, pl. 72.

Examination for, Bohio, **P-05**, 12.

Examination for dam across Chagres Valley, Gatun, **P-05**, 12.

Excavating material for dry fill, output of steam shovels, Gatun, **P-12**, 130.

Excavation, by months, Gatun, **P-09**, 53.

Excavation, dry, Miraflores, **P-11**, 163.

Excavation, Gatun, **P-08**, 70, pl. 32. (See Gatun, below.)

Excavation, Miraflores, **P-09**, 94.

Excavation, Pedro Miguel, **P-09**, 92; **P-13**, 162.

Exploration methods and results, Gatun Dam study, **P-08**, 153.

Exploration of material of sites, Pacific division, **P-09**, 92.

Extreme west end of dam and blanketing of the ridge, Gatun, **P-11**, 132, pl. 20.

Face of, rock dumping, Gatun, **P-11**, 132, pl. 19.

Fill, causes of bulging, **P-13**, 19.

Fill, Gatun, **P-10**, 136, pls. 13, 14.

Fill, Pedro Miguel, **P-12**, 175.

Fill, settlement, **P-13**, 17.

Fill, west dam, Pedro Miguel, **P-10**, 168.

Flood control of Chagres, Gamboa, **P-05**, 297.

Foundations, borings to investigate, at Gatun, **P-08**, 58, 196, pls. 140-147.

Foundations, tests, Pacific division, **P-09**, 92.

Gamboa, map showing location, profile showing depths to rock, **P-06***, 7, pls. 5, 6.

Gatun. (See Dam, Gatun.) **P-07**, 55; **P-08**, 60; **P-09**, 51; **P-10**, 124; **P-11**, 119; **P-12**, 129; **P-13**, 122; **P-14**, 7. (See Nos. 36, 199, 232, p. 2362, 2365, 2366 of this Index.)

- Guide wall, north, and west dam, Pedro Miguel, P-13, 186, pl. 48.
- Hydraulic fill at elevation of 73' above sea level, looking west toward spillway wall, showing east section of dam with; Gatun, P-11, 132, pl. 21.
- Hydraulic fill, Gatun, P-09, 66, pl. 24.
- Hydraulic fill, west section of dam looking west, showing progress of; Gatun, P-12, 142, pl. 25.
- Hydraulic grade lines, Wachusett Dam, P-08, 196, pls. 137, 138.
- Hydroelectric station under construction, Gatun Spillway, P-14, pls. 9, 10.
- Investigations, Gatun; report of C. M. Saville, assistant engineer. (See No. 232, p. 2366 of this Index.)
- La Boca-San Juan, P-07, 56.
- Locks and. (See Locks and dams.)
- Map, Gatun, P-09, 66, pl. 13; P-10, pl. 96; P-12, pl. 78.
- Masonry designing, P-08, 68.
- Material handled by dredges, Gatun, P-13, 126.
- Material handled, Gatun, P-13, 123.
- Material placed in, Toro Point (see Reservoirs), P-11, 130.
- Materials from vicinity available, Gatun, P-08, 130, 136.
- Materials of area, Gatun; mechanical analysis curves, P-08, 196, pls. 148-154.
- Miraflores, P-10, 169; P-11, 163; P-12, 175; P-13, 166; P-14, 9.
- Mount Hope Reservoir, P-07, 12, pl. 6.
- Pacific division, P-09, 92; P-10, 162; P-11, 158; P-12, 172; P-13, 162.
- Paving lake slope, Gatun, July 2, 1913, P-13, 138, pl. 28.
- Pedro Miguel, P-07, 55; P-08, 64; P-09, 92; P-10, 165; P-11, 158; P-12, 172; P-13, 162.
- Piling, with; mechanical analyses of material; Gatun Dam study, P-08, 160.
- Piling, without sheet; mechanical analyses of material, Gatun dam study, P-08, 159.
- Plan, general, Gatun, P-13, pl. 90.
- Porosity of material, experiments, Gatun, P-08, 169.
- Preliminary work, Gatun, P-08, 61.
- Pressure of water against, Gatun, P-08, 151.
- Profile on axis of, showing borings, Gatun, P-08, 196, pls. 155, 156, 157.
- Progress of construction, Gatun, P-12, 129; P-13, 123.
- Project, Gatun; special examination, P-09, 8, 9.
- Proposed, Gatun; map, P-06*, pl. 11.
- Proposed, Miraflores, P-09, 134, pl. 56.
- Proposed, Pedro Miguel, P-09, 134, pl. 55.
- Proposed regulating works, Gatun, P-06*, 7, pls. 11, 12, 13.
- Section, maximum, of, embodying changes suggested by board of engineers, Feb. 17, 1909, Gatun, P-09, 42, pl. 12.
- Section, maximum, of proposed dam, Gatun, P-08, 196, pl. 135.
- Section of, showing progress to July 1, 1913, Gatun, P-13, pl. 92.
- Sections, Gatun, P-07, pl. 146; P-13, pl. 91.
- Section showing fill to June 30, 1909, Gatun, P-09, 66, pl. 20.
- Section showing progress, Gatun, P-10, pl. 100; P-11, pl. 102; P-12, pl. 81.
- Seepage in, tests, Gatun, P-08, 134.
- Sites, Gatun, P-10, 136, pl. 3.
- Sites, Miraflores, P-09, 134, pl. 63.
- Slopes of material determined by experiment, Gatun, P-08, 196.
- Slopes of saturation, dam studies, Gatun, P-08, 196, pl. 136.
- Sosa-Corozal, P-07, 45, 56, pls. 29, 45.
- Special features of study, Gatun, P-08, 162.
- Spillway, and costs, P-12, 133.
- Spillway, details, finishing, P-13, 19.
- Spillway, concrete, east side of dam at Camacho Reservoir, P-11, 156, pl. 42.
- Spillway dam work, looking southeast, showing progress of, Gatun, P-11, 132, pl. 22.
- Spillway, excavation, Miraflores, P-13, 173.
- Spillway, Gatun, completed, P-14, pls. 9, 10.
- Spillway, Gatun Dam and, P-12, 129; P-13, 122.
- Spillway, Miraflores, P-13, 172.
- Spillway, Miraflores, looking toward locks, P-13, pl. 51.
- Spillway, plan of, Gatun, P-10, pls. 93, 94.
- Spillway wall, looking west toward, showing Bas Obispo rock being dumped on south face of dam, Gatun, P-11, 132, pl. 19.
- Steam shovels, daily and monthly record of, Gatun, P-12, 131.
- Studies of borings, etc., Gatun, P-08, 196, pls. 73, 74, 75, 78, 79, 80, 81.
- Study of discharge and velocity through various materials, Gatun, P-08, 196, pl. 172.
- Study of foundations, Gatun; theoretical considerations, P-08, 166.
- Surveys, P-04, 41.
- Topography, showing rock contours, Gatun, P-08, 196, pl. 165.
- View, Gatun, P-11, 132, pl. 8; P-12, 142, pl. 24; P-13, 138, pl. 27.
- Water running through temporary openings, showing all crest gates in position, June, 1913 Gatun Spillway, P-13, 138, pl. 29.
- Waves, rapping against, P-13, 18.
- West, Miraflores, P-10, 171; P-11, 165; P-12, 179; P-13, 171.
- Work on, progress, Sosa Corozal, P-07, pl. 45.
- Dams, Earth.**
- Croton drainage area, showing slopes of saturation, Gatun Dam studies, P-08, 196, pl. 136.
- Dams, Emergency, P-09, 40; P-10, 40; P-11, 83; P-12, 95; P-13, 101; P-14, 17, 85.**
- Assembly of gate-lifting machinery, Gatun and Pedro Miguel Locks, P-11, pl. 84.
- Deflection of chords, Gatun Locks, P-14, pls. 93, 94.
- Designing details, P-08, 197-200.
- Design, preliminary, locks, P-09, 42, pl. 11.
- Drawing, general, P-10, pl. 87.
- Driving pin for eyebear of top chord, Pedro Miguel, P-13, 110, pl. 10.
- East dam, Gatun, P-13, 105.
- Erection, method of, P-13, 102.

Gatun Locks, **P-10**, 58; **P-13**, 138, pl. 25.
General details of 110', **P-08**, 200, pl. 174.
General plan and profiles of locks, **P-10**, pl. 95.
Hoisting machinery for, **P-09**, 40; **P-10**, 57.
P-11, 80, pl. 83; **P-12**, 85.
Inspection in the U. S., **P-13**, 101.
Latching mechanism, **P-10**, pls. 88-91.
Leakage, Gatun Locks, **P-14**, pl. 95.
Miraflores, **P-10**, 61.
Pedro Miguel, **P-10**, 58.
Shipments, **P-13**, 102.
Sills, **P-12**, 108, pl. 3; **P-12**, 204, pl. 48.
Swinging across lock, Gatun, **P-13**, 110, pl. 1.
Tests, **P-13**, 11, 101, 102, pls. 6, 7, 8; **P-14**, 119, pl. 5.
Turning, wedging, and latching machinery, **P-10**, pls. 88, 89, 90, 91.
Typical sketch of erection tracks for; all locks, **P-13**, pl. 86.
Wicket girders being lowered, Gatun, **P-13**, 110, pl. 6.
Work on, progress of, **P-13**, 104.

Dams, Experimental.

Borings and, Gatun, **P-08**, 134.
Curves of saturation, Gatun Dam studies, **P-08**, 196, pls. 120, 130.
Experimental tanks, Gatun Dam studies, **P-08**, 196, pls. 64, 65, 66, 68, 69.
Gatun studies, **P-08**, 196.
Hydraulic slopes for different heads, Gatun Dam studies, **P-08**, 196, pl. 139.
Lines of saturation, Gatun Dam studies, **P-08**, 196, pls. 109-119, 121-129.
Rate of seepage, Gatun Dam studies, **P-08**, 196, pls. 120, 130.
Tank for, Gatun Dam studies, **P-08**, 196, pl. 107.

Dams, Locks and. (See Locks and dams.)

Dams, Model.

Experimental tank, **P-08**, 196, pls. 64, 65, 66, 67, 68, 69.

Dams, Movable. (See Dams, emergency; see No. 233, p. 2367 of this Index.)

Dams, Reservoir. (See Dams; Reservoirs; Water supply.)

Water supply, Panama, **P-05**, 38.

Dam Sites. (See Sites, dam.)

Dauchy, W. E.

Hearing. (See No. 205, p. 2365 of this Index.)

Davis, Maj. Gen. G. W. (See Nos. 25, 48, 164, p. 2362, 2365 of this Index.)
Governor, zone; return to U. S. ordered. (See No. 48, p. 2362 of this Index.)

Deaths. (See Civil administration.)

Statistics. (See Civil administration.)

Decks.

Tugs, **P-14**, pls. 127, 128.

Deeds.

Act relating to acknowledgment of land deeds, **P-11**, 433, 560.

Defense. (See Fortifications; see Nos. 10, 175, p. 2361, 2365 of this Index.)

Military value of the canal to the U. S., **P-99**, 167.

In time of peace the canal would facilitate movement of troops, supplies, etc. In time of war an Isthmian Canal would permit rapid movement from one ocean to another. Canal, however, only one link in a chain of communications. Hence, the power holding any one of the links can prevent the enemy from using the communication, but can itself use it only when it holds them all. Several existing powers which might be able to dispute complete U. S. control of the whole chain. Canal useless to an enemy unless in latter's possession. Fortification of the canal in the nature of insurance. **P-99**, 167.

Making canal neutral suggested as a means of guarding it against international attack. Canal managed by American citizens a source of strength if neutral; a source of weakness if not neutral. **P-99**, 168.

"The general question of defense of the isthmian transit will be in no way affected by the type of the canal." Dimensions of existing and probable future warships. "Military exigency requires, and it therefore results, that the dimensions of the canal and its appurtenances must be adequate for the largest vessels upon the oceans." Vulnerability of the canal. " * * * Well-nigh impossible to provide effectually and always against such peril." "Sovereign rulers, bridges, railway trains, buildings, and ships, all under very strict watch, have been destroyed by lawless individuals." Suggested methods for injuring works, etc. "The board believes that this jeopardy will exist at all times during the stress of war." " * * * Risks would be very much greater for a canal in which lift locks are an essential feature." **P-06**, 37.

Deficiency.

Act, deficiency, **P-13**, 607, 608.

Departments. (See p. 2368 of this Index.)

Deportations. (See Civil administration.)

100 cases, coming under Executive order giving zone authorities power to deport newly arrived aliens of the prohibited classes, vagrants, drunkards, etc., **P-06**, 20.

Deposits.

Mineral, zone, **P-13**, 577, 578.
Oil, zone, **P-13**, 579.
Underground, peat, zone, **P-13**, 579.

Depots.

Yard at Mount Hope, **P-09**, 220, pl. 89.

Depth of Canal.

Spooner Act, **P-11**, 550.

Derricks. (See Costs; Cranes.)

Designing. (See Construction and Engineering.)

Designs.

Gates and dams. (See No. 233, p. 2367 of this Index.)

Devices, Protective. (See Gates.)

Devol, Maj. C. A. (See No. 245, p. 2367 of this Index.)

Diagrams. (See Excavation; Maps.)

Excavation, Pedro Miguel to Panama Bay,

P-09, 134, pl. 54; **P-11**, pl. 116.

Freshets, Chagres River, **P-10**, pl. 136.

Manufacture and erection mitring lock gates, **P-13**, pl. 78.

Performance of steam shovels, **P-09**, 73; **P-10**, pl. 103; **P-11**, pl. 105; **P-12**, pl. 83; **P-13**, pl. 94.

Showing conditions of underground flowage, Gatun Dam studies, **P-08**, 196, pls. 168-170.

Showing effect of variation in material on hydraulic slope, **P-08**, 196, pl. 167.

Showing stopping power of fender chains, **P-11**, pl. 82.

Steam shovel performances, showing efficiency, **P-09**, 73.

Yardage and rainfall, central division, **P-08**, 36; **P-09**, 69; **P-10**, pl. 102; **P-11**, pl. 104; **P-12**, pl. 82; **P-13**, pl. 93.

Diamond Drilling. (See Drilling, diamond.)

Dickson, A. B., Superintendent, Clubhouses. (See Nos. 247, p. 2367 of this Index.)

Dickson, Lt. Col. T. C. (See No. 251, p. 2368 of this Index.)

Digging. (See Excavation.)**Dikes.**

Across canal, Gamboa, **P-13**, 160, pl. 33.

Basalt, cutting Cucaracha formation, Culebra Cut, **P-13**, 582, pl. 72.

Blowing up, barrier between Pacific and Miraflores, **P-13**, 186, pl. 53.

Blowing up, Gamboa, **P-14**, pl. 61.

Blowing up, Point 2, June, 1909, to turn water of Chagres, **P-09**, 90, pl. 39.

Combined dike and dump, Naos Island to East Balboa, **P-10**, 160, pl. 21.

Gamboa, **P-13**, 160, pl. 33.

Maximum sections, Wachusett's Dam, U. S. A.; Gatun Dam studies, **P-08**, 196, pl. 134.

Naos Island, **P-09**, 81; **P-10**, 153; **P-11**, 148; **P-12**, 159; **P-13**, 152.

Opening valves and flooding Culebra Cut, Gamboa, **P-14**, pl. 60.

Protection dike, break through, of Chagres River, **P-10**, 160, pl. 28.

Protection dikes, south end of Point 2, May, 1909, **P-09**, 38, pl. 38.

Dimensions. (See Nos. 3, 195, pp. 2361, 2365 of this Index.)

Dinner Time.

Isthmian Canal Commission Hotel, Gorgona, **P-07**, 80, pl. 99.

Diplomacy, P-13, 607. (See Acts; Civil Administration; Diplomatic Service.)

Relations with Panama and foreign representatives, **P-14**, 419.

Dipper Dredges. (See Dredges.)**Directors.**

List of, Panama R. R., **P-04**, 65.

Disbursements, P-04, 94-95; **P-05**, 75; **P-08**, 332; **P-09**, 238; **P-10**, 362. (See Appropriations; Funds; see Nos. 63, 123, pp. 2362, 2364 of this Index.)

Acting disbursing officer, bonds of, act, **P-11**, 572.

Officer, selected, **P-04**, 53.

Organization, chart, **P-09**, 358, pl. 109.

Payments by the disbursing department on the Isthmus, **P-13**, 458.

Report of disbursing officer. (See No. 236, p. 2367 of this Index.)

Salaries, by departments and divisions, **P-11**, 302; **P-12**, 310; **P-13**, 288.

To be after U. S. methods, **P-04**, 53.

Disbursements, Audits and.

Auditor of Isthmian Canal Commission, auditor and treasurer of zone, **P-05**, 72.

Disbursements, Department of.

Organization, chart, **P-07**, pl. 143.

Disbursing Officer. (See Disbursements; see No. 236, p. 2367 of this Index.)

Bond, **P-11**, 572.

Disbursing Officer; Operations.

1908. Duties: Had charge of time inspection, preparation of pay rolls, vouchers, issuances of commissary and hotel books, and disbursements of moneys on the Isthmus.

Organization: By Executive order Aug. 15, 1907, time inspection assigned to examiner of accounts; keeping property records and general books of the Isthmian Canal Commission transferred to the disbursing office.

Methods: Monthly payments instead of semi-monthly; preparation and checking of pay rolls in division offices instead of in disbursing office; elimination of duplicate property records in the division of material and supplies.

Disbursements: Pay rolls, \$18,062,000. Average payment per month to employees on gold roll, \$125.80. Silver roll, \$40 gold, or so. **P-08**, 28; **P-09**, 25.

1910. The work of this department embraces securing, disbursing, and accounting for all funds paid out or collected, and issuance of hotel and commissary books and meal tickets, **P-10**, 40.

1911. Pay-car schedule, which formerly provided 4 days to effect payment of forces on Isthmus, reduced to 3 in Apr. Total paid out on pay rolls aggregated \$19,415,987.02, in addition to which \$10,017,600.13 paid in settlement of public bills and reimbursement vouchers. Value of hotel books, commissary books, and meal tickets issued, \$4,150,943.50, **P-11**, 48.

1912. Total paid on pay rolls, \$19,407,398.90; in addition, \$10,465,634.09 paid in settlement of public bills and reimbursement vouchers. Hotel books, commissary books, and meal tickets issued \$4,591,510.50, **P-12**, 58.

1913. Total paid on pay rolls, \$20,524,705.75; in addition, \$9,035,630.18 paid in settlement of public bills and reimbursement vouchers. Hotel books, commissary books, and meal tickets issued, \$1,305,405, **P-12**, 61. (See p. 2368.)

Discharge.

Chagres River, Alhajuela, **P-13**, pls. 112, 115, 117.

Chagres River, Gamboa, **P-13**, pls. 113, 116, 118.

Chagres River, **P-09**, 284, pl. 83; **P-10**, 294; **P-11**, 269; **P-12**, 243; **P-14**, pl. 105.

Chagres River, Gatun, **P-10**, pl. 132; **P-11**, 270; **P-13**, pls. 114, 119.

Culverts, discharge from, Pedro Miguel Locks, **P-14**, pl. 2.

Curves of, Chagres Basins, Gatun, **P-12**, pl. 109.

Curves of, Chagres River, Alhajuela, **P-11**, pl. 125.

Curves of, Chagres River Basin, 24 years, **P-14**, pl. 107.

Curves of, Chagres River, Gatun, **P-11**, pls. 123, 124.

Curves of, duration, Alhajuela, **P-14**, pl. 106.

Curves of, Gatun, **P-10**, pl. 133.

Drainage basin, Chagres River, discharge at Alhajuela; dry seasons of 1908 and 1912, **P-12**, pl. 100.

Drainage basin, Chagres River, mass curves of discharge at Alhajuela, 1908 and 1911, and 22-year period, **P-12**, pl. 101.

Drainage basin, Chagres River, mass curves of discharge at Gamboa, 1908 and 1911, and 22-year period, **P-12**, pls. 102, 104.

Drainage basin, Chagres River, mass curves of discharge at Gatun Spillway, 1908 and 1911, and 22-year period, **P-12**, pls. 103, 104.

Duration of, curves of, Chagres River, Alhajuela, **P-12**, pl. 107.

Duration of, curves showing, Chagres at Gamboa, **P-12**, pl. 108.

Duration, Gatun, **P-10**, 295, pl. 135; **P-11**, 270.

Lake Bohio. (See No. 17, p. — of this Index.)

Mass curve, Alhajuela, **P-14**, pl. 105.

Mass curves of, Chagres River, Alhajuela, 1908, 1911, and 22-year period, **P-12**, pl. 101.

Measurements of, from actual gaugings, zone waterways, **P-11**, 270.

Minimum, various streams, dry season, 1912, **P-12**, 244.

Monthly, Alhajuela and Gatun, **P-13**, 240.

Monthly, Chagres River, **P-13**, 239; **P-14**, 161.

Monthly, Chagres River, 1912 and 1908, **P-12**, 242.

San Juan. (See No. 20, p. 2361 of this Index.)

System of, tests, locks, **P-13**, 77.

Tests of, Gatun Locks, **P-11**, 117.

Through various materials, Gatun Dam studies, **P-08**, 196, pl. 172.

Wet and dry seasons, Gatun and Gamboa, and calendar and river years during years of maximum and minimum flow, **P-12**, 246, 247.

Dispensaries. (See Civil Administration.)

Distilleries.

Executive order relating to collection of taxes, **P-11**, 433; **P-12**, 618.

Districts, Administrative.

Consolidations, orders relating to, **P-13**, 614.

Ditch, Drainage.

Bottom of Culebra Cut, **P-13**, 160, pl. 37.

Swamp east of Sosa-Coroza Dam, **P-07**, 57.

Ditches.

Condition before and after burning grass, **P-10**, 434, pls. 72, 73, 74.

Dug, Pacific terminals, **P-13**, 201; **P-14**, 221.

Sanitary, Atlantic division, **P-10**, 128; **P-11**, 127.

Diversions. (See Channels, Diversion.)

Blowing up dike to turn water of Chagres, **P-09**, 90, pl. 39.

Central division, **P-10**, 147; **P-11**, 145; **P-12**, 156; **P-13**, 151.

Coccolí, **P-08**, 66.

Comacho, near outlet of tunnel, Bas Obispo, **P-09**, 90, pl. 49.

Comacho, near outlet of tunnel during flood, Chagres River, **P-09**, 90, pl. 50.

Comacho Tunnel, **P-08**, 56, pls. 9, 10.

Comacho, White House yard, **P-09**, 90, pl. 48.

Corundu River, **P-12**, 187.

Channels, diversion, proposed, Culebra division, **P-07**, 46.

Culebra division, **P-08**, 40.

Dredging, **P-14**, 240.

Lock and dam work, Miraflores, **P-09**, 96.

Obispo, **P-08**, 56, pls. 7, 8; **P-09**, 77.

Obispo, break through rock bank at Empire, **P-10**, 160, pl. 24.

Obispo, deepest excavation, **P-09**, 90, pl. 46.

Obispo, excavation, **P-09**, 67; **P-10**, 137; **P-11**, 133; **P-12**, 143; **P-13**, 139.

Obispo, completed, **P-09**, 90, pl. 47.

Sixth division, **P-13**, 189.

Divisions. (See Nos. 239-266, pp. 2367, 2368 of this Index.)

Circular outlining organization, **P-05**, 146.

Docks.

Caisson sinking, progress, Panama R. R. dock, Pacific division, **P-12**, 186.

Cranes, Balboa-Panama R. R., **P-13**, 99.

Department, Panama R. R., **P-08**, 205.

Docking and general facilities after completion of canal, **P-11**, 206.

Docking facilities, terminals, **P-12**, 218.

Lumber docks, Balboa, **P-11**, pl. 115.

Lumber docks, Balboa, of reinforced concrete, looking northeast, **P-11**, 302; **P-12**, 204, pl. 57.

Operation of, **P-13**, 378.

Panama R. R., at Balboa, cost of construction, **P-12**, 311.

Panama R. R., Pacific entrance to, **P-09**, 134, pl. 64.

- Terminal, Balboa, bottom section of concrete pier shell, **P-13**, pl. 106.
 Terminal, Balboa, manufacturing and sinking caissons, **P-13**, pl. 104.
 Terminal, Balboa, plant for manufacturing pier shells, **P-13**, pl. 107.
 Terminal, Balboa, standard section of concrete pier shell, **P-13**, pl. 105.
- Docks, Dry**, **P-07**, pls. 37, 38; **P-10**, 111; **P-14**, 35, 189.
 Balboa, **P-14**, pls. 114, 115.
 Basin entrance, Pacific entrance, **P-13**, 196.
 Central division, **P-13**, pl. 96.
 Coaling, Ancon, **P-07**, 48, pl. 35.
 Colon dredging division, **P-07**, 50; **P-08**, 49.
 Cristobal, **P-07**, 48, pls. 37, 38; **P-14**, 244.
 Cristobal, arrival of labor train, **P-10**, 322, pl. 65.
 Equipment, **P-14**, 180.
 Excavation, Balboa, **P-13**, 254, pl. 55.
 Excavation, Pacific dry dock, **P-13**, 197.
 Floating equipment, **P-13**, 215.
 Gates, miter, **P-13**, 210.
 General description of, terminals, **P-13**, 209.
 Marine shops, dry dock and, Atlantic division, **P-09**, 58; **P-10**, 116; **P-11**, 107.
 Moving machinery, miter gates, **P-13**, 210.
 No. 1, Pacific terminal, **P-13**, 196.
 No. 2, Pacific terminal, auxiliary, **P-13**, 198.
 No. 1, principal dimensions, Balboa, **P-13**, 209.
 No. 2, principal dimensions, **P-13**, 211.
 Shops, **P-11**, 229; **P-12**, 262; **P-13**, 259.
 Shops, Atlantic division, **P-12**, 115.
 Terminals, **P-13**, 209; **P-14**, 201, 202.
 Wall, after near-by excavation, Balboa terminal, **P-14**, pls. 25, 26.
- Doors, Tunnel.**
 Operating, **P-14**, 114.
- Dormitories**, **P-10**, 436; **P-11**, 534.
- Dose, H. F.** (See No. 203, p. 2365 of this Index.)
- Double-lift Lock.** (See Lock, Double-lift.)
 Intermediate gate study, Miraflores, **P-10**, 93-100.
- Drainage.** (See Discharge; Ditch; Drainage.)
 Balboa town site, **P-14**, 224.
 Channels, Culebra Cut, **P-12**, 170, pls. 35, 37.
 Coping, locks, **P-11**, 81.
 Ditch, on bottom of Culebra Cut, **P-13**, 160, pl. 37.
 Ditch, swamp east of Sosa-Corozal Dam, **P-07**, 57.
 Earth drains, swamps, Mount Hope, **P-10**, 434, pl. 70.
 Monthly average, Chagras River, 20 years, **P-10**, pl. 131.
 Shops, **P-14**, 206.
 Sump and culvert pumps and motors, **P-14**, 114.
 Surface, Colon, **P-07**, 63.
 Surface, mechanical division and shops, **P-14**, 171.
 System, Colon, **P-11**, 130.
 System, Toro Point, **P-11**, 130.
- Drafting.** (See Construction and engineering.)
- Draftsman, Chief**, **P-11**, 238; **P-12**, 273.
- Drawings.**
 Emergency dams, **P-10**, pl. 87.
 Lock and dam structures, number made, **P-10**, 48.
 Lock entrance caisson, **P-13**, pls. 81, 82.
 Lock parts, **P-11**, 66.
 Masonry and lock structures, **P-12**, 70; **P-13**, 75.
 Operating machinery, locks, **P-11**, 83.
 Sill on masonry, lock gates, **P-09**, 42, pl. 10.
 Summary of, masonry and lock structures, **P-13**, 75.
- Dredges.** (See Equipment, Floating.)
 Atlantic division. (See Output, below.)
 "Corozal," **P-12**, 182.
 "Corozal," in channel near station 2210, **P-12**, 204, pl. 58.
 Dredge grounded 55' below sea level, Gatun Locks, **P-13**, 138, pl. 22.
 In operation, second division, **P-13**, 190.
 Material handled by, Gatun Dam, **P-13**, 126.
 Monthly output, second division, **P-13**, 191.
 Movement of, **P-11**, 167; **P-12**, 183.
 Operation, sixth division, **P-13**, 187.
 Output, **P-09**, 46; **P-10**, 115; **P-11**, 120; **P-12**, 113.
 Pacific division, **P-10**, 174; **P-11**, 166; **P-12**, 182.
 Performance of "Sandpiper," Miraflores, **P-10**, 170.
 Repairs and renewals, **P-14**, 236.
 Sand dredging by "Gopher," **P-11**, 170; **P-12**, 185.
 Used to place rock on Toro Point Breakwater, **P-12**, 142, pl. 19.
 Working on slide, toe, Culebra Cut, **P-14**, pls. 54, 55.
- Dredges, Dipper.**
 Dipper and ladder dredging plant, La Boca, **P-07**, 48, pls. 39, 40.
 French "clapet" loading, **P-07**, pl. 39.
 View of, in canal, **P-11**, 192, pl. 60.
- Dredges, French Ladder**, **P-07**, pl. 40; **P-10**, 160, pl. 30.
 Dredging, La Boca, **P-08**, 56, pl. 24.
 Mindi, **P-10**, 136, pls. 6, 7.
- Dredges, Ladder.**
 Plant, La Boca, **P-07**, 48, pls. 39, 40.
 Work on, shops, Balboa, **P-12**, 186.
- Dredges, Old**, **P-07**, pl. 41.
- Dredges, Suction**, **P-07**, pl. 35.
 "Ancon" coaling at dry dock, **P-07**, 48, pl. 35.
 Canal prism, in, **P-07**, pl. 36.
 Coaling, **P-07**, pl. 35.
 "Culebra" passing Cucaracha slide, **P-14**, pl. 57.
 Details of "Ancon" and "Culebra," **P-07**, 49.
 Working, Chagras River, **P-08**, 70, pl. 29.

Dredging, P-09, 99; P-14, 31. (See Dredges; see Nos. 219, 256, pp. 2366, 2368 of this Index.)
 "Ancon" coaling, **P-07, 48, pl. 35.**
 Atlantic entrance, **P-14, 237.**
 Barrier blown up between Pacific and Miraflores, **P-13, 186, pl. 53.**
 Clearings, **P-14, 240.**
 Colon dredging division, **P-07, 49; P-08, 47.**
 Colon, new plant, **P-08, 50.**
 Connection made with French canal, **P-10, 136, pl. 7; P-11, 132, pl. 25.**
 Cost of, between Mindi and Limon Bay, **P-10, 115.**
 Costs, **P-11, 291; P-14, 448.**
 Culebra Cut, **P-14, 238, pls. 86-89.**
 Diversions, **P-14, 240.**
 Division of, chart of organization, **P-14, pl. 141.**
 Excavation and, costs, **P-09, 57.**
 Dredges, lowering, **P-13, 13.**
 Dredge beached, **P-08, 56, pl. 25.**
 Dredge at work, Chagres River, **P-08, 70, pl. 29.**
 Excavation, dry, La Boca dredging division, **P-08, 52.**
 Excavations, cost, **P-12, 295; P-13, 276.**
 Gatun Lake, **P-14, 237.**
 Hydraulic excavation, and Balboa shops, **P-10, 172.**
 La Boca dredging division, **P-07, 51; P-08, 50.**
 Lock sites, Miraflores, **P-09, 134, pl. 62.**
 Mindi to Gatun, **P-11, 105; P-12, 112.**
 Miraflores Lake, **P-14, 238.**
 Miraflores lock and dam work, **P-09, 96; P-10, 170.**
 Miscellaneous, Atlantic division, **P-10, 114; P-11, 105; P-12, 113; P-13, 190.**
 Ocean to Mindi, **P-09, 55; P-10, 112; P-11, 104; P-12, 112.**
 Organization, chart, **P-07, pl. 137.**
 Output, Pacific division, **P-09, 99; P-10, 172; P-11, 167; P-12, 183.**
 Paraiso Wharf, **P-14, 240.**
 Plant, Colon dredging division, **P-07, 49.**
 Plant, La Boca dredging division, **P-07, 52.**
 Pools, lowering to lower dredges, **P-13, 13.**
 Report of resident engineer, dredging division. (See No. 264, p. 2368 of this Index.)
 Seventy-two feet three inches above sea level, Culebra, **P-14, pls. 44, 45, 47.**
 Shops and shipways, Balboa, **P-11, 166; P-12, 182.**
 Sixth division, **P-13, 192.**
 Terminals, at, **P-13, 205; P-14, 238.**
 Various localities, **P-14, 237.**
 Water hyacinth, **P-14, 241.**
 Yardage, districts, **P-14, 235.**

Dredging Division. (See No. 264, p. 2368 of this Index.)

1913. When it was finally decided to turn water into Culebra Cut, Oct., 1913, and to complete remaining excavation by dredges, all dredging on Isthmus combined under one head. May 1, 1913, dredging work under Atlantic division transferred to sixth division, O. C. E., consolidating it with dredging organization of Pacific side. Same date drydock shops at Cristobal transferred to mechanical division. **P-13, 2.**

1914. Dredging division subdivided into two districts, the first extending from deep water in Pacific to Gamboa, and the second from Gamboa to deep water in Caribbean.

In first district, Pedro Miguel Locks to sea, 5,364,816 c. y. removed, of which 3,329,072 c. y. taken from within prism. Of amount from prism, 1,186,432 c. y. rock. Of rock excavated, 146,477 c. y. drilled and blasted by drill barge "Teredo" and 60,832 c. y. broken by rock breaker "Vulcan." Operations began in Culebra Cut Oct. 23, 1913, and continued throughout the year; 3,432,363 c. y. removed, of which 919,655 c. y. earth and balance rock. Of this amount, 865,015 c. y. earth and 1,557,360 c. y. rock removed from Cucaracha slide. Pipe-line dredges pumped over west bank into Rio Grande Valley 684,514 c. y. earth and 77,880 c. y. rock. Cucaracha slide very active since dredging operations, daily movement averaging 24'. June 30, 1914, area of slide 60.4 acres, 44.6 acres active and 15.8 acres without motion. Dredging done during 4 months of year in Miraflores Lake, removing 159,817 c. y. earth from prism.

In second district 6,544,192 c. y. removed—3,692,576 c. y. from within prism, 574,630 c. y. from old French dump in Limon Bay; 158,994 c. y. from prism were rock. Of total taken out, there were removed between Oct., 1913, and Feb., 1914, 507,195 c. y. earth and 5,035 c. y. rock from canal prism north of Gamboa, formerly known as Point No. 1.

In connection with Atlantic terminals, dredges removed 18,286 c. y. earth and 16,015 c. y. rock from site of bridge crossing French canal south of drydock, 117,289 c. y. earth from approach channel, 275,993 c. y. earth and 46,360 c. y. rock from new Piers Nos. 7, 8, and 9, and 181,709 c. y. earth and 213,325 c. y. rock from coaling station. 17,000 c. y. placed in fill for substation and 304,411 c. y. placed in fills for bridge foundations, coal basins, and yards at coaling station.

At Pacific terminals dredges removed 1,919,003 c. y. earth and 7,964 c. y. rock, of which 1,831,711 c. y. earth handled by pipe-line dredges and placed in fills for reclaiming swamp land.

Considerable amount of miscellaneous dredging done, making total removed by dredging fleet, including sand and gravel reclaimed, 15,341,371 c. y. The fleet consisted of seagoing suction dredges "Caribbean" and "Culebra," seagoing ladder dredge "Corozal," French ladder dredges "Badger," "No. 1," "No. 5," "Gopher," "Marmot," and "Mole" (the last abandoned as worn out on Sept. 20, 1913), 5-yard dipper dredges "Cardenas," "Chagres," and "Mindi," 15-yard dipper dredges "Gamboa" and "Paraiso," and pipe-line suction dredges "No. 4," "No. 82," "No. 83," "No. 85," "No. 86," and "Sandpiper." In connection with these there were employed 12 tugs, 19 launches, 9 clappers, and 24 dump scows.

As noted in last report, contract made with Bucyrus Co. for two 15-yard dipper dredges.

First ready for towing to Isthmus Dec. 1, 1913, and second Jan. 1, 1914. First accepted at Port Richmond, N. Y.; Feb. 16, reached Isthmus Mar. 16, and placed in operation Apr. 4, 1914. Second accepted at Port Richmond Apr. 13, reached Isthmus May 22, and went into commission at Cucaracha slide June 7, 1914. Buckets not sufficiently strong, and additional delay caused. Failure to meet dates of delivery resulted in handicapping work at Cucaracha slide and delayed securing channel sufficiently deep and wide to permit canal to be utilized for passage of commerce before close of year.

\$2,000 authorized for temporary dikes on west side of channel where it is cut through at head of Limon Bay, to determine effect upon erosion occurring, due to waves created by trade winds. Results so satisfactory that it was decided to make dikes permanent. P-14, 31-33.

Drill Barge. (See Barge, Drill.)

Drill, Churn.

Working, P-07, 48, pl. 17.

Drill Cores. (See Cores, Drill.)

Drilling.

Comparison between wash and drive samples, Gatun Dam studies, P-08, 196, pls. 74, 75.

Dam sites, method of filing and preserving cores, Gatun Dam studies, P-08, 196, pl. 81.

Description of material, Gatun Dam studies, P-08, 158.

Diamond drilling, Gatun Dam study, P-08, 161.

Drill barge, operation of, Pacific division, P-10, 174; P-11, 169; P-12, 184.

Drill barge, performance, Pacific division, P-10, 175.

Drill barge "Teredo," operation of, P-11, 169; P-12, 184.

Drill barge "Terrier," P-10, 115.

Gang at work, Gatun Dam studies, P-08, 196, pls. 76, 77.

Holes, loading with dynamite, P-07, pls. 18, 19.

Methods, Gatun Dam study, P-08, 156.

Pacific terminals, P-13, 201; P-14, 211.

Drills. (See Holes, Drill.)

Air drills, at work, P-07, 40, pls. 15, 16, 17.

Barge, operation. (See Drilling.)

Cores from, Gatun Dam studies, P-08, 196, pls. 73, 74, 75, 78, 79, 80, 81.

Gatun Dam site, P-08, 196, pl. 72.

Well drill, operation of, Pacific division, P-10, 173; P-11, 168.

Well, or churn drill, at work, P-07, 48, pl. 17; P-12, 170, pl. 32.

Drinking Water. (See Water, Drinking.)

Driveway.

Ancon Hospital grounds, P-07, 32, pl. 10.

Dry Docks. (See Docks.)

Dry Fill. (See Fill, Dry.)

Dry Seasons. (See Discharge; Meteorology; Seasons, Dry.)

Ducts.

Electric lines, P-11, 82.

Vitrified tile, lock machinery installation, P-12, 87.

Dump, Old French.

Slides, native village of Culebra, P-09, 90, pl. 35.

Dumps and Dumping, P-07, pl. 29.

Central division, P-09, 75; P-10, 146; P-11, 142; P-12, 153; P-13, 149.

Central division, map, P-09, 90, pl. 28.

Culebra Cut, P-08, 56, pl. 26.

Culebra division, P-07, 43; P-08, 39.

Disposition of excavated material, central division, P-12, 153.

Dumping rock, Gatun Dam, P-11, 132, pl. 19.

Dump, in Pacific Ocean, Balboa, made from material taken from Culebra Cut, P-13, 160, pl. 46.

Grounds, dumping, central division, P-09, 76.

Handwork, excavating, P-10, 160, pl. 32.

Juan Grande River, plan and section, P-11, pl. 106.

La Boca, P-08, 48, pl. 28.

Leading to Naos Island Breakwater, view from Sosa Hill, P-11, 156, pl. 43.

Low trestle, across Chagres River, Point 4, near Gorgona. Material washed away; cheap method of disposing of material by short haul. P-11, 156, pl. 33.

Material spreading, P-07, 48, pl. 34.

Modern cars, P-07, 48, pl. 33.

Plan of Balboa dumps, P-13, pl. 96.

South end of Naos Island dump, 4,000' from island. Center shown 80' from track and 25' above original bottom. Elevation of trestle, plus 14. P-12, 170, pl. 44.

South end of Naos Island dump, 4,000' from island. Center shown 75' from track and 25' above the original bottom. Elevation of trestle, plus 14. P-12, 170, pl. 45.

Spreading dumps, P-07, pl. 34.

Train loads, plowing off, P-07, pl. 32.

Trestle driven, central division, P-10, 147.

Trestle, Sosa-Corozal Dam, P-07, 48, pl. 29.

Trestles, Central division, P-11, 143.

View showing combined dike and dump, East Balboa to Naos Island, P-10, 160, pl. 21.

Duties.

Quartermaster department, P-09, 205.

Duty. (See Imports; Order, Executive.)

Merchandise when entered into U. S. from zone, P-11, 433, 558.

Dwellings. (See Orders, Executive.)

Dynamite.

Amount used, Pacific terminals, P-14, 212.

Loading drill holes with, Culebra Cut, P-07, 48, pls. 18, 19.

Storage magazine at Cruces, P-09, 220, pl. 91.

Unloading, from ship, Mount Hope, P-10, 322, pl. 66.

E.

Earth, Fuller's.

Deposits, zone, **P-13**, 577.

Earthquakes, P-10, 287, 288. (See Seismography; see No. 7, p. 2361 of this Index.)

Act authorizing Isthmian Canal Commission to extend relief to sufferers in Costa Rica, **P-11**, 575.

Seismograph records, Ancon, **P-12**, 238.

Education. (See Civil Administration.)

Efficiency. (See Diagrams.)

Eight-hour Law. (See Law, Eight-hour.)

Electrical and Mechanical Engineer. (See No. 260, p. 2368 of this Index.)

Electrical Division.

1914. Operation of various power plants consolidated Apr. 1 to comprise electrical division, under Capt. W. H. Rose, U. S. Army. Includes operation and maintenance of steam-driven electric power plants at Gatun, Miraflores, Empire, and Balboa, and all substations, transmission, and distribution lines connected with power plants; operation and maintenance of air-compressor plants at Empire and Balboa; construction, operation, and maintenance of building and street lighting systems in zone; operation and maintenance of electric cargo-handling cranes on Panama R. R. pier at Balboa; installation of electrical equipment of new Balboa shops of mechanical division; and construction of permanent underground conduit systems for permanent towns of zone.

One of three 1,500-kilowatt vertical turbogenerator sets and two 410 high-pressure water-tube boilers removed from Gatun station for installation at Miraflores power plant. New unit in place June 1, 1914; gives Miraflores plant capacity of about 6,000 kilowatts, same as hydroelectric station. Total power in kilowatt hours generated during year: 6,824,556 kilowatt hours at Gatun, at \$0.0175 per kilowatt hour; 16,352,732 kw. h., Miraflores, at \$0.0135 kw. h.; 2,327,877 kw. h., Empire, at \$0.0240 kw. h.; 138,143 kw. h., Balboa, at \$0.1503 kw. h.

Air-compressor plants operated during year at Empire and Balboa, and Rio Grande plant operated until Nov. 1, 1913; furnished compressed air for excavation work at Culebra, Rio Grande, and Gold Hill; for mechanical division shops at Empire, Balboa, and Paraiso; for division of erection at Pedro Miguel Locks, Ancon quarry, and for work in vicinity of Sosa Hill and new dry dock at Balboa.

Removal and reerection of wooden buildings from various points along line to Ancon-Balboa district necessitated removal of wires and fixtures, and later rewiring, of 178 buildings. Feb., 1914, two temporary substations completed, one at Miraflores and

one at Balboa, each of 1,500-kilowatt capacity, for 11,000-volt transmission between these points. May, 1914, another 11,000-volt transmission line completed between Miraflores power plant and Cucaracha, supplying power to relay pumps and Gold Hill hydraulic plant. Additions and alterations necessitated change in pole lines for construction, amounting to 15 miles. 25 miles pole line to supply power to range lights and beacons of lighthouse subdivision constructed, lighthouse subdivision erecting poles and electrical division installing wires and transformers and making connections to lights and beacons. Duplicate 2,200-volt armored cables, supplying power to Agua Clara pumping station, installed between that station and Gatun substation. In all, 12,900' conduit, having 83,000' of duct incased in concrete, and 40 concrete manholes completed during year between Pedro Miguel telephone exchange, Tivoli Hotel, new administration building at Balboa, and latter with Balboa substation. Large amount of conduit work done in connection with electrical work in permanent buildings and Balboa shops. Eight 4-ton alternating current cargo-handling cranes, five 4-ton direct-current cranes, and one 20-ton direct-current French crane, all on Panama R. R. pier at Balboa, operated and maintained. These cranes handled practically all commercial freight crossing Isthmus in either direction. Vessels loaded and unloaded, 413. **P-14**, 22, 23.

Electricity. (See Gates, lock; Lines, Transmission.)

Cables for, installation, **P-13**, 9; **P-14**, 17.

Circuit, operating locks, **P-10**, 57.

Current, cost of, **P-10**, 231; **P-11**, 208; **P-12**, 249.

Distribution line construction and maintenance, **P-14**, 88.

Electrical department, Pacific division, **P-12**, 181.

Electrical division, **P-14**, 22, 85.

Electrical installation, division of erection, **P-14**, 73.

Electrical subdivision, **P-07**, 85; **P-08**, 80; **P-09**, 146.

Electrical work; designs, department of lock and dam construction, **P-08**, 67.

Equipment, **P-14**, 191.

Equipment, auxiliary electrical, for Gatun hydroelectric station, **P-12**, 88.

Equipment, inspection of, **P-13**, 99.

Equipment, valves, **P-14**, 102.

Generating station, hydroelectric, **P-14**, 74.

High-power transmission line, **P-14**, 17.

Hydroelectricity, gate house of station, Gatun, **P-14**, pl. 10.

Hydroelectric plant, **P-13**, 97; **P-14**, 15, 314.

Hydroelectric plant, general view of location and status of work. From west wall of tail-

- race, looking southeast, June 27, 1913. **P-13**, 110, pl. 5.
 Hydroelectric station, Gatun, **P-14**, 96.
 Hydroelectric station, lock operation, **P-12**, 88.
 Hydroelectric station under construction, Gatun Spillway Dam, **P-14**, pls. 9, 10.
 Hydroelectric stations and transmission line, **P-11**, 82.
 Installation, Balboa shops, **P-14**, 176.
 Installation, locks, **P-13**, 87.
 Light and air compressor subdivision, **P-11** 240.
 Light plant, operation of, **P-10**, 273.
 Light plants, **P-11**, 241; **P-12**, 275; **P-13**, 266.
 Light subdivision, **P-10**, 269.
 Line, high-power, **P-13**, 11.
 Plan of beacons, **P-12**, pl. 77.
 Power plant, operation of, **P-14**, 86.
 Station, Gatun, etc., **P-14**, 97-100.
 Transmission line, **P-13**, 98; **P-14**, 74.
 Transmission line construction and maintenance, **P-14**, 88.
 Transmission line, material, **P-14**, 96.
 Transmission line system, **P-14**, 100.
- Elevations.**
 Maximum, minimum, etc.; Chagres River and Gatun and Miraflores Lakes, **P-14**, 162.
 Monthly maximums, minimums, and means, **P-13**, 241.
- Embankments.**
 Completing large; Gatun River section of Panama R. R. relocation, **P-12**, 281.
 Embankment of old Panama R. R. excavated down to plus 35, **P-12**, 170, pl. 39.
 Making; three-deck system, **P-08**, 216, pl. 176.
 Pacific terminals, **P-13**, 202; **P-14**, 204.
 Panama R. R. embankment across Gatun River, **P-10**, 204, pl. 58.
 Ripping submerged, Panama R. R., **P-13**, 202.
 Toe and counterweight, Panama R. R. relocation, **P-11**, 200, pl. 63.
- Embree, C. J.** (See No. 260, p. 2368 of this Index.)
- Emergency Dams.** (See Dams, Movable.)
- Emigration and Immigration, P-08**, 252; **P-09**, 212; **P-10**, 311.
 Employees, of, **P-07**, 141.
- Empire, P-08**, 56, pl. 5.
- Employees.** (See Labor; see Nos. 67, 101, 146, pp. 2363, 2364 of this Index.)
 Allowance to; act relating to prohibition of longevity and lay-over day allowances to, **P-11**, 571, 577, 580.
 Bonds, **P-11**, 393.
 Bonds, act relating to, **P-11**, 574.
 Bonds, schedule, Illinois Surety Co., **P-12**, 412.
 Buildings for, **P-07**, 141.
 Civil Service without examination, isthmian employees eligible for retention in the, **P-13**, 616.
 Condition of employment, **P-05**, 157.
 Deaths, **P-07**, 193; **P-08**, 284; **P-09**, 291; **P-10**, 411; **P-11**, 505; **P-12**, 531; **P-13**, 621.
 Diseases of, **P-06**, 65.
 Distribution of, **P-11**, 359.
 Estates, administration of, **P-05**, 66, 199.
 Food supply for, to be obtained, **P-05**, 144.
 Force, average monthly, **P-07**, 139; **P-08**, 249.
 Force, classified, **P-07**, 139; **P-08**, 249; **P-09**, 212; **P-10**, 208; **P-11**, 226; **P-12**, 377; **P-13**, 382.
 Force records, high and low, **P-13**, 383.
 Fumigating force, Panama, **P-05**, 32, pl. 32.
 Gold; and the wage scale, **P-11**, 206.
 Gold personnel of the force on the Isthmus, statement of changes made each month in the, **P-08**, 252.
 Houses for families, **P-07**, pls. 100-126.
 Immigration and emigration, **P-07**, 141.
 Imports for, orders relating to, **P-05**, 208; **P-07**, 151.
 Increase of, etc., prohibited; act, **P-11**, 580.
 Injuries and compensation, **P-09**, 246; **P-10**, 355; **P-11**, 404, 405, 568, 569, 581; **P-12**, 415; **P-13**, 415.
 Injuries, Executive order relating to compensation for, **P-13**, 620, 625; **P-14**, 590.
 Injury of, liability of Panama R. R.; act, **P-11**, 565, 575.
 Malaria, cases of, **P-10**, 434; **P-11**, 530; **P-12**, 556; **P-13**, 554.
 Medical treatment, statistics, **P-12**, 546.
 Panama R. R. force, **P-07**, 139.
 Pay car, **P-07**, pl. 46.
 Pay for supplies, deductions from; act, **P-11**, 564.
 Payments, special; division of material and supplies, **P-08**, 235.
 Permanent employees, **P-14**, 584.
 Quarters, family, negroes, **P-07**, 96, pl. 117.
 Quarters for, **P-05**, 302.
 Quarters, Isthmian Canal Commission, employees in; statement, **P-09**, 212.
 Quarters, silver employees', **P-09**, 209.
 Recreation buildings, **P-07**, pls. 122, 123, 124. (See No. 247, p. 2367 of this Index.)
 Recreation, necessity of providing, **P-05**, 139.
 Retired officers or enlisted men of the Army and Navy, act relating to payment of compensation to, **P-11**, 573.
 Sick, etc., average, **P-11**, 518, 519; **P-12**, 545, 546; **P-13**, 541-552.
 Statistics, by tables, **P-06**, 49.
 Transportation, deductions from pay for, **P-08**, 249.
 Transportation from Isthmus, analysis of, **P-13**, 384.
- Employment.**
 General conditions of, in which salary is fixed in U. S. currency, **P-05**, 157.
 2,175 buildings inherited from French in bad condition. 2,400 men engaged in destroying buildings, repairing others, and erecting new ones. Hotels under construction. **P-05**, 7.
 Nov., 1904, 3,500 employees on the Isthmus.
 In Nov., 1905, 17,000. White Americans, 1,500.
 Panama R. R. employed about 2,500, not included above. **P-05**, 9.
 Nov. 15, 1904, the President put all employments, except laboring, under civil service

rules and regulations. Difficulty of obtaining skilled employees due to prosperity in the U. S. and sensational stories about health on the Isthmus. **P-05, 10, 11.**

Number of employees approximately 17,000. Efforts to provide social environment, clubs, lodges, churches, etc. 8-hour day adopted May 10, 1905, for laborers and mechanics. Pay of 10-hour men increased. Only minor complaints at times from employees. **P-05, 56.** Inexpensive method of administering estates of employees provided. 23 estates cared for. **P-05, 66.**

Credit given American employees who stayed on the Isthmus in the face of the yellow-fever panic, **P-05, 73.**

Discouragement among employees, due probably to executive changes on the Isthmus, **P-05, 103.**

Efficiency of staff might have been better if more discretion had been exercised in selections and appointments, **P-05, 109.**

Some difficulty in getting men from the U. S. Wild newspaper reports somewhat responsible. **P-05, 120.**

Policy of the Isthmian Canal Commission has produced a personnel entirely capable of good results, **P-05, 120.**

Force inadequate. 5,000 additional men needed, Aug., 1905, at Culebra alone. No adequate facilities for housing men. **P-05, 145.**

Sufficient buildings to house all its bachelor employees. 335 separate houses and 13 larger buildings constructed for married quarters, providing accommodations for 375 families. Approximately 1,200 American women and children on the Isthmus. **P-06, 3.**

4,569 persons tendered employment in the U. S. for Isthmus work; 3,962 accepted; 3,243 transported to their work. 834 members of families of employees and 929 persons returning from leave of absence have been transported at reduced rate. Capacity of Panama R. R. boats exhausted at times; other lines had to be used. Employees secured through the Civil Service Commission, employment agents, or personal application. On Jan. 12, 1906, the President put all employments on the Isthmus outside civil service examination, except clerks, bookkeepers, stenographers, typewriters, surgeons, physicians, internes, trained nurses, draftsmen. **P-06, 6, 7.**

Endicott, M. T. (See Nos. 64, 164, pp. 2362, 2365 of this Index.)

Engineer, Chief. (See No. 218, p. 2366 of this Index.)

John Findlay Wallace, **P-04, 37.**

Resignation, John F. Wallace, June 28, 1905, **P-05, 5.**

Engine, Electrical and Mechanical. (See No. 260, p. 2368 of this Index.)

Engineering. (See Nos. 145, 251, pp. 2364, 2368 of this Index.)

Engineering and Construction. (See No. 40, p. 2362 of this Index.)

Circular outlining organization by division and bureaus, **P-05, 146.**

Organization of department, **P-05, 154.**

Staff; list, **P-04, 37.**

Begun with four parties, each in charge of a resident engineer; preliminary work begun early part of 1904 immediately after return of Isthmian Canal Commission No. 2 from Isthmus. The first party sailed from New York about the middle of May, 1904. The chief engineer, John F. Wallace, entered upon his duties June 1, 1904. Early work surveys, etc.; study of water-supply question, control of the Chagres, terminals, etc. Operations at Culebra were continued with force of about 700 men. Plant taken over was cared for and examined. When the chief engineer arrived, force was entirely reorganized, plant was overhauled, accounting system established. **P-04, 48.**

Engineering, Municipal, P-14, 23. (See Nos. 127, 221, 261, pp. 2364, 2366, 2368, of this Index.) **P-04, 43.**

Atlantic division, **P-11, 125; P-12, 136; P-13, 131.**

Building construction and; Atlantic division, **P-09, 61.**

Colon, **P-11, 127; P-12, 137; P-13, 133.**

Cristobal, **P-12, 137; P-13, 133.**

Designs, **P-14, 138.**

Division, **P-07, 59; P-08, 80; P-14, 90.**

Expenditures, **P-07, 79; P-08, 91.**

Fifth division, **P-13, 176.**

Northern district, **P-14, 128.**

Organization of department; chart, **P-07, pl. 139.**

Pacific division, **P-09, 103; P-11, 174; P-12, 138.**

Southern district, **P-14, 129.**

Zone, **P-08, 80.**

Engineer, Office. (See Office.)

Engineer, Maintenance. (See No. 259, p. 2368 of this Index.)

Engineer, Mechanical. (See No. 260, p. 2368 of this Index.)

Engineer, Terminal Construction. (See No. 263, p. of 2368 this Index.)

Engineer, Testing. (See Tests.)

Engineer, Travelling, P-13, 247.

Engine Room.

Locomotive department, **P-10, 267.**

Engines. (See Fires.)

Engine houses, **P-07, 82; P-10, 268; P-11, 237; P-12, 272.**

Las Cascadas, **P-07, 80, pl. 90; P-08, 120, pl. 54.**

Locomotive; house, **P-07, pl. 90.**

Entertainments. (See Recreation.)

Entrance, Atlantic.Completed channel, **P-11**, 132, pl. 7.Distant view, **P-13**, 138, pl. 24.**Entrances.** (See Basins, Entrance.)**Entry, Ports of.**Laws relating to, **P-05**, 198.**Equipment.** (See Nos. 157, 210, pp. 2364, 2365 of this Index.)Aid to navigation, **P-13**, 108.Disposition of surplus, upon work's completion, **P-11**, 203.Excavation, equipment required for, **P-06***, 405.Executive order to prevent unauthorized purchases of, from persons in the Army and Navy, **P-12**, 612.Important items sold, **P-14**, 306.In service, **P-07**, 83.Inspection of, **P-13**, 247.Installation, mechanical division and ships, **P-14**, 171.On Isthmus, **P-09**, 148.Repairs, **P-10**, 231; **P-11**, 208; **P-12**, 249; **P-13**, 245; **P-14**, 259.Selected from other shops for permanent shop at Balboa, **P-12**, 267.Statement showing principal items in service or available on Isthmus, **P-08**, 78.**Equipment, Electrical.**Hydroelectric station, Gatun, **P-12**, 88.Inspection, **P-11**, 82; **P-12**, 93; **P-13**, 99.Rising stem gate valve machines, **P-14**, 102.**Equipment, Floating.** (See Dredges.)Dry docks, **P-13**, 215.Handling construction material, Gatun Locks, **P-09**, 50.Owned by Isthmian Canal Commission; statement of, **P-12**, 253; **P-13**, 251.Statement, in use by the various departments, **P-10**, 207; **P-11**, 203.Terminals, **P-12**, 220.**Equipment, Indicating.**Lock control, **P-12**, 89.**Equipment, Machinery and.**Status, **P-05**, 135, 141.**Equipment, Marine.**Repairs, cost of, **P-11**, 214; **P-12**, 250.**Equipment, Mechanical.**Rising stem gate valve machines, **P-14**, 102.**Equipment, Old and New.**Balboa shops, **P-14**, 179.**Ernst, Col. O. H.** (See Nos. 1, 64, 143, pp. 2361, 2363, 2364 of this Index.)Canal work; status, **P-05**, 139.**Estates.** (See No. 114, p. 2363 of this Index; see Civil Administration; see No. 225, p. 2366 of this Index.)Administration of, **P-07**, 158; **P-08**, 258; **P-09**, 260; **P-10**, 367; **P-11**, 419, 432; **P-12**, 462; **P-13**, 467; **P-14**, 54, 410.Administration of; costs saved, **P-06**, 34.Administration of; employees; laws, **P-05**, 100.Computation of pay, or in cases of injury, **P-13**, 622.Escheated, **P-11**, 432.Executive order governing administration of, **P-12**, 615; **P-13**, 617.**Estimates.** (See Nos. 46, 124, 190, 216, 229, 248, pp. 2362, 2364, 2365, 2366, 2367 of this Index.)Annual, required by Congress; act, **P-11**, 559, 577.Appropriation, 1908-9, **P-07**, 215.Atlantic division, cost of, **P-09**, 337.Canal, completed, cost of, **P-09**, 337.Canal cost, quantities, **P-09**, 350.Central division, **P-09**, 341.Construction and repair of buildings for the department of construction and engineering, **P-09**, 347.Excavation, Atlantic division, **P-09**, 60; **P-11**, 107; **P-12**, 114, 115, 145.Excavation, central division, **P-11**, 135.General expenses, **P-09**, 347.Land damages, **P-09**, 346.Loans, Panama R. R., **P-09**, 348.Lock canal; supplementary to a minority report of Board of Consulting Engineers, **P-06***, 425, 426.Original excavation and actual work, Mindi and Limon Bay, **P-10**, 116.Pacific division, **P-09**, 342.Profile and yardage estimate, central division, **P-12**, pl. 88; **P-13**, pl. 95.Profile and yardage estimates, **P-11**, pl. 109.Revised, **P-12**, 145.Slides, central division, **P-11**, 136.Work done, Gatun Locks, **P-11**, 118.**European Messes.** (See Messes, European.)**Europeans.**Sleeping quarters, **P-07**, 96, pl. 119.**Evaporation.** **P-10**, 284; **P-11**, 250; **P-12**, 225; **P-13**, 224; **P-14**, 144. (See Meteorology.)Brazos Brook station, **P-10**, pl. 129.Diagram showing, and allied phenomena, Bas Obispo station, 1907, 1908, and 1909, **P-09**, 204, pl. 78.Gatun Lake watershed, **P-14**, pl. 104.Isthmus, **P-10**, 277.Monthly, **P-10**, 284; **P-11**, 260; **P-12**, 235; **P-13**, 232; **P-14**, 150.Rio Grande station, **P-10**, pl. 130.**Examinations.** (See Surveys.)Bohio Dam, **P-05**, 12.Probable dam across Chagres Valley, **P-05**, 12.
Water under foundations, Gatun Locks, **P-08**, 124.**Examiner of Accounts.** (See No. 237, p. 2367 of this Index.)**Excavation.** (See Nos. 207, 210, p. 2365 of this Index; see Costs; Culebra; Digging; Plowing; Shovels, Steam.)Air drills working, Bas Obispo, **P-07**, 40, pl. 16.

- Ancon stone quarry, **P-09**, 97.
- Atlantic division, **P-09**, 66, pl. 13. (See Dredging.)
- Bas Obispo, **P-08**, 56, pl. 6.
- Blasting or mining, Pedro Miguel, **P-10**, 166.
- Bohio, **P-09**, 80.
- Buena Vista, **P-09**, 80.
- Caimito, **P-08**, 56, pls. 17, 18, 19, 20; **P-09**, 79.
- Canal prism, Caimito, June, 1909, **P-09**, 90, pl. 43.
- Canal prism, central division, **P-09**, 67; **P-10**, 137; **P-11**, 133; **P-12**, 143; **P-13**, 139.
- Canal prism, Miraflores, **P-13**, 175.
- Canal prism, Pacific division, **P-12**, 180.
- Cano River, **P-09**, 80, 90, pl. 42.
- Chagres division, **P-08**, 44.
- Chagres River, straightening, **P-11**, 156, pl. 37.
- Channel, Gatun to Atlantic Ocean, **P-10**, 111; **P-12**, 111.
- Channel; general map, Atlantic division, **P-09**, 66, pl. 13; **P-10**, pl. 96; **P-11**, pl. 98.
- Channel, San Pablo, **P-09**, 90; **P-12**, 170, pl. 38.
- Classification of material, Pedro Miguel to Balboa, **P-09**, 134, pl. 51.
- Coaling plant, Balboa, **P-14**, 203.
- Commencement of, Point 3, **P-09**, 90, pl. 45.
- Conduit tunnel, steam shovel rigged on skids for excavating, **P-13**, 254, pl. 59.
- Cost, **P-05**, 143; **P-12**, 295; **P-14**, 449.
- Cost, central division, **P-09**, 82; **P-10**, 155; **P-11**, 151; **P-12**, 164; **P-13**, 155.
- Cost, Chagres division, **P-08**, 46.
- Cost, Culebra, **P-06***, 395, 396.
- Cost per cubic yard, Mindi, **P-10**, 112.
- Costs, relative, Mindi and Mindi to Limon Bay, **P-09**, 57.
- Culebra, **P-06***, 395, 396; **P-07**, 40, pls. 13, 14; **P-09**, 76; **P-11**, 146.
- Culebra Cut, **P-07**, 40, pls. 13, 14; **P-14**, 40.
- Culverts, lateral, excavating Pedro Miguel Locks for, **P-11**, 192, pl. 55.
- Cut, deepest, Culebra, **P-13**, 160, pl. 39.
- Diagram, Pacific division, Pedro Miguel to Panama Bay, **P-09**, 134, pl. 54; **P-11**, pl. 116.
- Disposal, a problem, Panama, **P-07**, 22.
- Disposal of material, cheap method of, by short haul and sluicing, **P-11**, 156, pls. 32, 33.
- Disposal of material, central division, **P-12**, 153; **P-13**, 149.
- Diversion, Obispo, **P-09**, 67; **P-10**, 137; **P-11**, 133; **P-12**, 143; **P-13**, 139.
- Diversion, Obispo, deepest part of, **P-09**, 90, pl. 46.
- Dredges, by; Gatun Locks, **P-09**, 46; **P-13**, 125.
- Dredging, cost, **P-11**, 291; **P-13**, 276.
- Dry dock, approach for, and coaling plant, general view of excavation, Balboa, **P-13**, 254, pl. 55.
- Dry Dock No. 1, Pacific, monthly excavation, **P-13**, 197.
- Dry docks, work of steam shovels, **P-13**, 197.
- Dump after downpour, **P-07**, 28.
- Dumped per day, **P-12**, 154.
- Dumping from cars, **P-07**, pl. 33.
- East Mamel, **P-10**, 160, pl. 41.
- Effect of, on near-by dry dock walls, Balboa terminals, **P-14**, pls. 25, 26.
- Embankment, old Panama R. R., **P-12**, 170, pl. 39.
- Empire, **P-07**, 40, pl. 14.
- Equipment required, **P-06***, 405.
- Estimate of original, and amount done to date, Atlantic division, **P-11**, 107; **P-12**, 114.
- Estimate of quantities remaining to be done, Atlantic division, **P-12**, 115.
- Estimate, revised, of the total quantity yet to be removed, **P-12**, 145.
- Estimates, **P-11**, 135.
- Foundations, Miraflores, **P-11**, 164; **P-12**, 176. (See Locks, below.)
- Foundations, Pedro Miguel, **P-11**, 159; **P-12**, 173; **P-13**, 163.
- Gatun, **P-08**, 70, pls. 42, 43, 44; **P-09**, 53. (See Dams.)
- Gatun to Atlantic Ocean, **P-11**, 103.
- Gold Hill, **P-07**, 40, pl. 13.
- Hand excavation, principal items of, terminals, **P-14**, 219.
- Handwork, central division, **P-10**, 152; **P-13**, 152.
- Handwork contracts, **P-11**, 143; **P-12**, 153.
- Heated material, west side of canal, 350 yards north of Culebra Y, **P-12**, 170, pl. 31.
- Inner harbor, Pacific terminals, **P-13**, 201.
- Lock and dam site, Gatun, **P-08**, 70, pl. 32.
- Locks, **P-07**, pl. 42 (See Foundations, above.)
- Locks and dams, Miraflores, **P-09**, 94.
- Locks and dams, Pedro Miguel, **P-09**, 92; **P-13**, 162.
- Locks, Gatun, **P-07**, 56, pl. 42; **P-08**, 58; **P-09**, 46; **P-10**, 120, pl. 97; **P-11**, 113, pl. 99; **P-12**, 122; **P-13**, 115.
- Lock site, Gatun, **P-08**, 70, pls. 30, 31.
- Locks, Miraflores, **P-11**, 163; **P-12**, 175; **P-13**, 167.
- Locks, Pedro Miguel, **P-10**, 165; **P-11**, 158; **P-12**, 172; **P-13**, 162.
- Matachin and Gorgona, excavation between, **P-08**, 56, pl. 21.
- Methods, experiments to give best, Culebra, **P-05**, 117.
- Mindi, **P-08**, 46, 56, pl. 23; **P-09**, 66, pl. 27.
- Mindi, intersection of American and French canals, **P-11**, 132, pl. 25.
- Mindi section, **P-09**, 54.
- Monthly, central division, **P-09**, 68; **P-10**, 133; **P-11**, 134; **P-12**, 144; **P-13**, 140.
- Monthly, Mindi, **P-10**, 112.
- Organization, chart, **P-07**, pl. 137.
- Original, estimate and amount done to 1909, Atlantic division, **P-09**, 60.
- Original, estimates, Mindi and Limon Bay, **P-10**, 116.
- Output, monthly, and cost of excavation, Atlantic division, **P-11**, 106; **P-12**, 113.
- Output of shovels excavating dry fill, Gatun Dam, **P-12**, 130.
- Outside of prism, central division, **P-09**, 67.
- Outside work, central division, **P-10**, 137; **P-11**, 134; **P-12**, 143; **P-13**, 140.

Pacific terminals, **P-13**, 196, 201; **P-14**, 200.
 Pedro Miguel to Panama Bay, **P-09**, 134, pl. 54.
 Pedro Miguel to Miraflores, **P-11**, 166.
 Pipe lines and monitor, **P-10**, 177.
 Plant for, Gatun Locks, **P-10**, 121.
 Plant, hydraulic excavating, Miraflores, general plan, **B-10**, pl. 114.
 Plant, hydraulic, Pacific division, **P-11**, 190.
 Points 1, 2, 3, 4, 5, 6, **P-09**, 78, 79, 90, pls. 33, 37, 40; **P-10**, 142, 150, 151; **P-11**, 146, 147; **P-12**, 157.
 Problem of, Culebra, **P-05**, 119.
 Profile and yardage estimate, central division, **P-13**, pl. 95.
 Progress, Gatun Spillway, **P-13**, 129.
 Progress, Gatun Lock site, middle chamber, **P-09**, 66, pl. 15.
 Progress, Gatun Lock site, upper chamber, **P-09**, 66, pl. 16.
 Progress of, sections showing, Gatun Lock site, lower chamber, **P-09**, 66, pl. 14.
 Quantity to be removed, central division, **P-13**, 141.
 Rate of, Panama, **P-07**, 40.
 Rock, Gold Hill, **P-07**, 40, pl. 15.
 Rock, subaqueous, Pacific division, **P-10**, 173; **P-11**, 168; **P-12**, 184.
 Rock, subaqueous, sixth division, **P-13**, 188.
 San Pablo, **P-08**, 56, pls. 15, 16, 22; **P-09**, 79.
 Sea level, below Mindi, **P-10**, 111; **P-11**, 103; **P-12**, 111.
 Shoveling, Miraflores Locks, **P-11**, 192, pl. 53.
 Slides and breaks, central division, **P-12**, 161.
 Slides, Culebra, **P-12**, pl. 86. (See *Slides*.)
 Spillway, **P-07**, pl. 44.
 Spillway dam, Miraflores, **P-13**, 173.
 Spillway, Gatun, **P-07**, 56, pl. 44; **P-08**, 70, pl. 33.
 Status, **P-05**, 143.
 Terminals, Cristobal, **P-10**, 113; **P-12**, 112.
 Total, central division, **P-10**, 138; **P-11**, 134.
 Total, including accessory work, central division, **P-09**, 67; **P-12**, 144; **P-13**, 140.
 Trains, making up, **P-07**, pl. 26.
 Transportation a factor, **P-05**, 119.
 Transportation, central division, **P-09**, 74.
 Tropics, best periods, **P-05**, 118.
 Yardage and rainfall, diagram of, central division, **P-12**, pl. 82.

Excavation and Dredging, Department of. (See No. 219, p. 2366 of this Index.)

1905. Stopped by Isthmian Canal Commission No. 3 until preparatory work of sanitation, quarter providing, terminal construction, etc., had been adequately arranged, **P-05**, 6.
 Estimate of rate of. "Demonstrated that each steam shovel may be counted upon to yield an average record of at least 1,000 c. y. per working day. The chief engineer estimates that with 100 steam shovels installed, with a complete system of tracks serving them, a yearly record of 30,000,000 c. y. of excavation may be reached without requiring a greater

output per shovel or greater speed in working than has already been attained. This rate of working could probably be reached within two years from the present time." **P-05**, 299.

1906. Engineering work hitherto considered preparatory. Delay in deciding upon type of canal made it impracticable to locate permanent and well-arranged dumping grounds. Levels at Culebra Cut put in proper condition for installation of a maximum number of steam shovels, etc. 1,500,000 c. y. excavated during the year, as against 742,000 c. y. previously. Notwithstanding rainy season (Apr.-Dec.), 244,844 c. y. taken from Culebra, the largest amount taken out up to that time during any one month since the canal came under American control. "At the close of the fiscal year, which was practically the date of the decision, as to the type of canal, the conditions in Culebra Cut regarding the installation of shovels and consequent large increase in the output, were generally satisfactory. At the beginning of the fiscal year there were 10 shovels erected and ready for work. There was available in Sept., 1906, a total force of 46 steam shovels, of which 27 were at work in the canal prism, 2 outside the prism, 4 on the Panama R. R., and the rest set up and ready for work in various places." **P-06**, 7.

1907. Department embraced the Culebra division (from Chagres River to Pedro Miguel); Chagres division (between deep water in Lake Gatun and the Chagres River); the Colon dredging division (Gatun to deep water in the Atlantic); and the La Boca dredging division (taking in all the excavation between the La Boca Locks and deep water of Pacific), **P-07**, 2.

Culebra division: "That the preparation (mentioned in the annual report of Isthmian Canal Commission No. 3, 1906) was efficiently done and the organization effective is best attested by the results accomplished and the relatively small falling off of the output during the wet months; thus the amount of material removed from the Culebra Cut was 4,047,071 c. y., place measurement, from Jan. 1 to June 30, out of a total of 5,570,432 c. y. for the fiscal year."

Division, 10 miles long, subdivided into 5 construction districts, each under a superintendent of construction. Better results.

July to Sept., inclusive, output over 2,300,000 c. y. 77 working days. An average of about 40 shovels at work.

During rainy season dumps a source of delay; soft, impeding trains.

Surveys looking to preventing water from adjacent watersheds entering canal. Plans under way for carrying Obispo waters, etc., into Chagres River. **P-07**, 2, 3.

Chagres division: Preparatory work; surveys and borings; Chagres crosses this division 22 times; desirable that rockwork be done in

advance of excavation (in dry); steam shovels diverted from Culebra division to this division after close of fiscal year, **P-07, 3.**

Colon dredging division: Consists of Mindi and Colon districts; 700,000 c. y. to be shoveled in former; necessary preparations under way. Dredging in progress, mostly in vicinity of dry-dock slip, and along the route of the old French canal as far as Gatun, the latter for transportation of materials to site of lock construction.

Dredging fleet: Old French ladder dredge, 5-yard dipper dredge, one 16" suction dredge. Under contract: Dipper dredge, and seagoing suction dredge, 6 steel hopper barges.

Dredges during year served by tug and 4 old French self-propelling clapets.

1,112,321 c. y., place measurement, dredged (43,602 c. y. rock), 17,000 c. y. being from canal prism.

Machine shop at Cristobal equipped with many pieces of new machinery.

Steps taken to enlarge dry dock, to take vessel 15' by 50' by 298'. **P-07, 3, 4.**

La Boca dredging division: Surveys continued to determine line of canal; test borings.

Dredging fleet: One old French ladder dredge and one 5-yard dipper. Second French ladder dredge, after repairs, put in operation about end of year.

Under contract: Seagoing suction dredge; to come by way of Cape Horn to Panama; 3 steel hopper barges.

Dredging plant served by 7 French self-propelling dump barges.

1,235,897 c. y. dredged, 64,352 c. y. of which taken from canal prism.

Machine shop at La Boca fairly well equipped for marine work; repairing and building of clapets, launches, etc. **P-07, 4, 5.**

1908. Embraces Culebra division, Chagres division, Colon dredging division, and La Boca dredging division, **P-08, 2.**

Equipment: Fourteen 70-ton steam shovels, sixteen 95-ton steam shovels, 292 Lidgerwood cars, and 668 12-yard dump cars added. With 200 more dump cars, equipment should be complete for this class. **P-08, 2.**

Culebra division: Division extends from Chagres River in the vicinity of Gamboa to include the Pedro Miguel Lock, a distance of 9.2 miles, **P-08, 3.**

12,065,138 c. y., place measurement, 11,685,253 c. y. being from canal prism. Steam shovels assigned, 59. **P-08, 3.**

Dumps, Culebra division: Greater part of material hauled over main line of Panama R. R. to Gorgona and Tabernilla on the north, and to two new dumps on the south, at Miraflores and La Boca. Average haul, 10 miles. Rock from the "cut" at Obispo taken to Gatun; since Mar. 20, 1908, 1,300 c. y. deposited daily on the south toe of the dam. **P-08, 3.**

Diversions, Camacho: French diversion channel on west side of canal utilized; new channel revetted with stone cut through White House yard, the French tunnel through the hill at Obispo cleared out, and a dam constructed across Obispo River. Waters carried from Culebra to the Chagres River, near Matachin. **P-08, 3.**

Diversion, Obispo: Survey for diverting Obispo River and other streams on the east side of the canal completed, a new channel located, and construction pushed. Channel finished from Gold Hill to a point opposite Las Cascadas. Waters to be carried into the Chagres River about 1 mile above the crossing of the river by the canal. 313,511 c. y. excavated. **P-08, 3.**

Slides, Cucaracha: Movement begun Oct. 4, 1907; 14' in 24 hours, decreasing later to about 4' a day. 113,000 c. y. stopped transportation through to the south. Work of excavating through carried on day and night; in a month trains going through. Area of slide, 34,455 sq. y.; 600,000 c. y. in motion. **P-08, 3, 4.**

Slides, Paraiso: Developed Apr., 1908. On east bank. Estimated area, 16,700 sq. y.; amount in motion, about 140,000 c. y. 90,000 c. y. removed. **P-08, 4.**

Slides, New Culebra: West bank. Area, 6,110 sq. y.; about 50,000 c. y. in motion. **P-08, 4.**

Slides, Las Cascadas: East bank. Area, 5,433 sq. y. In motion, 100,000 c. y. **P-08, 4.**

Slides: Uplift of bottom of cut, Culebra, corresponding with sinking; similar action just south of Gold Hill. Removing material on upper levels stopped sinking. **P-08, 4.**

Chagres division: Surveys of last year completed; center line of canal permanently marked. Saving of 1,264,700 c. y. made by slight change in alignment (264,300 c. y. being rock). Surveys show total of 12,256,300 c. y. to be removed, 8,313,500 c. y. being earth **P-08, 5.**

Excavation begun on four different sections—San Pablo, Caimito, Matachin, and Santa Cruz. Total excavated, 1,774,124 c. y. **P-08, 5.**

Overflow protection: Levees built at Santa Cruz and Matachin, and pumps and sumps installed, **P-08, 5.**

Equipment: Steam shovels, 15. Balance of equipment mostly French—47 out of a total of 50 engines French, and 410 of the 645 dump cars. **P-08, 5.**

Colon dredging division: Division extends from foot of Gatun Lock to deep water in the Caribbean Sea; embraced Mindi and Colon districts, and Cristobal marine shops.

Survey: Of Mindi district completed.

Clearing: Between Mindi and Limon Bay finished Aug.

Excavation: Begun with steam shovels July; 2 removed 536,959 c. y.

Levee: Built along low part of prism to protect cut from waters of French canal.

Dredging: Done by 2 French ladder dredges, 2 dipper dredges, a 16" suction dredge, and by seagoing suction dredge "Ancon." Total, 5,087,623 c. y. removed, about 5,000,000 being from prism.

Machine shops: Additional machinery installed. Dredges received from U. S. and reerected.

Dry dock: Enlargement completed; capable of taking ship 15 by 50 by 293'. **P-08**, 5, 6.

La Boca dredging division: Limits extended by change in location of locks and dams on Pacific side, about 3 miles. Area to be dredged to extend from the Miraflores Locks to deep water in the Pacific (about 8 miles), with a width of 500'.

Excavation: Quantity to be removed, about 30,000,000 c. y., about 1,500,000 c. y. being rock.

Borings: Being made to determine amount and character of rock.

Rock removal: Experimental plant arranged for.

Channel alignment: Slight change made, with abandonment of the lock site at La Boca, so as to utilize the existing wharves of the Panama R. R. Co., as well as the dredging already done.

Plant: Suction dredge "Culebra," and 4 French ladder dredges; a dipper dredge part time.

Excavation: Over 5,270,000 c. y. removed (9,350 c. y. being from accessory works). **P-08**, 6.

Dump: Spoil from removal of Cardenas Hill dumped along the east bank of the Rio Grande, forming a dike for confining suction dredgings; over 55,000 c. y. utilized from canal prism.

Shops: Repairs, U. S. dredge reerected; shops in new location not subject to floods; fitted up for permanency. **P-08**, 6, 7.

Chagres division: Covers distance of about 23 miles. Extends from Gatun to a point where the canal crosses the Chagres River at Gamboa. River crosses canal 23 times in these limits; prism, hence, subject to overflows, producing delays. **P-08**, 5.

(See Atlantic division, Central division, and Pacific division.)

Excavation and Expenditures.

Charts showing, **P-09**, 180, pl. 76; **P-10**, pl. 124; **P-11**, pl. 119; **P-12**, pl. 95; **P-13**, pl. 103.

Excavation, Department of. (See No. 219, p. 2366 of this Index.)

Excavation, Dry, **P-14**, 28, 241.

Cost, **P-11**, 290; **P-12**, 294; **P-13**, 276; **P-14**, 445.

Cost, average, **P-13**, 245.

Cost, average of, in central division, and of wet excavation in Atlantic and Pacific divisions, **P-12**, 250.

Cost, central division, **P-11**, 217.

Culebra Cut, **P-14**, 241.

Dredging division, La Boca, **P-08**, 52.

In prism, Miraflores to Pedro Miguel, **P-11**, 166.

In prism, Pacific division, **P-10**, 169; **P-12**, 180.

Locks and dams, Miraflores, **P-10**, 169; **P-11**, 163; **P-12**, 181; **P-13**, 174.

Pacific division, **P-09**, 92; **P-10**, 162; **P-11**, 168; **P-12**, 172; **P-13**, 162.

Terminals, Balboa, **P-12**, 187.

Excavation, Operation. (See No. 264, p. 2368 of this Index.)

1914. Excavation for prism in dry, uncompleted at close of previous year, embraced Culebra Cut from Gamboa to Pedro Miguel Locks, channel Pedro Miguel to Miraflores Locks, and channel below Miraflores Locks to dike which excluded waters of Pacific. As noted in previous report, decision reached to admit water to cut by blowing up dike at Gamboa Oct. 10, 1913, and complete excavation by dredges. Excavation in cut carried on during July with average of 40.74 steam shovels; Aug., with average of 34.65 steam shovels; and Sept., with average of 14.62 steam shovels. These shovels worked not only in cut proper, but on upper reaches in vicinity of Culebra and on east side opposite Lirio. After water had been admitted to cut, 5 to 2 shovels worked on both east and west bank in vicinity of Culebra to lighten load. Work on east bank continued until Apr. 1, 1914, and on west bank intermittently until June 15, 1914. Last movement of considerable amount occurred on west side of Culebra just as steam shovels were withdrawn. Removed during year total of 3,122,702 c. y., 2,205,847 c. y. classified as rock. Work continued on Cucaracha slide, Culebra slides, Hagan's slide, Lirio slide, and powder-house slide until steam-shovel operations suspended; removed from these slides 2,635,902 c. y.; in other words, 84 per cent of material removed from cut due to slides. Total material removed in dry from Culebra Cut, from beginning of American operations to June 15, 1914, 110,261,883 c. y.; of this amount, 25,206,100 c. y. removed because of slides. This was increase of 4,940,100 c. y. over estimate in report for 1912. Steam-shovel operations in cut proper permanently suspended Sept. 10, 1913; estimated 600,000 c. y. remained to be removed by dredges from cut section within original limits of canal, exclusive of slides and inclines at north and south ends of cut. Practically all of this material lay between Cucaracha slide and point about midway between Culebra and Empire.

To prevent possible damage to canal due to velocity of current caused by difference in head between Gatun Lake level and bottom of cut, water admitted through 24" pipe extending into lake under Gamboa Dike, these pipes remaining from old pumping plant located in vicinity to take care of drainage water north of divide. This done 9 a. m., Oct. 1. Work on drilling dike at Gamboa preparatory to demolition begun latter part of Aug.; holes loaded and fired Oct. 10, 2 p. m. Blast fired by President Woodrow Wilson, at

Washington. The President depressed lever, current relayed from point to point along the route to local circuit, closing it and tripping a weight attached to handle of switch. Weight threw switch, setting off blast. Result of explosion was clear opening 125' wide through which water from Gatun Lake flowed in sufficient volume to complete filling cut from dike to Cucaracha slide in about 2 hours' time. Prior to dynamiting dike water in cut about 6' below level of lake.

Oct. 10 after blowing up Gamboa Dike, effort made to dynamite passage through Cucaracha slide to flood cut between dike and Pedro Miguel Locks. Though steam shovels had been at work on slide with view to securing passage, on cessation of this work movement continued and completely blocked channel. Attempt to open passage by dynamite not successful; it was not until Oct. 12 that a stream of water was gotten through and area to south of slide began to fill. Dredges reached Cucaracha slide from north end Oct. 20 and from south end Oct. 24. Gamboa Dike attacked by dredges immediately after explosion. Channel finally dredged through Cucaracha slide to permit passage of dredging fleet, Dec. 13. With exception of small pocket slide in vicinity of Cascadas, admission of water to cut had no bad effects; no perceptible tendency for water to produce slides.

In central division 44.5 miles track removed July 1 to Oct. 10, 33.7 miles laid, and 294.81 miles shifted.

Sluicing to north of Gold Hill and to rear of Cucaracha slide continued, removing 1,384,455 c. y. rock and earth.

Material removed in dry from cut wasted bulk going to Balboa waste dumps, where 1,017,596 c. y. deposited, and on dumps along relocation of Panama R. R., where 920,748 c. y. placed.

South of Pedro Miguel Locks 306,700 c. y. excavated by fifth division. Of this, 20,510 c. y. from channel south of Pedro Miguel Locks and 286,190 c. y. from prism south of Miraflores Locks. Material was used as back fill to lock sand for sloping Miraflores Dam.

Total excavated in dry, Pedro Miguel to sea, since beginning of work, aggregated 4,819,969 c. y.

Berm and chamber cranes on west side of locks taken down and stored; 4 berm cranes, which formed part of concrete-handling plant during construction of Pacific Locks, used in connection with coal-handling plant at Balboa.

Steam-shovel work south of Pedro Miguel Locks stopped Aug. and south of Miraflores Locks Sept.; steps taken to remove tracks that remained within limits of canal channel. Last remaining barrier at Pacific end of canal dynamited 9.30 o'clock Aug. 31, 1913. This dike, composed of trestle fill of rock and earth, prevented water from sea level from entering steam-shovel cut, 46' below mean tide by 500' by 5,000', extending to Mira-

flores Locks. Rio Grande diversion turned into this pit Aug. 23, but depth of water had only reached about 15' Aug. 31. 37,000 pounds dynamite used, charge being placed in 541 holes at average depth of 30'. At time of explosion water in channel south of barrier nearly at low tide. Dynamite tore gap in dike about 100' wide, but as bottom of gap was still at some height above existing tide level no water passed through until high tide, at 1.35 p. m. At 3 o'clock, 1 hour and 25 minutes after water first began to flow over, level in inside channel that of outside channel, while gap had been widened to 400' or more. As noted in previous reports, two low places in the perimeter of Gatun Lake were to be raised to avoid possibility of waters of lake escaping—one was in vicinity of Gatun, and embankment built across it. Fill about 350' long and containing 4,117 c. y. made, which raised surface to elevation 105, with crown width of 15'. Nov. 28, 1913, contract made for earth dike at Cano Saddle No. 4, along ridge 12 miles southwest of Gatun, to raise rim of Gatun Lake at that point to 105' above sea level. Material involved 71,500 c. y.; completed May, 1914. Saddle between head-waters of Siri River and Lagarto River, which flows into Caribbean Sea. Surface of earth at lowest point, 87.4' above sea level. Fill approximately 900' long between 105' contours on knolls at ends of saddle. It is 15' at top, with slope of 1 on 3 both sides.

Excavation, Hydraulic, P-10, 172; P-11, 291.

Central pumping station, Agua Dulce, **P-10**, 196, pl. 48.

Costs, **P-12**, 296; **P-13**, 277.

Dredging pumps, Pacific division, **P-10**, 177.

Fifth division, **P-13**, 185.

Methods, Pacific division, **P-10**, 178.

Pacific division, **P-10**, 176; **P-11**, 190; **P-12**, 203.

Pipe lines and monitor, Pacific division, **P-10**, 177.

Plant, Pacific division, **P-12**, 203.

Excavation, Rock.

Pacific division, **P-10**, 173; **P-11**, 167; **P-12**, 184.

Second district, Pacific division, **P-09**, 100.

Excavation, Subaqueous.

By districts, **P-14**, 237.

Executive Department. (See Civil Administration; see No. 103 and No. 271, pp. 2363, 2368 of this Index.)

1914. Department outgrowth of department of civil administration. Prior to reorganization, Apr. 1, department of civil administration under supervision of Mr. R. L. Metcalfe-appointed member of Isthmian Canal Commission Aug. 9, 1913, succeeding Commissioner M. H. Thatcher. He arrived on Isthmus Aug. 7, 1913. Since reorganization Mr. Metcalfe has been member of committee for formal and official opening of the Panama

Canal, created by Executive order May 20, 1914. Department embraces general office business of governor, work under supervision of executive secretary as already outlined, courts, and offices of special attorney, district attorney, and Canal Record. In charge of Mr. C. A. McIlvaine, acting under the governor.

Customs service: 280 vessels entered Balboa, total tonnage, 569,681; and 277 vessels cleared; total tonnage, 558,334. At Cristobal 295 vessels entered; tonnage, 832,579; and 296 vessels cleared; tonnage, 838,708. Usual customs services rendered seamen and vessels, and interests of Panama guarded by customs inspectors on wharves.

Estates: Estates of 452 deceased and insane employees of the Panama Canal and Panama R. R. Co. administered.

Posts: 13 post offices in operation, 6 of the 17 offices in existence at close of fiscal year 1913 discontinued, while 2 new offices established. The sale of postage stamps and postal cards, including the revenue derived from the sale of stamp books, amounted to \$90,590.63, as compared with \$100,485.54 for previous fiscal year, and \$463.67 were collected for second-class mail matter, as compared with \$318.84 for the preceding year. Money orders amounting to \$4,029,364.83 issued. As compared with preceding year, decrease of \$854,259.30 in amount; and decrease of \$3,938.71 in fees collected. 5,113 postal savings accounts opened, 2,180 of which active at close, with deposits aggregating \$498,481. Total deposits for year, \$1,708,530, as compared with \$1,601,616 for previous year. In addition there were on deposit at close of year \$70,750.41 in form of money orders issued and drawn on zone post offices payable to remitter.

Schools: Opened Oct. 1, 1913, with enrollment of 2,167 children—1,109 in white schools and 1,058 in colored schools—as compared with 2,199 during Oct., 1912. Total during year, 1,270 in white schools and 1,492 in colored schools. In addition to white schools at Gorgona and Toro Point and colored schools at Gorgona and Matachin, closed in 1913, the white school at Bas Obispo and colored schools at Miraflores, Pedro Miguel, and Cruces not reopened, and schools permanently closed at Mandingo Dec. 19, 1913, Marajal colored school Feb. 6, 1914, branch high school at Empire on Feb. 20, 1914, white school at Porto Bello Apr. 24, 1914, and colored school at Cucaracha May 29, 1914, \$1,089 collected as tuition from nonresidents of zone, as compared with \$744 during 1913. Medical inspection of white schools continued, fire drills inaugurated, and hand chemical extinguishers installed. Public-school athletic league formed in white schools, and annual meet of league held June 12, 1914, in canal clubhouses at Balboa, Corozal, Empire, Gatun, and Cristobal; 193 participants.

Police and fire division: Police, prisons, and fire protection consolidated Apr. 15, 1914,

under designation "police and fire division." Positions of assistant chief of police, fire chief, and assistant fire chief abolished and position of fire inspector created. Station at Gorgona and substation at Matachin closed July 17, 1913. On Aug. 31, 1913, call station at Matachin abolished, and Dec. 15, 1913, station at Bas Obispo abolished. July 18, 1913, call station at Cucaracha abolished. On Sept. 14, 1913, station at Miraflores abolished; also station at Las Cascadas on Dec. 15, 1913. Mount Hope station abolished Apr. 15, 1914; station at Paraiso on same date, and station at Porto Bello May 13, 1914. Arrests totaled 4,911—4,455 males and 456 females—as compared with 6,827 arrests for previous year. 5,021 charges—4,713 misdemeanors and 308 felonies. Of total arrested, 3,927 convicted. 75 convicts confined in penitentiary June 30, 1914, as compared with 133, 1913. Operation and supervision of markets and slaughterhouses of zone turned over to police division July 16, 1913. At Empire 1,533 animals killed. Rentals derived from stalls and tables in public markets, \$2,599.75. Five markets in operation June 30, 1914, three having been discontinued during year.

Sept., 1913, fire station, together with equipment, at Gorgona removed to Corozal, and one-man volunteer fire station at this point discontinued. Las Cascadas station closed Apr. 30, 1914, and apparatus and equipment desired by military authorities at that point transferred to them. Equipment withdrawn from Bas Obispo and Porto Bello stations Aug. 20, 1913, and May 6, 1914, respectively. Fire pump and turret nozzle removed from tug "Bolivar" during preceding year, installed on claret "No. 7," Aug., 1913, to provide water-front and harbor fire protection at Balboa. Fire protection provided new piers, Nos. 8 and 9, Cristobal. 215 alarms responded to, 8 false; of 207 actual fires, 98 occurred in property of Panama Canal, 14 in Panama R. R. property, 27 in private property, and 68 in grass, rubbish, dumps, etc., on zone. Of fires in private property, 11 occurred in Colon, 1 in Panama, 1 at old Porto Bello, in Republic, and 14 in zone. Largest fire in zone Jan. 3, 1914, in pile of creosoted and untreated piling stored about three-quarters mile south of shops at Balboa, where it was impossible to drive apparatus. Automobile fire engine loaded on flat car and hauled to scene. Total loss to Panama Canal, \$14,551.71.

Courts: Supreme court held 24 sessions, disposed 29 cases—3 criminal, 25 civil, and 1 habeas corpus—and ceased to exist June 30, 1914.

Circuit Court of Third Judicial Circuit, Cristobal, last criminal session Mar. 26, 1914. At Ancon last regular session of Circuit Court of First Judicial Circuit held Mar. 30, 1914; and at Empire last regular session of Circuit Court of Second Judicial Circuit held Mar. 31, 1914. While further business relating to these

courts formally ordered over to new district court Apr. 1, they continued to act on civil cases until May 1, pending confirmation of appointment of new district judge. In circuit courts, July 1, 1913, to May 1, 1914, 395 criminal cases filed and 4 cases pending July 1, 1913, making total of 399. Of this total, 370 cases disposed of, leaving 29 pending May 1, 1914. 158 civil cases filed during period and 51 civil cases pending July 1, 1913. Of this number, 179 disposed of, leaving 30 civil cases pending. 435 probate cases filed, which, with 57 probate cases pending July 1, 1913, made total of 492 probate cases before court. Circuit courts held 225 sessions. District courts discontinued Apr. 1, 1914. July 1, 1913, to Apr. 1, 1914, 4,183 cases settled, 3,656 of which criminal. Pending July 1, 1913, 35 civil and 3 criminal cases, and pending Apr. 1, 1914, when courts closed, 1 civil case.

On Apr. 1, 1914, courts of zone ceased to exist, pursuant to provisions of Executive order Mar. 12, 1914, with exception of supreme court, which went out of existence June 30, 1914. The judiciary created by act of Congress consists of district court and two magistrates' courts. District court consists of two divisions, known as Balboa division and Cristobal division. Former includes all that part of zone within lines of 10-mile zone and extends from south bank of Chagres River and shore line of Gatun Lake, 87' above mean sea level, to Pacific Ocean. Latter includes all territory within lines of 10-mile zone extending from Balboa division to Atlantic Ocean and area of Gatun Lake beyond lines of 10-mile zone up to contour line of 100' above mean sea level and islands and peninsulas in and bordering on Gatun Lake taken by U. S. for Panama Canal. A magistrate's court for both Cristobal and Balboa, jurisdiction of each covering that division, into which zone is divided as described for district court, in which town is located.

District court has original jurisdiction of all felony cases, all causes in equity and admiralty, all cases at law involving principal sums exceeding \$300, and all appeals from judgments rendered in magistrates' courts. Jurisdiction in admiralty of district court is same as that exercised by U. S. district courts and procedure and practice are same. Circuit Court of Appeals of Fifth Circuit of U. S. has jurisdiction to review, revise, modify reverse, or affirm the final judgments and decrees of district court of zone in certain cases, and final appeal may be had to Supreme Court of U. S. in same manner as appeals from district courts of U. S.

Magistrates' courts have exclusive original jurisdiction throughout subdivision in which situated of all civil cases in which principal sum claimed does not exceed \$300, and all criminal cases wherein punishment that may be imposed does not exceed fine of \$100 or imprisonment not exceeding 30 days, or

both; all violations of police regulations and ordinances and all actions involving possession or title to personal property or forcible entry and detainer of real estate. Magistrates also hold preliminary investigations in charges of felony, and commit or bail in bailable cases to the district court.

In district court under new judicial system during May and June, 1914, 206 cases settled—9 civil, 120 probate, and 77 criminal. In magistrates' courts 1,203 cases settled, leaving 18 cases pending.

Negotiations carried on with Republic included following: Enforcement of quarantine; regulations; establishment of rates for transportation of passengers by automobile between points in zone and Panama and Colon; enforcement of sanitary rules and regulations; use of revenue stamps on bills submitted by Isthmian Canal Commission and Panama R. R. against Republic; new contract for street cleaning and garbage removal in Panama; charge for interments in zone of remains of persons who resided in Republic; water supply for village of Taboga; certification by Panaman consuls of manifests of ships clearing for ports of zone; jurisdiction of U. S. over islands and peninsulas in Republic formed by waters of Gatun Lake; sale in Republic of dynamite stolen from Panama Canal; collection of burial fees for interments in zone cemeteries of indigents from Republic; assessment of commercial tax by Republic on steamers of Panama R. R. Steamship Co.; improvements in Chorrillo district of city of Panama; misuse of transportation issued to employees of Republic; modification of existing arrangement for purchase of postage stamps used in zone; sale of old administration building in city of Panama; water supply for section of Panama known as "El Hatillo"; cooperation of Republic health officers with those of zone in effort to prevent introduction of plague into Panama from infected ports on west coast of South America; enforcement of exclusion law in zone; use in zone post offices of U. S. postage-due stamps; modification of existing agreement respecting release of mail parcels received by gold employees through zone post offices; arrest in Panama of Panama Canal employees while engaged in discharge of duties; care of patients by health department for Republic in consideration of withdrawal of request of Panaman Government for establishment of independent hospital in Colon; removal of garbage and street cleaning in city of Panama; construction in Republic of military trails at expense of U. S.; segregation of stables in city of Panama within certain areas; desirability of having Panaman Government cancel licenses for five saloons near zone boundary line; granting of commissary privileges to certain persons not connected with Panama Canal or Panama R. R.; deportation of American in city of Panama charged with fraudulently representing himself as attorney

licensed to practice in zone courts; deportation of criminal characters from zone; violation of quarantine regulations; securing of statistics concerning health conditions in interior towns of Republic; promulgation by Panama of resolution with reference to manifests of vessels arriving at ports of zone with cargo for consignees in Republic; substitution of properly surcharged stamps of Republic for surcharged U. S. postage-due stamps used in zone post offices; installation and cost of municipal improvements in area in Colon set aside for erection of manufacturing plants; protection of revenues of Panama in connection with parcel-post entries into zone; and admission to Ancon Hospital, as pay patients, of Americans residing in Republic who, on account of character of their employment, not entitled to hospital privileges. Relations with Republic and with foreign representatives satisfactory.

Time keeping: Time-keeping work centralized; time keeping of all departments and divisions, with exception of Panama R. R., done by time-keeping bureau.

Clubs and playgrounds: Division of club houses continued to exist to Mar. 31, 1914, when, in reorganization, it became bureau of clubs and playgrounds. Activities conducted under supervision of secretaries furnished by Y. M. C. A. Gorgona clubhouse closed Aug. 1, 1913; removed to Pedro Miguel; reerected and opened Jan. 27, 1914. Porto Bello clubhouse closed May 1, 1914; being reerected with improvements as clubhouse for colored men at La Boca. Decided to inaugurate system of playgrounds in permanent towns of zone; equipment and supervision under jurisdiction of this bureau.

Canal Record: Canal Record continued under direction of secretary of the commission, Mr. Joseph Bucklin Bishop, until Apr. 1, 1914, when he was designated special secretary and continued in charge until July 1, when he resigned. Record transferred to charge of executive secretary.

Law: Law department continued in charge of Judge Frank Feuille until Apr. 1, when reorganization became effective. Since Apr. 1 Judge Feuille continued as special attorney for purpose of codifying laws of zone and to defend interests of U. S. before joint land commission in acquisition of lands in private ownership taken over in accordance with Executive order of Dec. 5, 1912.

Number of Executive orders of legislative character issued, the more important of which were orders prohibiting flights over the Isthmus by machines; providing punishment to deported persons returning to zone; fixing legal rates of interest; prohibiting gifts or gratuities to agents, employees, or servants; providing punishment for persons engaged in practice of hunting deer or other animals at night by use of lanterns or torches; to establish permanent organization for zone:

and order conferring power upon governor of zone to remit fines and forfeitures, to grant pardons, reprieves, and commutations of sentences, and to establish system of paroling prisoners.

Joint land commission, appointed under Panama Canal treaty between U. S. and Panama, in session from July 1 until middle of Sept., when one American commissioner resigned, his resignation being followed by that of the other American commissioner. Commission heard and disposed of 1,253 claims; 602 were dismissed, awards made in 629, disagreed in 22. During same period law department settled 752 claims, aggregating the sum of \$48,659. From discontinuance of joint land commission until end of year law department adjusted 1,528 claims; so that total claims settled without intervention of joint land commission during year was 1,903, aggregating \$147,452.50. On May 25, 1914, joint land commission reorganized with Messrs. Federico Boyd and Samuel Lewis, who served on previous commission, and Messrs. Levi Monroe Kagy and David Marks, the two American members. Work of commission interrupted by death of Commissioner Marks, at Ancon Hospital, July 17, 1914.

Leases for lots in Culebra and Empire districts, including villages of Empire, New Empire, Camacho, Golden Green, New Culebra, Cow Pen, and West Culebra, canceled on behalf of Panama R. R., June 30, 1914. At the same time leases for Panama R. R. lots in New Gatun canceled, but cancellation did not become effective until after close of year. **P-14, 54-62.**

Executive Office. (See Office, Executive; see No. 103, p. 2363 of this Index.)
Department of civil administration, **P-12, 457.**
Details of duties, **P-05, 58.**

Executive Order. (See Orders, Executive.)

Executive Secretary. (See No. 270, p. 2368 of this Index.)

Expenditures. (See Appropriations; see Nos. 46, 150, 228, 235, pp. 2362, 2364, 2366, 2367 of this Index.)

Audit should be with Isthmian Canal Commission, **P-05, 121.**

Classification, detailed; statement, **P-07, 214.**

Classified, to June 30, 1910, **P-10, 347.**

Excavation, chart of, **P-09, 180, pl. 76.**

Motive power and machinery, division of, **P-07, 84; P-08, 78.**

Municipal engineering, division of, **P-07, 79; P-08, 91.**

Municipalities, **P-07, 172.**

Panama R. R. relocation, **P-12, 284.**

Report, **P-04, 75, 76.**

Statement, consolidated, from inception of canal work to June 30, 1908; Appendix H, **P-08, 218, 220.**

- Itemized list of expenditures and receipts,
June 28, 1902, to Sept. 30, 1904. Budget for
fiscal year ending June 30, 1905, and 1906.
P-04, 72.
- Expenses.**
Contingent, table of, **P-06**, 49.
Mechanical division, **P-11**, 241.
Shops, **P-11**, 225; **P-13**, 253, 265.
Shops, per cent for, **P-12**, 261.
- Expenses, Administrative and General.**
Comparative statement of, **P-10**, 234; **P-11**,
215, 301; **P-12**, 309; **P-13**, 287; **P-14**, 455.
- Expenses, Traveling.**
Order governing, **P-05**, 211.
- Experiments.** (See Dams, Experimental.)
Dams, Gatun, **P-08**, 134.
Dams, lines of saturation; Gatun Dam studies,
P-08, 196, pls. 109-119.
Materials deposited in, Gatun Dam studies,
P-08, 196, pls. 131, 132.
Prism, work on, **P-05**, 108.
Spillway, Gatun, models used of, **P-10**, 64,
pl. 1.
Tank for experimental dam, Gatun, **P-08**,
196, pl. 107.
- Explorations, P-09**, 201; **P-10**, 301.
Arroya, **P-10**, 301.
Barro, **P-11**, 266.
Cano, **P-10**, 301; **P-11**, 286.
- Egronal, P-11**, 287.
Gatun, **P-10**, 302.
Lagarto, **P-10**, 301.
Material in prism and lock and dam structure,
Pacific division, **P-09**, 92.
Methods and results, Gatun Dam studies,
P-08, 153.
Quebrancha, **P-10**, 303.
- Explosives.** (See Dynamite.)
Ancon quarry, **P-12**, 202; **P-13**, 184.
- Exposition to Celebrate Opening of Canal.**
Act relating to, **P-11**, 573; **P-13**, 608.
- Expropriation Proceedings.** (See No. 100, p. 2363
of this Index.)
For lands required in connection with pro-
posed fixing of seat of zone government at
Ancon, **P-05**, 53.
- Extradition.**
Agreement reached with Panama, **P-06**, 19.
Decree of Panama and executive order of
governor of zone relative to procedure for
the extradition of fugitives from justice of
the respective territories, **P-06**, 75.
Panama, **P-07**, 152.
Other countries than Panama, extradition to,
P-07, 152.
- Eyebars.**
Driving pin for eyebars of top chord of emer-
gency dam, Pedro Miguel, **P-13**, 110, pl. 10.
- ## F.
- Faces, Dam.**
Gatun Spillway, **P-12**, 142, pls. 26, 27.
- Families.**
Four-family houses, Balboa Village, **P-14**,
pl. 69.
Houses, family, **P-07**, 96, pl. 111.
Houses for, Culebra, **P-07**, 80, 96, pl. 125.
Houses for, Empire, **P-07**, 96, pl. 120.
- Family Quarters, P-07**, 80, 88, pls. 101, 102, 103.
(See Quarters, Family.)
- Fasteners.**
Lock gates, **P-10**, 54.
- Faults.** (See Geology.)
Fault plane, geological, vicinity of Lirio, **P-12**,
214, pl. 61.
- Faure, Ad.**
Cost-keeping accountant. **R.** (See Nos. 250,
272, pp. 2367, 2368 of this Index.)
- Fenders, Chain, P-12**, 81; **P-14**, 70.
Arrangement of, locks, **P-11**, pl. 80.
Chain-fender machines, **P-14**, 13, 112.
Diagram showing stopping power, **P-11**,
pl. 82.
- General assembly, **P-11**, pl. 81.
Locks, **P-10**, 51; **P-11**, 71; **P-13**, 81.
Locks, general assembly, all pits except Nos.
852, 853, 854, and 855, lower approach to
Miraflres Locks, **P-13**, pl. 79.
Locks, general assembly of fenders in lower
approach at Miraflres Locks, **P-13**, pl. 80.
- Feuille, F.** (See Nos. 252, 273, p. 2368 of this In-
dex.)
- Field Work.** (See Surveys; Gauging.)
Hydrology, **P-13**, 236.
- Fifth District, Pacific Division, P-11**, 190;
P-12, 203.
- Fifth Division.** (See No. 255, p. 2368 of this In-
dex.)
- 1913.** Pacific division abolished Dec. 12, 1912,
and fifth and sixth divisions of O. C. E.
organized.
Fifth division has charge of construction of
locks, dams, spillway, excavation in dry in
prism between and below locks, operation
of Ancon quarry, municipal engineering work

within area covered by works of division, and such sanitary engineering work as prescribed by sanitary department within area. Work in charge of H. O. Cole as resident engineer. Excavation of Pedro Miguel Locks completed by removal of 3,044 c. y. from locks. Bulk of excavation consisted of removal of French dump east of lock site; material utilized for back fill. In addition to excavation for completing locks, 2,190 c. y. removed for construction of northeast core wall built to prevent passage of water back of east wall. Excavation done by hand, and extended under tracks of old Panama R. R. in use by central division. To prevent flooding locks, cofferdam left to south until completion of concrete work of locks, and subsequent increase in length of south approach pier to 1,200' prevented its completion until after cofferdam could be removed. In preparing foundations for guide pier and for wing walls 15,366 c. y. removed, of which 10,701 c. y. rock. Total excavation for locks, approach piers, and guide walls, including preparation of foundations, 1,319,742 c. y. Total concrete placed during year, 58,367 c. y., mixed entirely by auxiliary mixers consisting of two 2-cubic yard mixers at north end of locks on west side and of average of 3.05 $\frac{1}{2}$ -cubic yard mixers, moved about as necessity required. Concrete handled either by derricks and locomotive cranes or dumped direct into place through chutes. Of this, 39,465 c. y. were plain concrete and 18,902 c. y. reinforced concrete. Total concrete placed prior to July 1, 1913, in Pedro Miguel Locks, 906,293 c. y.

Back filling of lock, wing walls, and center wall completed, and riprap finish at ends of south wing walls partially placed. Amount used in back fill, 367,150 c. y., of which 193,212 c. y. were in center wall, balance behind side walls. Total back fill placed to June 30, 1913, 806,538 c. y. back of lock walls and 215,149 c. y. in center wall. West dam at Pedro Miguel, consisting of rock-filled sides and puddled-clay core, completed and top finished at elevation 107 with clay. North face riprapped with hard stone at 85' level. 114,117 c. y. fill added, making total in dam 696,558 c. y.

Miraflores Locks carried to completion. Foundation work for lower west wall seriously interfered with and retarded by slides and by water-bearing strata of banks. In some places necessary to build retaining walls to prevent mud from flowing onto foundation areas; and slides carried away berm-crane tracks, necessitating use of auxiliary concrete mixers for laying wall bases sufficiently high to secure bearing for berm-crane tracks. Similar difficulty experienced with south guide walls, especially on east side of locks, which could be built only in small sections. Concrete would be pushed as far as possible, then stopped until another portion of slide could be removed; in this way slide gradu-

ally encroached upon until guide or flare wall completed. North flare walls founded on piles; on west side of locks piles driven in marsh and weight supported entirely by friction on piles. While back filling, this portion of wall constituting return bulged slightly; further movement checked by depositing material along face of return, adding counterweight.

Center approach piers constructed to full length of 1,200' each from angle of flare walls. North wall of cellular reinforced concrete construction and founded on concrete caissons sunk to rock. Caissons consist of reinforced concrete shells $7\frac{1}{2}$ ' in diameter and 1' thick, built up in sections 6' long and sunk progressively, bottom shell fitted with steel shoe for cutting edge. Caissons sunk to bedrock at average depth of 29.43' and filled with concrete, forming solid columns to rock. They were spaced 15' centers longitudinally and 27' centers transversely. Wall then supported on heavily reinforced concrete girders spanning caissons in both directions. South approach wall of massive concrete and founded on natural rock.

Construction plant, consisting of 4 berm and 4 chamber cranes, supplied concrete. Total concrete laid in Miraflores Locks during year, 450,792 c. y., of which 402,607 c. y. plain concrete and 48,185 c. y. reinforced concrete. Of total, 308,914 c. y. laid by 4 berm cranes. Chamber cranes handled 218,135 c. y. concrete and 92,359 c. y. fill for center wall. Concrete furnished in part by mixers on berm cranes and by 2-yard mixers on east wall, operated July 1, 1912, to Oct. 26, 1912, producing 97,603 c. y. In addition to regular plant, average of 3.12 $\frac{1}{2}$ -yard portable mixers used. Total concrete laid in Miraflores Locks to close of year, 1,476,895 c. y. Concrete in locks proper completed May 17, except reinforced concrete floor and stairway in middle wall at junction of upper and lower locks, completed June 10. There remain to be completed lamp-post bases, snubbing-button bases, parapets around stairways, and nosing at end of south center approach pier, added during year to completed plans. Total concrete laid in Pacific Locks, July 1, 1913, 2,382,983 c. y.

Back filling lock walls continued with material from locks and prism excavation and aggregated 1,128,769 c. y., of which 149,301 c. y. were in center wall. Total back fill placed behind walls to June 30, 1913, 2,006,054 c. y., and in center wall 157,213 c. y. Sept. and Oct., 1912, 9,896 c. y. excavated for spillway dam by hydraulic method. Owing to limited space and excessive rainfall this method abandoned; no work done until beginning of dry season; excavation resumed by steam shovels and by hand. Situation complicated by fact that central division tracks for hauling spoil from cut to south passed through spillway site, and it was desired to give central division as much advantage during dry

season as possible. Assumed that spillway must be completed by Sept. 1, 1913. To meet this required removal of central division tracks from site by Mar. 1, 1913; not accomplished until Mar. 4, and when excavation of entire site could proceed, found that more material had to be removed than was estimated, and greater amount of concrete needed. Difficulty experienced due to fact that Rio Grande passed through site of dam and had to be diverted twice. After concrete for west end of dam brought up to elevation of bottom of river, dike constructed confining water to space sufficient to enable it to discharge through opening left in concrete of dam, and another dike built on south side to confine water after passage through opening. After these were finished further trouble from this source avoided. To credit of those engaged in construction, structure completed, notwithstanding difficulties and delays, Sept. 1, 1913, including placing of gates and erection of steelwork for walk way on top. Opening for passage of Rio Grande left until gates at Pedro Miguel completed. In addition to material removed by hydraulic method, 124,775 c. y. excavated by steam shovels, hand, derricks, and cranes, completing excavation for spillway dam.

Total concrete laid in spillway, 64,142 c. y., of which 63,707 c. y. plain concrete and 435 c. y. reinforced concrete. In laying this concrete narrow-gauge tracks laid from berm cranes located on east side of locks to south toe of dam, ending in various spurs leading to derricks which handled concrete mixed by berm cranes and delivered on transfer cars in 2-yard buckets. Berm cranes mixed for use at spillway 27,619 c. y. In addition, average of 1.43 1-yard mixers and 1 $\frac{3}{4}$ -yard mixer supplied 38,551 c. y. West dam at Miraflores completed, with exception of junction of dam with back fill along west lock wall. Hydraulic fill in west dam completed during previous year and total dry fill added was 418,375 c. y. As this dry fill was advanced over hydraulic fill, softer material crowded to center and increased in height and, as it was not sufficiently hard to bear tracks, outlet was cut on west side of dam through which much of soft material crowded out, assisted by water jet. What remained pushed over on west slope of dam by raising and crowding east dry fill.

Excavation in dry between Pedro Miguel and Miraflores Locks and south of locks continued, spoil being used for back filling lock walls, for dams, and filling swamp areas on east and west sides of canal. Total removed, 379,626 c. y. To divide more equally excavation between steam shovels and dredges, to keep latter at work, new dike built across canal 3,300' north of old one. After closing down hydraulic excavating plant which had excavated area between these dikes to rock at elevation approximately minus 20, area drilled to minus 45 and blasted preparatory

to being excavated by dredges after area rewatered. Steam shovels, prior to turning in of water, took out 59,000 c. y. rock. Lower dike drilled to grade and blown up May 18, advancing water to new dike. Total removed below Miraflores Locks by steam shovels, 2,949,943 c. y.

Total dry excavation in prism, 3,120,851 c. y. Ancon quarry operated for about 3 years without general overhauling until May 16, 1913, when it was shut down for 10 days for putting in various repair parts. Small No. 5 gyratory crusher, taken from old Rio Grande quarry, installed on floor of south end of rock bins for crushing larger rock to supply increased demand for smaller-sized stone. Total produced, 688,301 c. y., of which 424,460 c. y. placed in storage, 21,301 c. y. supplied to municipal division, and 161,311 c. y. supplied to other divisions and departments.

Hydraulic excavating plant continued at work until Dec. 1, 1912, when it was taken out of service. Material removed used for reclaiming tidal swamp lands east of and adjacent to prism. Total removed, 451,631 c. y., making total removed by this method 1,549,904 c. y.

Plant still in serviceable condition, and suggestion made that at least part be utilized in sluicing soft material found, on north side of Gold Hill and on top of east bank of Culebra Cut. Bank had been to a certain extent stepped back by steam shovels in process of lightening loads on upper part of bank, but this work stopped Aug., 1912, on score that Lidgerwood cars could not be spared for this service and that material could not be handled economically with steel side-dump cars during wet season. Rain had cracked bank badly and part had sloughed off into cut. To the north and east of Gold Hill lies valley of the Obispo, and material excavated by steam shovels on this upper bench deposited on dump extending almost across valley of river. By continuing dump entirely across valley and placing culvert pipes through dam that would result, water could be allowed to flow through former channel and Obispo diversion to Chagres River. By tilting these pipes upward on south side of dam they would form spillway to any pool that dam might make; calculations indicated sufficient pool could be created to furnish water for pumps to sluice back into depression to east some clay that would otherwise fall into cut. After renewed activity of Cucaracha slide, decided to make use of sluicing plant for this purpose. Location for pumps and pipe line such that rear of Cucaracha Hill could be taken off and washed back into valley to east by relay pumps and whatever material remained on cut side of Cucaracha Hill could be washed down to dredges, thereby finishing Cucaracha slide for good and all. Work placed in charge of resident engineer of fifth division. Work on

installation of hydraulic pumping mains and flumes started Feb. 1, 1913. Two boilers and two Worthington pumps erected, with necessary flumes. Dam has created lake of 180 acres, with drainage area of 4 sq. m. Elevation at bottom of suction at pumping plant, 214' above sea level, and elevation of pipes forming spillway 223. Material washed back into depression which forms lake, and discharges at such a distance from pumping plant that water used in sluicing returned to lake and used over again, requiring only small inflow to keep lake at constant elevation. Sluicing begun June 17, 1913, and 57,274 c. y. removed by this method. Booster pumps ordered; when received, operations for attacking rear of Cucaracha Hill will be begun.

To meet increased demand for water at Ancon and Panama, two pressure filters removed from Miraflores power house and installed in Ancon filtration plant. On account of future inundation, 16" Rio Grande water main taken up between Pedro Miguel and Miraflores power house, and work of relaying it along Panama R. R. line partially completed at close of year. Construction work on locks made it necessary to relay portions of 10" main between Coccol pumps and junction with 16" main at Miraflores power house.

Grading completed on new road, Diablo to Ancon, and macadam partly placed and rolled at close of year. Work on road included construction of 20' span concrete bridge over Corundu River.

Work started on permanent town site at Balboa in Mar. and included installation of 750 linear feet of reinforced concrete storm sewer and 1,222 linear feet of reinforced concrete drains, filling hydraulically of a portion of town site with material pumped from inner harbor excavation, laying out permanent laborers' barracks, and location of permanent administration building. In connection with latter, 36,500 c. y. material excavated preparatory to installation of foundations, concrete piers for columns placed, and erection of steel frame for superstructure begun.

Sanitary work consisted of cleaning 593,127 linear feet of earth drains, excavating 5,079 c. y. of new earth drains, sweeping 1,023,382 linear feet of cement drains, filling 2,862 c. y. of holes and swamps, laying 2,520 linear feet of tile drains, constructing 10,566 linear feet of cement drains, and clearing 131 acres of vegetation. P-13, 28-35, 161.

(See p. 2368 of this Index.)

FILL.

Colon, P-11, 107; P-12, 115.

Gatun Dam, P-08, 61.

Gatun Dam, estimated quantities of fill placed, P-10, 124.

Gatun Dam, section showing, P-09, 66, pl. 20.

Limon Bay, P-10, 113.

Output of steam shovels excavating material for dry fill, Gatun Dam, P-12, 130.

Pedro Miguel, P-10, 168; P-11, 162; P-12, 175; P-13, 165; P-14, pls. 72, 73.

Permanent shops, Pacific terminals, P-13, 199.

Settlement, P-13, 17.

Terminals, P-13, 202; P-14, 203.

Toes, Gatun Dam fill, P-08, 61.

Fill, Back.

Gatun, P-10, 123; P-11, 118; P-12, 128; P-13, 121.

Miraflores, P-11, 166; P-12, 179; P-13, 172; P-14, pl. 14.

Pedro Miguel, P-10, 168; P-11, 162; P-12, 175; P-13, 165.

Fill, High.

Completing, Panama R. R. Gatun, P-09, 136.

Fill, Hydraulic.

Colon, P-11, 129, 294.

Gatun, P-09, 66, pl. 24; P-10, 123; P-11, 132, pl. 21; P-12, 142, pl. 25.

Levees for retaining, near Mindi, P-11, 104; P-12, 111.

Filling. (See Locks.)

Filters.

Agua Clara, P-12, 136; P-13, 132

Agua Clara filter plant, P-11, 126.

Building, Gatun waterworks, P-11, 132, pl. 24.

Building, Miraflores, P-14, pl. 97.

Building, Mount Hope, P-14, pls. 17, 18.

Mount Hope, P-11, 128; P-12, 139; P-13, 134.

Plant, Gatun waterworks, P-11, pl. 103.

Filtration. (See Water Supply; Waterworks.)

Ancon, P-10, 180.

Ancon pumping and filtration station, details and cost, P-13, 177.

Ancon station, P-09, 103; P-11, 174; P-12, 188; P-13, 176.

Coccol pumping and filtration plant, P-10, pl. 117.

Coccol station, P-10, 181; P-11, 175; P-12, 188.

Dam, Gatun, study, through different materials, P-08, 153.

Mount Hope plant, P-07, 76; P-10, 135; P-11, 127; P-14, pls. 17, 18.

Pumping, Coccol, P-12, 188, 189.

Purification plant, Agua Clara, P-14, pl. 16.

Finances. (See No. 76, p. 2363 of this Index.)

Clubhouses, P-10, 438; P-11, 535; P-12, 559; P-13, 559; P-14, 403.

Firearms.

Executive order relating to, P-12, 611.

Fires. (See Engines; Civil Administration; see No. 118, p. 2363 of this Index.)

Company and house, P-07, pl. 114.

Department, P-07, 164.

Division, P-14, 56.

Drill, P-07, 64, pl. 75.

Drill, P-07, pl. 75.

Drill, Colon, P-07, 64, pl. 75.

House, Ancon, P-07, 96, pl. 114.

Precautions against, P-07, 165.

Protection, division of, P-07, 77; P-08, 260; P-09, 264; P-10, 369; P-11, 423; P-12, 466; P-13, 469; P-14, 413.

Station, **P-14**, 320.

Station, Cristobal, **P-08**, 280; pl. 183.

Station, Gatun, **P-08**, 280, pl. 184.

Statistics, **P-07**, 172; **P-11**, 434.

Storehouse, Mount Hope, **P-07**, 103.

Storehouse, Mount Hope, after fire, **P-07**, 104, pls. 130-133.

Fires, Destruction by.

Destruction of property by fire, and liability of the Isthmian Canal Commission. 30 houses were destroyed in Panama, Jan. 12, 1906, the fire said to have been caused by fumigating methods. Owners presented claims. Comptroller of the Treasury suggested that the value of the property destroyed might be assessed by a joint commission for the condemnation of property required for canal purposes, as provided by treaty, and that the legality of the awards thus established could then be decided and tested. **P-06**, 21.

Plans made for paid fire departments at Cristobal and Ancon. Volunteer departments established at various points. Extinguisher apparatus provided generally. Special means held in readiness at places of risk. All the fires discovered in their beginnings. Damages kept under. **P-06**, 37.

First District, Fifth Division.

Work of, **P-13**, 162.

First District, Pacific Division, **P-09**, 92; **P-10**, 162; **P-11**, 158; **P-12**, 172.

First Division, Office of the Chief Engineer. (See No. 239, p. 2367 of this Index.)

Fixtures, Plumbing.

Installation, **P-08**, 104.

Flats.

Flowing off flats. Tabernilla, **P-07**, 48, pl. 32.

Fleets.

Visits of, **P-13**, 559; **P-14**, 559.

Float Wells.

Mechanism, locks, **P-11**, 81.

Flooding.

Culebra Cut by opening Gamboa Dike, **P-14**, pl. 60.

Floods.

Canal Zone, **P-05**, 297.

Chagres River, **P-05**, 297.

Control of, Canal Zone, **P-05**, 299.

Control of, Chagres, **P-04**, 42.

Cut at Bas Obispo, **P-10**, 160, pl. 27.

Cut at Cairnito during flood in Chagres, 1909, **P-09**, 90, pl. 44.

Deposits of sand and gravel from floods, Point 2, **P-10**, 160, pl. 29.

Diversion, Camacho, near outlet of tunnel, Chagres River, **P-09**, 90, pl. 50.

Fluviograph, Chagres River, 1909, **P-10**, pl. 134.

Run-off for floods exceeding elevation 60 at Gamboa, **P-10**, 296.

Floor Areas.

Permanent shops, **P-14**, 177.

Floors.

Gatun Locks, **P-11**, 132, pl. 11.

Gatun Spillway, **P-09**, 66, pls. 25, 26.

Lateral connections, Miraflores, **P-11**, pl. 113.

Miraflores Lock, **P-10**, 196, pl. 45.

Pedro Miguel Locks, **P-10**, 196, pl. 43.

Reinforcement, Balboa pier, **P-14**, 28.

Terminal construction, **P-14**, 171.

Flow.

Rate of flow of water under various heads, Gatun Dam studies, **P-08**, 196, pl. 99.

Flowage, Underground.

Alluvial valleys and, Gatun Dam studies, **P-08**, 196, pl. 173.

Diagrams showing conditions controlling, Gatun Dam studies, **P-08**, 196, pls. 168-170.

Measured velocity of, Gatun Dam studies, **P-08**, 196, pl. 173.

Fluviographs.

Chagres River, 1909 flood, **P-10**, pl. 134.

Station, Chagres River, at Bohio, **P-10**, 303, pl. 63.

Flying Machines.

Executive order, **P-14**, 560.

Fogs, **P-10**, 285; **P-11**, 250, 261; **P-12**, 226, 235; **P-13**, 224; **P-14**, 144.

Isthmus, **P-10**, 27.

Light and fog signals, west breakwater **P-12**, p. 76; **P-13**, pl. 87.

Percentage of fogs dissipated, **P-11**, 261.

Food, (See Commissary Subsistence; see No. 91, p. 2363 of this Index.)

Relative value of, consumed per day in Isthmian Canal Commission hotels, **P-10**, 324; **P-13**, 396.

Supply, proper food, to employees, further steps needed to obtain, **P-05**, 144.

Footbridges.

Fixed irons, **P-13**, 74.

Forage.

Stabling and, **P-08**, 234, 246.

Force. (See Employees.)

Forces. (See Charts.)

Forebays. (See Locks.)

Miraflores Locks, **P-11**, 192, pl. 56.

Oscillations of water level in, Pedro Miguel Locks, **P-14**, pl. 74, 76.

Pedro Miguel Locks, **P-11**, 192, pl. 52.

Foreign Countries. (See Countries, Foreign.)

Foreigners.

Executive order relating to business of, in zone, **P-13**, 619.

Foreign Representatives. (See Representatives, Foreign.)

Formations. (See Geology.)

Geological, ridge near Escoval, **P-09**, 204, pls. 84-88.

Foremen.

Reduction in, **P-11**, 224.

Forms. (See Bids; Bonds; Specifications.)**Forms, Concrete.** (See Bids; Bonds.)

Approach walls, Pedro Miguel Locks, **P-12**, pl. 90.

Connection of side wall culvert and laterals, **P-11**, pl. 111.

Cylindrical valve chamber, form used at Pacific division locks, **P-11**, pl. 112.

Lateral culvert forms, Miraflores Locks, **P-10**, 196, pls. 45, 46.

Lock walls, **P-09**, 66, pl. 18.

Miraflores, **P-11**, 165; **P-12**, 179; **P-13**, 171.

Pedro Miguel, **P-10**, 168; **P-11**, 162; **P-12**, 175, pl. 90.

Steel, culverts, Gatun Locks, **P-11**, 132, pl. 16.
Tee, used for equalizing culvert and floor lateral connections, Pacific division locks, **P-11**, pl. 113.

Wooden, special forms, lock building, Pedro Miguel, **P-11**, 162.

Formula.

Flight of locks, cross filled, **P-10**, 87.

General formula for lifts, locks, **P-10**, 76.

Paints, **P-09**, 180.

Formula, Hodges.

Application to 1,000' lock, Gatun, **P-10**, 77.

Fortifications, P-11, 550, 580; **P-12**, 597; **P-13**, 611; **P-14**, 65. (See Defense.)

1912. When it was determined to fortify the canal, recommended that construction be done by Isthmian Canal Commission, utilizing forces and such plant as could be spared from other work under its charge. Proposed at same time, in order that completed work might embody latest improvements in battery construction, that plans be prepared by the Chief of Engineers, U. S. Army, subject to approval of Panama Fortification Board, and batteries and accessories built in accordance. Recommendation received approval at Washington. **P-12**, 1.

Act Mar. 4, 1911, appropriated \$2,000,000 for gun and mortar batteries for defense of canal against naval attack. Work commenced Aug. 7, 1911, under provisional organization which continued until Jan. 1, 1912, when work was consolidated and placed in charge of Lt. George R. Goethals, U. S. Army, reporting to chief engineer. 408,392 c. y. excavation done, 5,159 c. y. concrete laid, and channel excavated to one of islands by dredging 32,150 c. y. **P-12**, 1, 47.

1913. By act Aug. 24, 1912, \$1,000,000 appropriated for gun and mortar batteries, making total appropriated \$3,000,000, sufficient for completion of this portion of work. In addition, \$200,000 appropriated for land defenses. Work continued on gun and mortar batteries. Detailed surveys for location of land defenses well advanced to completion and arrangements made to begin

work July 1, 1913, on construction of redoubts in accordance with plans prepared by board appointed by Sec. of War. 416,542.5 c. y. excavation done, 131,952.8 c. y. concrete laid, 93,808 linear feet piling driven, and 100,957 c. y. filling done by one dredge. Work in charge of Lieut. George R. Goethals, U. S. Army, assisted by Lt. A. H. Acher, U. S. Army, and R. M. Elder and H. P. Warren as superintendents of construction, **P-13**, 49.

1914. Work continued during year on gun and mortar batteries; by close of year concrete work practically completed, as well as greater portion of back fill. July 1, 1913, construction of redoubts in accordance with plans prepared by a board appointed for purpose and approved by Sec. of War undertaken; completed, as well as clearing necessary in connection with them. **P-14**, 65, 66.

Foundations. (See No. 231, p. 2366 of this Index.)

Borings to investigate, Gatun Dam, **P-08**, 196, pls. 140-147.

Caissons in reloader, Cristobal coaling station, **P-14**, pl. 31.

Caissons, sinking, Miraflores Locks, **P-13**, pl. 98.
Concrete, Pacific terminals, **P-13**, 200.

Construction of, Gatun Spillway, **P-10**, 136, pl. 15.

Excavation, Miraflores Locks, **P-11**, 164; **P-12**, 176.

Excavation, Pedro Miguel Locks, **P-11**, 159; **P-12**, 173; **P-13**, 163.

Locks, **P-10**, 166.

Locks and dams, Pacific division, tests, **P-09**, 92.

Locks, Miraflores, **P-10**, 170; **P-11**, 163; **P-12**, 176; **P-13**, 166.

Locks, Pedro Miguel, **P-11**, 159; **P-12**, 172; **P-13**, 163.

Machines, terminal shops, **P-13**, 301; **P-14**, 206.

Materials in, Gatun Locks, **P-08**, 121.

Permanent shops, Pacific terminals, **P-13**, 199.

Pile foundations, standard rail-top box, culverts, Panama R. R., **P-09**, 142, pl. 72.

Piles driven, shops, Pacific terminals, **P-13**, 200.

Piling for, costs, **P-12**, 304.

Planes, joint, and issuing stream, Gatun Dam, **P-08**, 196, pl. 85.

Profiles, Gatun Locks, **P-08**, 126, pl. 55.

Report of Maj. Harding, Corps of Engineers, Gatun Locks, **P-08**, 121-125.

Shop tools, machinery, etc., **P-13**, 201.

Study of, Gatun Dam, **P-08**, 166.

Submarine foundations, range towers, Gatun Lake, **P-13**, 110, pl. 15.

Terminal construction, **P-14**, 170.

Test holes for, Gatun Dam, **P-08**, 58.

Water under, Gatun Locks, **P-08**, 124.

Wharves, Pacific division, **P-11**, 171.

Foundries.

Car and foundry department, **P-10**, 267; **P-11**, 236.

Gorgona shops, **P-09**, 145.
Iron and brass, operations, **P-10**, 272; **P-11**, 241.
Operation, **P-12**, 275.
Storage, **P-12**, 271.
Work for locks, **P-11**, 82.

Foundry and Pattern Shop, P-11, 237.

Fourth District, Pacific Division, P-10, 195;
P-11, 189; **P-12**, 202.

1914. Jan. 1, 1914, all dry excavation in progress in Culebra Cut, construction of Naos Island Breakwater, sluicing operations on east bank of cut north of Gold Hill to relieve pressure, and fill of town site at Balboa consolidated and placed in charge of George A. Greenslade, general superintendent, and constituted the fourth division of O. C. E. **P-14**, 2.

Frames, Steel.

Administration Building, Balboa, **P-13**, 186, pl. 54. M

Frames, Stoney Gate Valve.

In position, Miraflores Locks, **P-11**, 192, pl. 59;
P-12, 108, pl. 9.

Franchises. (See No. 8, p. 2361 of this Index.)

Freeman, F. C., Superintendent, Club-houses. See No. 247, p. 2367 of this Index.)

Freight.

Handling, **P-10**, 58.
Panama R. R. freight yards, **P-14**, 44.
Statement, **P-09**, 212; **P-10**, 311; **P-11**, 359;
P-12, 283; **P-13**, 391; **P-14**, 302.

French. (See Nos. 25, 26, p. 2361 of this Index.)

Old bridge of, connected with trestle, Gamboa, **P-08**, 216, pl. 178.

Work of French companies: Their work not to be spoken of lightly. Those directing it men of international skill, and their associates some of the best engineering talent of Europe. Its large scale operations were embraced within about 72 months. They excavated about 1,000,000 yards a month. Haste was imperative with them, due to the limited concession, enormous interest charges, etc. The residue of their plant testifies to the feverish energy with which it was used. Cost was a secondary object. Since their time there have been huge strides in modern methods. The terror of yellow fever has also been conquered. **P-06***, xii.

French Barges. (See Barges.)

French Canal.

Connection to, dredged, **P-10**, 136, pl. 7.

French Government. (See No. 164, p. 2365 of this Index.)

French Ladder Dredges. (See Dredges, French Ladder.)

French Material, P-09, 211.

French Pier, Old.

Relocation of main tracks to, Pacific terminal, **P-13**, 195.

French Push Cars, Old.

Utilized in handwork, **P-10**, 160, pl. 31.

Freshets, P10, 291; **P-12**, 240; **P-13**, 237. (See Discharge; Floods.)

Chagres, diagram, Gamboa, **P-10**, pl. 136.

Data on slopes of Chagres during freshet period, Nov., 1912, **P-13**, 243.

Data on slopes, Chagres River: and Gatun Lake, during reshet period, **P-14**, 164.

Four largest, 1910, **P-11**, 268.

Gamboa, 1890 to 1911, **P-11**, 271.

Hydrography, **P-11**, 267.

Important feature of, Chagres River, since 1906, **P-10**, 295.

Principal, **P-12**, 245; **P-13**, 243; **P-14**, 163.

Run-off for floods exceeding elevation 60 at Gamboa, 1910, **P-10**, 296.

Surface slopes, Chagres River, freshet Feb., 1911, **P-11**, pl. 126.

Three largest, Chagres River, Gamboa station, 1906-1909, **P-09**, 204, pl. 77.

Friction.

Frictional resistance of rocks, apparatus and methods of determining, Gatun Dam studies, **P-08**, 136.

Frictional resistance of rocks, Gatun Dam studies, **P-08**, 135.

Soils, Gatun Dam studies, **P-08**, 138.

Fuel.

Canal situated near to important sources of natural supply, **P-13**, 579.

Coal and oil consumed, **P-09**, 82; **P-10**, 156; **P-11**, 151, 210; **P-12**, 166, 251; **P-13**, 155.

Consumption, **P-13**, 249.

Deposits, zone, **P-13**, 578.

Fuel oil, Pacific division, **P-09**, 102.

Fuel-oil plants, **P-12**, 217; **P-13**, 218; **P-14**, 40, 194, pls. 121, 122.

Fuller's Earth.

Deposits, zone, **P-13**, 577.

Fumigating.

View of force, Panama, **P-05**, pl. 32.

Funds. (See Appropriations; Disbursements; Expenditures.)

Canal Zone, **P-07**, 159; **P-08**, 263; **P-09**, 267; **P-10**, 373; **P-11**, 430; **P-12**, 471; **P-13**, 475.

Receipts and disbursements, **P-05**, 89.

G.

Gallard, Lt. Col. D. D.

Report. (See Nos. 217, 219, 241, pp. 2366, 2367 of this Index.)

Retirement, **P-14**, 561.

Gamboa Lake.

Probable effect of, **P-05**, 298.

Gangs.

Drilling gang at work, Gatun Dam studies, **P-08**, 196, pls. 76, 77.

Task gang at work, Panama R. R., **P-09**, 142.

Gardens, School, P-11, 433.**Gas.** (See Acetylene.)

Buoys, **P-13**, 108..

Gas, Natural.

Possibilities, zone, **P-13**, 579.

Gatehouse.

Hydroelectric station, Gatun, **P-14**, pl. 10.

Gates, Caisson.

Caisson, floating, **P-10**, 51; **P-11**, 75; **P-12**, 81; **P-14**, 18.

Gates, Crest.

Water running through, Gatun Spillway, **P-13**, 133, pl. 29.

Gates, Guard.

Constructing, method of, Gatun Locks, **P-11**, 10, 132, pls. 2, 14; **P-12**, 103, pls. 1, 3

Construction of upper guard and upper gates, Pedro Miguel, **P-12**, 103, pl. 5; **P-13**, 108, pl. 4.

Gates, Intermediate Lock. (See No. 249, p. 2367 of this Index.)

Advisability of using. **R.**, assistant chief engineer, in charge of first division of O. C. E., **P-10**, 65, 70.

Advisability of using, Miraflores, **P-10**, 70.

Advisability of using, Pedro Miguel, **P-10**, 73.

Effect of omitting intermediate gates of locks, **P-10**, 103.

Gatun, **P-12**, 103, pl. 1.

Intermediate gate study, locks, Miraflores, **P-10**, 93-100.

Prisms of lift of intermediate gates, locks, **P-10**, 87.

Proposed for Gatun Locks, **P-10**, 65, 66.

Saving due to, Gatun, various areas, **P-10**, 80, 82, 84, 87, 88, 89, 93.

Study, single-lift locks, Pedro Miguel, **P-10**, 93.

Water saved by intermediate lock gates, **P-10**, 79.

Gates, Lock, P-11, 68; **P-12**, 74; **P-13**, 77, 78; **P-14**, 10, 63. (See Gates; Miters; Locks; see No. 233, p. 2367 of this Index.)

And protective devices, **P-09**, 37; **P-10**, 49; **P-11**, 68; **P-12**, 74.

Appurtenances, correcting, **P-13**, 3.

Bridge for the erection of lock gates, Pedro Miguel, **P-11**, 192, pl. 46.

Caissons. (See Caissons.)

Construction of safety and lower gates, Pedro Miguel, **P-12**, 103, pl. 6.

Contracts, **P-12**, 82.

Crank-gear machinery, cover seats for, **P-12**, 92.

Current observations below Miraflores, **P-14**, 159, pl. 111.

Curve leading from Stoney gate chamber, **P-11**, 132, pl. 17.

Designing, **P-10**, 50.

Designing, report on, showing status, **P-08**, 197.

Effect of different density of water on the two sides. **R.** of a special board. **P-11**, 85-99.

Erecting, methods used in, **P-12**, 77.

Erection, Gatun Locks, **P-11**, 117; **P-12**, 128; **P-13**, 121.

Erection, increasing progress, **P-13**, 5.

Fastening, **P-10**, 54.

Fixed irons, weights of, embedded in concrete, **P-10**, 51; **P-13**, 81.

Gatun, **P-12**, 103, pl. 1.

Leaves, **P-09**, 42, pl. 8; **P-10**, 50.

Machines, **P-09**, 39; **P-14**, 11.

Miter, perfect; proposed machinery for forcing, **P-10**, pl. 84.

Miters, forcing machines, **P-12**, 87; **P-13**, 90; **P-14**, 11.

Movable dam and; designs, by Hodges, **P-08**, 197-200.

Moving machine, strut compression, **P-14**, pls. 83, 84.

Moving machines, **P-11**, 78; **P-13**, 90.

Opening and closing, current duty, **P-14**, pls. 77, 78, 79, 80, 81, 82.

Operating machinery, proposed arrangement of, **P-10**, 53, pls. 82, 83.

Panama, rivets, 5,700,000, **P-13**, 5.

Plans, general, **P-10**, pl. 95.

Safety devices, Gatun, **P-12**, 103, pl. 1.

Torque of valve machines, Miraflores Locks, **P-14**, pl. 76.

Vanadium steel yoke, tested to destruction, **P-11**, 100, pl. 3.

Valves. (See Valves.)

Weights of mitering lock gates (57,552 tons), **P-13**, 6, 89.

Weights of iron, etc., embedded in concrete of, **P-13**, 81.

Gates, Lower Guard.

Ready for entrance of Atlantic waters, Gatun, **P-13**, 110, pl. 1.

Gates, Miter. (See Gates, Lock.)

Anchorage, **P-09**, 42, pl. 9.

Diagram showing progress in manufacture and erection, **P-13**, pl. 78.

Dry docks, terminals, **P-13**, 210.

Forcing machines, **P-10**, pl. 84; **P-12**, 87; **P-13**, 90.

Leaf, plan, **P-09**, 42, pl. 8.

Machinery, proposed, **P-10**, pls. 82, 83.

Machinery, test of miter gate, **P-13**, 7, 91.

Moving machinery, dry docks, **P-13**, 210.

Moving machines, **P-12**, 108, pl. 7; **P-13**, 90;
P-14, 105, pls. 77-84.
Opening and closing, strut compression, **P-14**,
pls. 83, 84.
Plan showing method of erection, **P-12**, pl. 73.
Recess cover, **P-13**, 110, pl. 4.
Sill on masonry, general drawing of, **P-09**, 42,
pl. 10; **P-12**, pl. 72.
Weights, **P-10**, 89.

Gates, Movable Dam.

Hoisting machinery, **P-11**, 80, pl. 84.
Lowering, **P-13**, 110, pl. 7.

Gates, Sea.

Full pressure against, Gatun, **P-13**, 110, pls.
2, 3.

Gates, Sluice.

Regulation, hydrography, Lake Gatun, **P-13**,
pls. 110, 111.

Gates, Spillway, **P-14**, 13.

Changes in spillway due to, **P-14**, pl. 108.
Fixed irons, **P-13**, 74.
Leakage, Gatun, **P-14**, pls. 109, 110.
Leakage investigations, Gatun, **P-14**, 157.
Machinery for, **P-10**, 55; **P-11**, 80.
Machines, gate, **P-13**, 93, 94; **P-14**, 110.

Gates, Stoney.

General drawings, Gatun and Miraflores Spill-
ways, **P-10**, pl. 77.
Stoney gate castings in place, Miraflores Locks,
P-12, 108, pl. 10.

Gatun. (See Nos. 36, 209, pp. 2362, 2365 of this
Index; also Dams; Locks; Gates; Spillway.)

Gatun to Bohio. (See No. 18, p. 2361 of this
Index.)

Gauging, **P-10, 291; **P-12**, 239.** (See Hydrol-
ogy; Discharge; Surveys.)

Chagres River, **P-05**, 13.
Chagres River, cross section at Gamboa gaug-
ing station, **P-12**, pl. 104.
Chagres River, Gamboa station, **P-13**, pl. 120.
Hydrography, **P-11**, 266.
Measurements of discharge, zone waterways,
P-11, 270.
Station, Gatun Spillway, **P-11**, 288, pl. 72.

Gear, Crank.

Cover seats for, machinery rooms, **P-13**, 98.

General Purchasing Officer.

Report. (See No. 274, p. 2368 of this Index.)

Geography. (See No. 50, p. 2362 of this Index.)
Isthmus, **P-13**, 566.

Geology. (See Nos. 194, 223, p. 2365, 2366 of this
Index.)

Ancon Hill and quarry, **P-13**, 582, pl. 74.
Basalt dike cutting Cucaracha formation, in
Culebra Cut, **P-13**, 582, pl. 72.
Canal, center line, profile (Howe), **P-07**, pl.
147.
Columnar structure in hardened flows of lava.
This jointing, permitting seepage, tended to
promote slide vicinity of La Pita. **P-12**,
214, pl. 60.

Cross section, Culebra Cut, **P-13**, 582.

Deforming and sliding ground near Culebra,
ideal section of, **P-12**, 214, pl. 59.

Fault contact, Contractors Hill, **P-13**, 582,
pl. 76.

Fault contact, northern, Gold Hill showing,
P-13, 582, pl. 75.

Fault on west side of Culebra Cut south of
Las Cascadas, **P-13**, 582, pl. 77.

Fault plane, chief cause of slide vicinity of
Lirio, **P-12**, 214, pl. 61.

Formation, geologic, sections showing; ridge
near Escoval, **P-09**, 204, pls. 84-88.

Formations, Canal Zone, generalized section,
P-13, 582, pl. 69.

General, of Isthmus, **P-13**, 567.

Geological classification, zone, **P-13**, 580.

Geological conditions, zone, **P-12**, 207.

Historical, zone, **P-13**, 572.

Isthmus of Panama, detailed **R.**, **P-07**, 108.

Note (Nov. 19, 1898) on the Culebra and Em-
perador Cuts. Messrs. Bertrand and Zürcher.
(From S. Doc. 188, 56th, 1st.) **P-06***, 162.

Report of Donald F. MacDonald, geologist.
(See No. 223, p. 2366 of this Index.)

Rise, recent, of isthmian lands, **P-13**, 574.

Section across the Isthmus, **P-13**, 582, pl. 68.

Slides, **P-13**, 580.

Slides, Culebra Cut, **P-12**, 205.

Slides, Culebra Cut, will cease when natural
slopes are reached, conclusions of, to effect
that, **P-12**, 214.

Sliding ground, cross sections of Culebra Cut
showing, **P-13**, pl. 123.

Volcanic agglomerate, character of, **P-13**, 582,
pl. 70.

Zone, **P-12**, 205.

Geology, Economic and Engineering.

Zone, **P-13**, 574.

Geology, Isthmian.

Geology of Isthmus of Panama: Paper printed
as Appendix B of report of Board of Con-
sulting Engineers, on Geological Study of
the Isthmus of Panama. By Marcel Ber-
trand, member of the Institute of France;
professor of geology at the National High
School of Mines at Paris. By Mr. Philippe
Zürcher, chief engineer in the Corps of
Bridges and Routes of Communications of
France. Translation by Capt. John C.
Oakes, Corps of Engineers, U. S. Army.
P-06*, 149-163.

Geological section of the Isthmus: Preliminary
work; general structure; the Gamboa rock;
Atlantic slope; southwest slope; Culebra
Cut; Pacific slope; central part; plateau of
Alhajuela; later eruptions; dividing ridge;
superficial red clays; alterations of the strata
in depth; alluvial soils and Quaternary
phenomena; résumé; cross section.

Description and microscopic diagnosis of the
rocks: Gamboa breccia.

System of the bituminous schists (clays and
tuffs of Culebra): Cut at Culebra; section of
the Pacific slope; Trachytic tuffs. **P-06***,
149-163.

- German Government.** (See No. 164, p. 2365 of this Index.)
- Gillette Project.** (See No. 173, p. 2365 of this Index.)
- Girders.**
Hoisting machinery, emergency dams, **P-11**, pl. 83.
Machinery for, movable dams, **P-10**, 57.
Old girder span across Gatun at Mount Lirio, **P-10**, 204, pl. 59.
- Girders, Iron.**
Placing, lock walls, Gatun, **P-13**, 138, pl. 20.
- Girders, Steel.**
Towing-locomotive tracks, Gatun Locks, **P-12**, 108, pl. 7.
- Girders, Wicket.**
Hoists, **P-11**, 80.
Lowering of, emergency dam, Gatun, **P-13**, 110, pl. 6.
- Goethals, Geo. W.** (Governor Panama Canal; Col., Corps of Engineers, U. S. Army.)
Reports. (See Nos. 217, 218, 225, 258, pp. 2366, 2368 of this Index; see Fortifications.)
- Gold.** (See Employees, Gold.)
Mining possibilities meager, zone, **P-13**, 575.
- Gold and Silver Schedules.** (See Schedules, Gold and Silver.)
Wages, **P-09**, 152.
- "Gopher."**
Production of sand by, **P-12**, 185.
Sand dredging by, Pacific division, **P-11**, 170.
- Gorgas, Wm. C.** (See Governor.)
Chief sanitary officer. (See Nos. 211, 217, 226, pp. 2365, 2366 of this Index.)
- Government, Seat of.**
Expropriation proceedings for lands at Ancon, **P-05**, 53.
- Governments, Foreign.** (See Civil Administration; Consuls; Diplomacy.)
Relations with, **P-14**, 419.
- Governments, Municipal.**
Laws relating to organization of, **P-05**, 197.
- Government, Zone.** (See Nos. 30, 54, p. 2362 of this Index.)
Act providing government, **P-11**, 558; **P-12**, 599.
- Governor, Zone.** (See Nos. 48, 77 258, pp. 2362, 2363, 2368 of this Index.)
Davis, Maj. Gen. G. W. Returned to U. S. under orders of Sec. of War, May 9, 1905. (See No. 48, p. 2362 of this Index.)
Gorgas, Wm. C., acting governor, **P-05**, 28.
Reports, Nov. 1, 1905, to Sept. 30, 1906. (See No. 77, p. 2363 of this Index.)
- Grade Lines.** (See Lines, Grades.)
Hydraulic grade lines, Wachusett Dam, U. S. A., **P-08**, 196, pls. 137, 138.
- Grass.**
Burning grass in ditches, **P-10**, 434, pls. 72, 73, 74.
- Gravel.**
Deposits, Point 2, from floods, **P-10**, 160, pl. 29.
Flow of water through, Gatun Dam studies, **P-08**, 185-196.
Pits, zone, **P-13**, 575.
Schlieter's scales for estimating transmission constant, Gatun Dam studies, **P-08**, 196, pl. 171.
- Groceries.** (See Subsistence.)
Consumption of, Tivoli Hotel, **P-11**, 373; **P-13**, 398.
Weights and costs, **P-11**, 372.
- Grounds, Buildings and.**
Status, 1905, **P-05**, 141.
- Grounds, Dumping.** (See Dumping.)
- Grounds, Hospital.**
Ancon, **P-07**, pl. 9.
Driveway, Ancon, **P-07**, 32, pl. 10.
- Grunsky, C. E.** (See No. 26, p. 2362 of this Index.)
- Guerard, Adolphe.** (See Nos. 164, 195, p. 2365 of this index.)

H.

- Hains, Gen. P. C.** (See Nos. 1, 64, 142, pp. 2361, 2363, 2364 of this Index.)
- Handrail-operating Machines, P-14**, 113.
- Handwork.**
Contracts, showing use of old French push cars, **P-10**, 160, pl. 31.
Excavation, central division, **P-10**, 152; **P-13**, 152.
- Excavation contracts, **P-12**, 158.
Excavation, methods of dumping, Bohio, **P-10**, 160, pl. 32.
- Harbor, Inner.**
Excavation, Pacific terminals, **P-13**, 201.
- Harbor, Porto Bello, P-09**, 66, pl. 23.
- Harbors and Channels.** (See Nos. 35, 51, 82, 195, 198, pp. 2362, 2363, 2365 of this Index.)
Atlantic division, **P-09**, 54, 66, pl. 13.

Cristobal Harbor: Suitable interior harbor at Colon important; problem never solved by the French. Surveys begun, in view of increasing shipments. **P-04**, 40.

Degree of control of harbors adjacent to canal's ocean terminals by U. S. and Republic of Panama to be determined, **P-04**, 80.

Harbor masters appointed Dec. 8, 1905. Traffic in harbors put under definite rules. **P-06**, 21.

Harbors, World.

Depths of world harbors.—Table I: Depths that can be carried into 50 commercial and navigable harbors of the world. Table II: Available depths for navigation of 160 principal commercial and naval harbors of the world. Table III: Entrance depths, 1905, of principal commercial and naval seacoast harbors of the U. S. Table IV: Data and methods shown in obtaining entrance depths shown in Table III. **P-06***, 267-278.

Harbors, Atlantic.

Need for breakwater as protection against northerners, **P-05**, 294.

Harding, Maj. Chester. (See No. 231, p. 2366 of this Index.)

Report on foundations of Gatun Locks, **P-08**, 121-125.

Harrod, B. M. (See Nos. 26, 64, 142, pp. 2362, 2363, 2364 of this Index.)

Haupt, L. M. (See No. 1, p. 2361 of this Index.)

Hay, John. (See No. 1, p. 2361 of this Index.)

Health. (See Nos. 7, 59, 66, 104, 270, pp. 2361, 2362, 2363, 2368 of this Index.)

Bills of, quarantine regulations, **P-13**, 626.

Statistics, general, **P-08**, 283.

Yellow fever completely extirpated. Better health generally. In 1884 the French lost 161 men out of 19,234; in 1905, Americans lost 55 men out of 19,685. Sanitation no longer a problem. **P-05**, 6, 7.

2,500 men in health department. Organized into hospital service, health office of Panama, health office of Colon and Cristobal, sanitary service of zone, quarantine service, and Ancon laboratory. Problem of sanitation no longer a formidable obstacle to the completion of the canal. Credit given Col. Gorgas and staff. **P-05**, 59.

Laboratory established to test foods, water, drugs, etc. Investigation as to susceptibility of natives and nonnatives to malaria. Water of zone not inferior to drinking water of U. S. Entirely new fumigating material discovered. Evidence of liquor adulteration provided. Agricultural investigations with a view to improving breed of dairy cattle on the Isthmus. **P-06**, 30.

Average daily sick rate among employees, Jan. 1, 1906, to June 30, 1903 per 1,000. **P-06**, 31.

"The health conditions have been so very materially improved during the year that the feeling of fear and panic which prevailed at its beginning has been entirely done away with, and the fact has been proved beyond a doubt, that with rigid quarantine and with a never-ceasing vigilance in carrying forward sanitary measures, that the health of the average white person depends almost entirely upon the care he takes of himself." **P-06**, 117.

Health Department.

Employees, 2,313, July, 1906; in July, 1905, 1,989, **P-06**, 27.

Report, health officer. (See Health above.)

Health, Laboratory of, P-08, 314.

Hearings. (See No. 200, p. 2365 of this Index.)

Hecker, F. J. (See No. 26, p. 2362 of this Index.)

"Hercules." (See Cranes.)

Highway.

Pacific terminals, **P-13**, 201.

Relocation of, Pacific terminal, **P-13**, 195.

Hills.

Hill type of topography, vicinity of Zion Hill, **P-13**, 582, pls. 65, 66.

History, Panama Canal. (See No. 213, p. 2365 of this Index.)

Hodges, Col. H. F. (See Nos. 217, 227, 233, 239, 249, 259, pp. 2366, 2367, 2368 of this Index.)

Hodges Formula. (See Formula, Hodges.)

Hoisting Machine.

Movable dams, **P-11**, 80.

Hoists.

Wicket girder hoists, **P-11**, 80.

Holes, Drill.

Loading with dynamite, Culebra, **P-07**, 48, pl. 18.

Holes, Test.

Foundations, Gatun, **P-08**, 58.

Tests for seepage, Gatun Dam studies, **P-08**, 196, pls. 89-94, 95.

Holmes, F. (See No. 268, p. 2368 of this Index.)

Horsepower.

Shops, Balboa, **P-14**, 174.

Hospitals. (See Grounds, Hospital; Civil Administration; see Nos. 106 and 226, p. 2363 of this Index.)

Driveway, Ancon, **P-07**, 32, pl. 10.

Grounds, Ancon, **P-07**, 32, 64, pls. 9, 72.

Grounds, Panama Canal work, **P-05**, 60, 62.

Hospitals at Ancon, Colon, Culebra, Santo Tomas. (See title above.)

Isthmian Canal Commission, Colon, **P-07**, 32, pl. 12.

- Nurses hall and quarters for physicians, **P-10**, 434, pl. 68.
 Report, consolidated, **P-07**, 199; **P-09**, 301; **P-10**, 422; **P-11**, 512; **P-12**, 543; **P-13**, 541.
 Roads in grounds, **P-07**, pl. 72.
 Views, **P-07**, pl. 12.
 Views, Ancon, Colon, **P-05**, 60.
- Hospitals (Operation).**
 Under the agreement of the previous year for expenditure of Isthmian Canal Commission funds for the improvement, repair, and equipment of Santo Tomas Hospital in city of Panama, several buildings built, old ones repaired, and the hospital throughout made thoroughly modern, and a credit to Panama and a source of economy to Isthmian Canal Commission, **P-06**, 23.
 Hospital at Ancon enlarged. Additions made to Colon Hospital. 6 smaller hospitals and 8 dispensaries maintained at various points. Hospital-car service. Sanitarium at Taboga, formerly maintained by the French, reopened. At Miraflores, hospital maintained for insane, lepers, and the indigent sick of Panama and the zone. Arrangements made for leper asylum at Palo Seco, in zone, on shore of Panama Bay, a few miles west of Panama. **P-06**, 28.
- Hostling, P-11**, 222; **P-12**, 261; **P-13**, 259; **P-14**, 260.
- Hotel, Isthmian Canal Commission.**
 Culebra, **P-07**, 96, pls. 1, 115.
 Dinner time, Gorgona, **P-07**, 80, pl. 99.
 Food, relative value of, **P-10**, 324.
- Hotel, Tivoli.**
 Operation, **P-07**, 80, pls. 96, 97; **P-08**, 253; **P-09**, 221; **P-10**, 328; **P-11**, 382, 384; **P-12**, 404; **P-13**, 398; **P-14**, 308.
 Repairs to, **P-13**, 399.
- Hotels, P-07**, pls. 96, 97, 98, 99. (See Labor; Employees; Kitchens; Messes; Subsistence.)
 Cristobal, **P-07**, 80, pl. 98.
 Food, relative value of, **P-13**, 396.
 Labor, etc., **P-07**, pls. 100-126.
 Operation of, **P-07**, 142; **P-08**, 250; **P-09**, 224; **P-10**, 330; **P-11**, 374; **P-12**, 397; **P-13**, 396; **P-14**, 309.
 Registration required. (See Orders, Executive.)
- Hours.** (See Law, Eight-Hour.)
 Acts governing, **P-11**, 560, 562; **P-12**, 595.
 Eight-hour law unfortunate for the canal work. Legislation against it recommended. **P-05**, 121.
 Congress, Feb. 27, 1906, removed restrictions of 8-hour law from application to alien labor in the zone work, and to the foremen and superintendents of such laborers. Again, June 30, 1906. **P-06**, 14.
- House, Control.**
 Gatun Locks, **P-13**, 122.
 Gatun, Pedro Miguel, and Miraflores, **P-14**, 321.
 Pedro Miguel Lock, **P-14**, pl. 13.
- Houses.** (See Employees; Labor.)
 Authorized-for construction, **P-08**, 252.
 Employees, cost, charges to reduce, **P-07**, 86.
- Houses, Engine, P-10**, 268; **P-11**, 237; **P-12**, 272.
 Las Cascades, **P-07**, 80, pl. 90.
 Lirio, **P-07**, 82.
- Houses, Family.**
 Ancon, **P-07**, pls. 100-126.
 Culebra, **P-07**, 96, pls. 100, 116, 125.
 Empire, **P-07**, 96, pl. 120.
- Houses, Power.** (See Power.)
- Howe, E.** (See No. 223, p. 2366 of this Index.)
- Humidity, P-10**, 277; **P-11**, 249; **P-12**, 225; **P-13**, 224; **P-14**, 144. (See Meteorology.)
- Hunter, W. H.** (See No. 164, p. 2365 of this Index.)
- Hunting.**
 Night or fire hunting prohibited, **P-14**, 581.
- Hyacinth, Water.**
 Dredging, **P-14**, 241.
- Hydraulics.** (See Nos. 138, 197, pp. 2364, 2365 of this Index.)
 Condition of ground, Gatun Locks, **P-08**, 70, pl. 41.
 Hydraulic conditions, Miraflores Spillway, **P-14**, 158.
 Locks, **P-14**, 76.
- Hydraulics, Isthmian.**
 Panama Canal: Paper by Henry L. Abbot, as Appendix E, Report of Board of Consulting Engineers.
 Some of the hydraulic problems of a sea-level Panama Canal: Topography of the canal route; discharge of the tributaries below Gamboa; volume of freshets and great floods; conclusions that for a sea-level canal there must be a tidal lock at Miraflores, a dam at Gamboa, spillways, and over 40 miles of artificial and very costly diversion channels for tributaries entering below Gamboa, etc. **P-06**, 185-191.
 Water supply of the canal for three variants, assuming a lake at Gatun raised to elevations 85', 60', and 30', the latter combined with a lake at Bohio raised to elevation 60': Flow of the rivers; requirements for lockage; other losses of water; volume of water reserves; storage of the reserves. **P-06**, 192-197.
- Hydraulics, River, P-07**, 58; **P-08**, 68. (See Hydrography.)
 Bureau established, Panama, **P-05**, 130.
- Hydroelectricity.** (See Electricity.)
- Hydrographer.** (See No. 262, p. 2368 of this Index.)
- Hydrographs.**
 Gatun Lake, **P-12**, pl. 105; **P-13**, pls. 110, 111.

Hydrography and Hydrology, P-09, 181;
P-10, 275, 291; P-11, 265; P-12, 221; P-13,
235; P-14, 26, 154. (See Meteorology; Hy-
drography; see Nos. 16, 21, p. 2361 of this
Index.)
Equipment, P-10, 291; P-11, 265; P-13, 236.
Field work, P-13, 236.
Freshets, P-11, 267.
Gatun Lake, P-10, 293; P-14, pl. 100.
Gaugings, P-11, 2 66.

Miraflores Lake, P-14, pl. 101.
Rating station, P-14, 156.
Section of, P-14, 91.
Special work, P-12, 241; P-13, 238.
Stations, P-10, 291; P-11, 265; P-13, 236.
Surge, Culebra Cut, on locking, Pedro Miguel,
P-14, pl. 112.
Work of section, P-13, 220, 221.

Hygiene. (See Nos. 168, p. 2365 of this Index.)

I.

Igneous Rock, P-13, 570. (See Rock.)

Illinois Surety Co.
Schedule bond for employees, **P-12, 412.**

Illumination, P-14, 114.
Aids to navigation, **P-12, 104.**
Calculated, Balboa shops, **P-14, 175.**
Gatun Locks, **P-14, pls. 87, 88, 89, 90.**
Illuminants and, **P-13, 109.**
Locks, **P-12, 92; P-13, 96.**

Immigration and Emigration, P-09, 212;
P-10, 311. (See No. 80, p. 2363 of this
Index.)
Act relating to status of persons entering U. S.
from zone, **P-11, 558.**
Employees, **P-07, 141.**
Statement of, **P-08, 252.**

Immigration Restrictions.

Isthmian Canal Commission No. 3 authorized
excluding undesirable immigrants; this re-
striction inapplicable to Panama, so that
undesirables simply landed in Panaman
territory and finally landed in the zone a
burden therein. Panama, on suitable rep-
resentations, issued a decree, Mar. 17, 1906,
banning undesirables from entrance into her
territory. **P-06, 20.**

Importations.

Employees, by, **P-07, 151.**
Orders, etc., relating to, **P-05, 202.**
Orders relating to imports for employees,
P-05, 208.

Improvements, Public. (See Engineering; Mu-
nicipalities; see No. 215, p. 2365 of this Index.)
Map showing Panama improvements, **P-10,**
pl. 118; P-12, pl. 94.

Indio River. (See No. 22, p. 2361 of this Index.)

Individuals.

Work of mechanical division for, **P-14, 253.**

Industries. (See Nos. 24, 53, pp. 2361, 2362 of this
Index.)

Revived by U. S. occupation, zone and adja-
cent cities, **P-05, 53.**

Injuries. (See Employees.)

Claims for, **P-11, 392, 432; P-12, 415; P-13,**
415; P-14, 329.
Computation of pay, **P-13, 622.**
Employees, act relating to compensation,
P-11, 568, 569, 581.
Employees, statement, **P-09, 246; P-10, 355;**
P-11, 404, 405.
Executive order relating to compensation for
injuries, **P-13, 620, 625.**
Liability of Panama R. R., **P-11, 565, 575.**

Insane. (See No. 97, p. 2363 of this Index.) (See
Hospitals.)

Executive order relating to, **P-11, 433.**
Insane, lepers, and indigent sick, care of:
Provision made for the care of. Hospitals
repaired. Panama reimbursed U. S. for
portions of the work. Panama hospitals
under oversight of U. S. Per capita charge
for Panaman patients, 30 cents per day.
P-05, 51.

Inspections.

Boiler-inspection service, **P-10, 269; P-11,**
239; P-12, 274.
Division of general inspection, **P-12, 410.**
Division of time inspection, **P-12, 412.**
Emergency dams, **P-13, 101.**
Equipment, **P-13, 247.**
Inspection department established, machinery
and electrical equipment, **P-11, 82.**
Lubricants, **P-13, 247.**
Machinery, **P-13, 99.**
Material, **P-11, 240.**
Mechanical apparatus, **P-11, 204, 218.**
Organization, division of canal transportation, -
P-14, 263.
Shops, duties of inspectors, **P-11, 218.**
Steamboats, **P-10, 365; P-11, 416; P-12, 458;**
P-13, 462, 615; P-14, 264.
Supplies, **P-08, 223.**
Terminal construction, **P-14, 166.**
Water service, **P-07, 78.**

Inspectors, Board of Local, P-14, 262.

Insulators.

Electric transmission line system, **P-14, 101.**

Insurance. (See Orders, Executive.)

Panama R. R. prohibited from carrying, act, **P-11**, 566, 577, 580.

Interest.

Usury and, **P-14**, 563.

Intermedlate Gates. (See Gates; see No. 249, p. 2367 of this Index.)

Intermedlate Lock Gates.

Special report on, by Lt. Col. H. F. Hodges, Corps of Engineers, U. S. Army. Member Isthmian Canal Commission No. 4. **P-10**, 65.

Internal Revenue. (See Civil Administration; see No. 111, p. 2363 of this Index.)

Nine distilleries in active operation, **P-06**, 34.

Inventory. (See Property.)

Inventory and property returns, **P-08**, 227.

Investigations. (See Dams; see Nos. 232, 244, pp. 2366, 2367 of this Index.)

Investigations, Special.

Currents, Colon Harbor; and leakage, Gatun Spillway gates, **P-14**, 156.

Gatun Dam studies, by C. M. Saville, **P-08**, 127-196.

Iron. (See Foundries.)

Castings of, output and cost, **P-13**, 262; **P-14**, 258.

Covers of cast iron, **P-12**, 92.

Foundries, **P-10**, 272; **P-11**, 241.

Scrap iron, sales, **P-11**, 359.

Irons, Fixed.

Design and contract, **P-13**, 74.

Erection and installation, **P-13**, 75.

For rising gate stem valves, **P-13**, 87.

Lock gates, **P-13**, 81.

Milling machine for correcting, rising stem valves, locks, **P-13**, 110, pl. 11.

Pacific locks, **P-12**, 179.

Spillways, spillway gates, caissons, foot-bridges, and railings, **P-13**, 74.

Valves and fixed irons, locks, **P-13**, 74.

Isthmian Canal Commissions. (See p. 2359 of this Index.) (See Nos. 1-256, pp. 2361-2368 of this Index.)

Isthmian Canal Commission No. 1: Letter from John Hay, Sec. of State, June 10, 1899, announcing to Rear Admiral John G. Walker (retired) the latter's appointment as a member of the Isthmian Canal Commission or investigators referred to by act Mar. 3, 1899, authorizing the President to make full and complete investigation of the Isthmus of Panama, particularly those routes known as the Nicaragua and Panama routes, with a view to ascertaining the best route for an interoceanic canal and the cost of the same and placing it under the control, management, and ownership of the U. S., embracing the cost of all rights, etc., acquired by all former enterprises; and authorizing the President to employ any engineers or others to carry out the details. The act also sets

aside \$1,000,000 for expenses, and requires the President to report to Congress the results of such investigations, together with his recommendations. Copy of act referred to. **P-99**, 10, 11.

Organization of commission by committees (the President being ex officio a member of each committee): Investigation of Nicaragua route, Mr. Noble, Mr. Burr, Col. Hains; investigation of Panama route, Mr. Burr, Mr. Morison, Lt. Col. Ernst; investigation of other possible routes, Mr. Morison, Mr. Noble, Col. Hains; investigation of industrial, commercial, and military value of an interoceanic canal, Mr. Johnson, Mr. Haupt, and Mr. Pasco; investigation of rights, privileges, and franchises, Mr. Pasco, Lt. Col. Ernst, and Mr. Johnson, **P-99**, 12.

Assistants: On July 6, 1899, Lt. Commander S. A. Staunton, U. S. Navy, chosen secretary, **P-99**, 13.

Chief hydrographer, A. P. Davis. Appendices D and I. **P-99**, 219, 281.

Lock studies, S. H. Woodward. Appendix A. **P-99**, 179.

Special surveys, A. B. Nichols. Appendix J. **P-99**, 349.

Special commercial report, Prof. E. R. Johnson (member of commission). Appendix NN. **P-99**, 515-573.

1899-1901. Operations: Organization; law authorizing commission; instructions to commission; committees named; subjects of investigation (see Engineers); appointment of chief engineers, one for Nicaragua and one for the Panama route, third engineer appointed to direct field work at Darien, **P-99**, 13.

Employment of assistants and laborers: 20 working parties organized in Nicaragua, 5 in Panama, 6 in Darien; total field force, about 850. Chief engineers directed to make examination of geography, topography, hydrology, and other physical features of the different countries, and to make a special study of the routes in Panama and in Nicaragua. Commission visited Paris, 1899.

New Panama Canal Co. permitted inspection of all its records, etc. Commission visited various canal works in Europe. Visit made to Central and South America in 1900. **P-99**, 14.

Darien visited by Mr. Morison. U. S. S. "Scorpion" used by commission. Officials of the various countries consulted and conferred with. **P-99**, 15.

Upon return to the U. S., commission considered dimensions and unit prices. Conclusions reached used in making subsequent plans, computations, and estimates. Other questions considered, such as treaty relations, grants and concessions already made-value of the canal, operation and main, tenance, etc. Second visit made to Nicaragua by Mr. Noble, 1901. Parties disbanded, as they finished their work, the engineers being brought to the U. S. for the necessary office work. Field work completed June,

1901. Special report on the industrial and commercial aspect of the canal lines obtained. **P-99, 16.**

Many maps prepared. Short history of canal projects referred to. **P-99, 17.**

Report submitted, 1901, favoring the Nicaragua route, **P-99, 13.**

Supplementary report of Isthmian Canal Commission, 1899. S. Doc. 123, 57th Cong., 1st sess. The President (Theodore Roosevelt) transmits to Congress a proposal, laid before him by the Isthmian Canal Commission through Sec. of State (John Hay), of the New Panama Canal Co. to sell and dispose of all its rights, property, and unfinished work to the U. S. for \$40,000,000. **P-99, 675.** Correspondence of New Panama Canal Co. with Isthmian Canal Commission, **P-99, 676.** Outline of rights, etc., offered by the New Panama Canal Co., **P-99, 676.**

Repetition of respective virtues of the Nicaragua and Panama routes. The offer of the New Panama Canal Co. makes the cost of the two routes—for Nicaragua, \$189,864,062; Panama, \$184,222,358. **P-99, 679.**

Acceptance of terms of New Panama Canal Co. should, in the opinion of the commission, be conditional upon the satisfactory adjustment of concessions desirable from the Republic of Colombia. "The grant must be not for a term of years, but in perpetuity, and a strip of territory from ocean to ocean of sufficient width must be placed under the control of the U. S. In this strip the U. S. must have the right to enforce police regulations, preserve order, protect property rights, and exercise such other powers as are appropriate and necessary. The business relations between the railroad and canal companies and the Colombian Government must also be settled, and the consideration to be paid by the U. S. for the privileges and rights to be exercised in the future must be agreed upon free from all embarrassment with reference to past transactions." **P-99, 680.**

"* * * It must be assumed by the commission that Colombia will exercise the same fairness and liberality if the Panama route is determined upon that have been expected of Nicaragua and Costa Rica should the Nicaragua route be preferred." **P-99, 680.**

"* * * The commission is of the opinion that 'the most practicable and feasible route' for an Isthmian Canal, to be 'under the control, management, and ownership of the United States,' is that known as the Panama route." **P-99, 681.**

1904. Congress authorized the President to purchase at not exceeding \$40,000,000 the rights of the New Panama Canal Co.; to acquire from Colombia perpetual control of zone not less than 6 miles wide, and over operation of railroad; additional territory and rights if needful; building of a canal, etc., through a commission; failing satisfactory conclu-

sions concerning the Panama route, negotiations to be conducted for canal by Nicaragua route; the States through which canal shall run to have use of canal and harbors, etc., on special terms to be agreed upon; authorizing commission; appropriating funds; and authorizing Sec. of Treas. to issue bonds to amount of \$150,000,000 for this special work. **P-04, 23.**

Treaty with Panama signed 1903. \$10,000,000 paid Panama. **P-04, 36.**

Operations continued with French company's employees. Organization of survey parties. **P-04, 40.**

Isthmian Canal Commission No. 2. Committees: Engineering plans, Mr. Harrod, Mr. Burr, Mr. Grunsky, and Mr. Parsons, **P-04, 37.**

Executive, Mr. Parsons, Mr. Grunsky, Admiral Walker, **P-04, 37.**

Engineering, Mr. Burr and Mr. Parsons, **P-04, 37.**

Finance, Mr. Hecker and Mr. Harrod, **P-04, 37.** Legislature, Mr. Harrod and Mr. Hecker, **P-04, 37.**

Sanitation, Mr. Grunsky and Mr. Burr, **P-04, 37.**

Isthmian Canal Commission likened to a board of directors of a railway. Frequent meetings held. **P-04, 36, 37.**

Temporary head of engineering staff after transfer, Maj. Wm. M. Black, Corps of Engineers, U. S. Army, **P-04, 36.**

Sanitary department, Dr. W. C. Gorgas, colonel, U. S. Army, the chief officer, **P-04, 37.**

Disbursing, Geo. C. Schafer, paymaster, U. S. Navy, **P-04, 38.**

Sec. of War Taft suggests more elastic organization, permitting designating members of the commission to charge of special duties, **P-04, 13.**

First visit of Isthmian Canal Commission No. 2 to Isthmus: Arrived Apr. 1, 1904. Cordial reception from Republic officials, etc. Study made of plans and methods of old company; points of work visited; evident that new and extended surveys and examinations necessary because of increase in modern requirements; advisability of sea-level or lock-level canal to be determined; surveys planned. **P-04, 38.**

"The organization of the department of engineering and construction has been made with two distinct purposes in view. The first of these purposes covered the entire field work, including surveys and investigations necessary for the solution of all problems preliminary to the development of plans for the entire project of a ship canal between the two oceans and the design and construction of waterworks and sewer systems for the cities of Panama and Colon. The second purpose was the formation of the preliminary organization in such a manner as to merge efficiently into the permanent organization ultimately required for

the actual construction of all classes of work embraced in the entire engineering construction within the limits of the Canal Zone." Preliminary work of surveys nearly completed, "so that the studies for the features of the general project can soon be undertaken." The purpose of the Isthmian Canal Commission No. 2 to install and operate considerable number of large steam shovels already purchased in the U. S. Some of the old French plant has been found usable temporarily. Feasibility of excavating the Culebra Cut by the hydraulic method considered. **P-04**, 43.

Law establishing government for the Canal Zone, act Apr. 28, 1904, **P-04**, 31.

Letter of instructions from President Roosevelt to Isthmian Canal Commission No. 2, through Sec. of War Taft, placing Isthmian Canal Commission No. 2 in charge of the government of the zone, giving it the power to legislate, and appointing Maj. Gen. Geo. W. Davis (member) governor of the zone, **P-04**, 31.

Instrument conveying canal properties to the U. S., Apr. 23, 1904, **P-04**, 35.

Letter of President Roosevelt, Oct. 18, 1904, instructing Sec. of War Taft to proceed to Panama to reassure Panama authorities it "is not the purpose of the U. S. to take advantage of the rights conferred upon it by the treaty to interfere with the welfare and prosperity of the State of Panama or of the cities of Colon and Panama," **P-04**, 5.

Executive order, in name of President Roosevelt, Dec. 3, 1904, limiting importations,

tariff duties, port control, postal matters, currency, voting of Panama residents in zone, roads, hospital treatment, by Sec. of War Taft. "The truth is that while we have all the attributes of sovereignty necessary in the construction, maintenance, and protection of the canal, the very form in which these attributes are conferred in the treaty seems to preserve the titular sovereignty over the Canal Zone in the Republic of Panama, and as we have conceded to us complete judicial and police power and control over the zone and the two ports at the end of the canal, I see no reason for creating a resentment on the part of the people of the Isthmus by quarreling over that which is dear to them but which to us is of no real moment whatever." Supplementary order, Dec. 6, 1904, clarifying doubts relating to imports. Section XIII of the treaty construed (Jan. 7, 1905) to give free entry of things needed by those engaged on the canal work, etc., but not of things customarily found on sale in the zone and required by those who come from tropical countries, but if the local merchants charge undue prices for these the canal employees may avail themselves of imports for those coming from nontropical limits. **P-04**, 5, 17.

1905-1913. (See pp. 2361-2368 of this Index.)

Isthmian Routes. (See No. 4, p. 2361 of this Index.)

Isthmus, Geology of. (See Geology; see No. 194, p. 2365 of this Index.)

J.

Jails. (See No. 58, p. 2362 of this Index; and Civil Administration.)

Johnson, E. R. (See No. 1, p. 2361 of this Index.)

Judiciary.

Compensation, **P-14**, 581.

Recommendations and suggestions, **P-11**, 498.

Executive order, **P-14**, 589.

Statistics, **P-06**, 71.

System established working admirably, **P-06**, 41.

Jury.

Executive order relating to trial by jury, **P-13**, 631.

Justice and Judiciary. (See No. 57, p. 2362 of this Index.)

K.

Kitchens. (See Commissary; Subsistence; Employees; Labor.)

Articles consumed, **P-12**, 396.

Laborers', **P-07**, 96, pl. 107.

Laborers', Comacho, **P-07**, 88, pls. 105, 106.

Laborers', Gorgona, **P-07**, 88, pl. 106.

Operations, **P-10**, 334; **P-11**, 374; **P-12**, 397, 406; **P-13**, 400-409.

Rations and meals, **P-09**, 230.

Rio Grande, **P-07**, pls. 84, 85, 86, 105, 106.

Statement, **P-09**, 224.

L.

La Boca.

Town practically owned by the U. S. Instead of being a dangerous plague spot, made into a model camp, with houses in good repair, freshly painted, supplied with electric light, a water system, and good drainage. **P-05, 42.**

La Boca Division. (See No. 135, p. 2364 of this Index.)

Covers work from Pacific to Miraflores, operation of small machine shop and marine ways for repair of floating equipment. Quarantine delayed work, and so did sickness following. Surveys, soundings, and tidal observations. Old French dredge at work on harbor, deepening and enlarging channel. **P-05, 115.**

Extends from Pedro Miguel to Panama Harbor.

Prior to Aug. 10 under the immediate charge of the engineer at Cristobal. Surveys: Complete system of triangulation established from Pedro Miguel to Naos Island and points surrounding Bay of Panama; topographical surveys made of the lock and dam sites proposed by minority Board of Consulting Engineers; survey of Bay of Panama; many borings at various points; current observations Bay of Panama.

Repair of plant: Heavy repairs made of floating plant, of dredges, barges, etc. Old French dredge kept at work dredging canal entrance east of Panama; about 1,200,000 c. y. dredged at cost of 12 cents per c. y. Work of division seriously handicapped on account of shortage of labor and material. **P-06, 88.**

Labor, P-04, 13; P-05, 9; P-06, 5; P-07, 139; P-08, 247; P-10, 305; P-11, 354; P-12, 377; P-13, 372; P-14, 270. (See Convicts; Employees; Messes; Quarters; Subsistence; see Nos. 68, 126, 162, 224, pp. 2363, 2364, 2366, of this Index.)

Accidents and deaths, statistics, **P-07, 189.**

Act eliminating aliens from operation of 8-hour law, **P-11, 560, 562.**

Attracted from farms to public works, **P-05, 54.**

Barracks, Cristobal, **P-09, 220, pl. 95.**

Brought to Isthmus at Isthmian Canal Commission expense, **P-07, 140; P-08, 248.**

Camps, **P-07, pl. 104, 110.**

Colored, expensive, **P-05, 120.**

Commissaries, **P-05, 8, 48.**

Commissary for, inadvisable, **P-04, 12.**

Conditions, **P-07, 78.**

Contract labor, **P-09, 212; P-10, 311; P-11, 354; P-12, 412; P-13, 384.**

Contract vs. hired, **P-07, 16.**

Cost of, **P-07, 139.**

Crime statistics, **P-07, 181.**

Culebra division, **P-07, 43.**

Demoralization, cause of, **P-05, 108.**

Department of, organization, chart, **P-07, pl. 145.**

European more disorderly but superior to West Indian, **P-07, 78, 163.**

Food, etc., **P-10, 324; P-11, 378; P-12, 400; P-13, 396.** (See Kitchens and messes, below.)

Food supply, tropical, **P-05, 46.**

Foreign, consular complaints, **P-07, 153.**

Hotels for, tropical, **P-05, 44.**

Houses, **P-07, pl. 111.** (See Houses.)

Kitchens, etc., **P-07, 88, 96, pls. 105, 106, 107.** (See Food, above.)

Mess Halls, **P-07, 96, pls. 107, 108, 109.**

Obtaining, for tropics, **P-04, 12; P-05, 9; P-07, 25; P-08, 247.**

Obtaining labor from various sources—Jamaica, Porto Rico, Japan, etc., **P-04, 13; P-07, 25.**

Panama Canal conditions against contract work, **P-07, 18.**

Quarters, **P-07, pls. 100-120.**

Quarters, tropical, organization, **P-05, 44, 45.**

Rations, etc., **P-07, 88, 96; P-10, 324; P-11, 378; P-12, 400; P-13, 396.**

Recreation, providing, **P-05, 8, 55.**

Recruiting of, on zone, prohibited. (See Orders, Executive.)

Sick, care of, **P-05, 50.**

Trains for, **P-07, 96, pl. 127; P-10, 322, pl. 65.**

Unskilled, tropical laborers unsatisfactory, **P-06, 5.**

Labor and Quarters. (See Labor above.)

Has charge of the hiring of all grades of employees and of assigning them to the various departments, of providing and assigning quarters, record of employees; handles directly all hotels and mess houses; has general charge of all buildings on the zone belonging to the Isthmian Canal Commission. **P-05, 105.**

Supply of efficient unskilled labor a problem.

Tropic laborers 25 per cent to 33 per cent efficient only compared with U. S. labor. Eight-hour law applied to this class not deemed advisable, as it would add many millions to cost of canal; not expected by laborers until they arrive and learn of it. Isthmian Canal Commission No. 3 recommends that labor on the Isthmus be excluded from the application of the 8-hour law, contract-law law, Chinese-exclusion act, or any other law for the protection of U. S. labor at home. **P-05, 9, 10.**

Tropical labor inefficient and hence expensive.

Regular pay, good food, and better overseers already producing more efficiency. **P-05, 120.**

Branch has charge of hiring of all grades of employees, assigning them to the various departments, assigning them quarters, etc. Directly handles all hotels and mess houses, and has general charge of all buildings on the zone belonging to the Isthmian Canal Commission. Table showing the force in the three departments of construction and engineering, government and sanitation,

and material and supplies, ranging from 9,786 to 16,997. Sources of supply: Barbados, 8,043; Martinique, 1,756; Jamaica, 4,981; coast towns and small islands, 10,254. Spanish laborers very satisfactory, being paid 40 cents silver per hour, as compared with 20 cents to other kinds of labor. Skilled labor obtained through recruiting agencies in the U. S.; improvement in grade being noted; increased wage rate necessary; authorized Dec., 1905, but even then scale not higher than in U. S., making it difficult to obtain class of men needed. Clerical force, obtained through civil service, not altogether satisfactory. Ordinary labor far from efficiency. "The majority work just long enough to get money to supply their actual bodily necessities, with the result that, while we are quartering and caring for twenty-odd thousand of these people, our daily effective force is many thousands less." Preliminary steps taken toward securing large numbers of Spanish laborers direct from the northwestern Provinces of Spain, and also for securing trial shipment of Cantonese Chinese. Upon fixment of lock-level plan, 5,000 to 6,000 additional employees could have been used; delay from their not being available. Eating houses established at various points. Isthmian Canal Commission took charge of hotels, etc., opened for white employees until better arrangements could be made. Year's work of labor and quarters branch satisfactory. Believed that physical stamina of employees can be kept up to a standard equal to that of the U. S. **P-06, 114.**

Bids asked by Isthmian Canal Commission for Chinese labor—2,500 for not less than 2 years, with privilege of increasing number to 15,000. Four bids; the two accepting the terms the lowest. Laborers, 9 to 11 cents an hour. **P-06, 14.**

Impossible to get satisfactory work from tropical negroes. Will not take nourishing food. Spanish labor efficient. White men can stand isthmian climate better than "blacks, who are supposed to be immune from practically everything, but who, as a matter of fact, are subject to almost everything." **P-06, 5, 6.**

Transportation of, amount spent, **P-08, 249.**

Labor, Quarters, and Subsistence. (See Labor above.)

1907. This department charged with securing all skilled and unskilled labor and its assignment; is the custodian of all living quarters; supplies furniture, delivers distilled water and food supplies; polices grounds around camps and quarters; has charge of the lighting of camps and roads; operates the hotels, messes, and kitchens for the accommodations of the employees; keeps service history of each individual employee; records leaves, etc.; authorizes transportation, etc., **P-07, 24.**

Labor supply: Skilled labor recruited in U. S., through agents. Clerks, stenographers, draftsmen, doctors, and nurses secured through civil-service registers. Skilled force, June 30, 1906, approximately 2,500; June 30, 1907, actually 4,404. To increase the force 1,904 men, 3,038 men brought from the U. S. during the year. Unskilled force brought from West Indies and Europe; gained through agents. June 30, 1906, 500 Europeans and 13,625 West Indians. June 30, 1907, 4,317 Europeans and 14,606 West Indians. An average of about 1,500 men per month recruited to keep up the force. June 30, 1907, the increase in the employees was 10,000 over previous year. "Labor problem is still an unsolved one," but efficiency increasing. Always large periodical changes in tropical labor. **P-07, 25, 26.**

Quarters: June 30, 1906, 1,129 houses available for quartering employees of all classes. June 30, 1907, 2,208 were available. Quarters better and more comfortable than ever. Congestion in quarters of laborers has entirely disappeared. **P-07, 26.**

Subsistence: 15 hotels operated for Americans; meals, 30 cents. Hotel Tivoli, Ancon, with superior accommodations; charging more. 18 mess halls for Europeans; day's board, about 40 cents. 23 kitchens for West Indian laborers; day's board, about 30 cents. West Indian laborer employed upon a basis of subsistence as a part of his compensation, because of his careless habits and the probability that he would impair his efficiency by lack of proper nourishment. Nearly a million meals a month served to all classes. Subsistence operations self-sustaining; no profit taken, however. **P-07, 26, 27.**

Commissary: Commissary department of railroad furnishes supplies to hotels, messes, kitchens, etc. Various branch stores. In operation, cold storage and ice plants, laundry, bakery, etc., all at Cristobal. **P-07, 33, 34.**

1908. Organization: Resignation of Jackson Smith. Maj. Carrol A. Devol, quartermaster, U. S. Army, assigned. Duties of the department to be divided. Maj. Devol to have charge of labor and quarters, and division of material and supplies, as a "quartermaster's department." The subsistence features to be consolidated with the commissaries of the Panama R. R., and to be in charge of Maj. Eugene T. Wilson, Artillery Corps, U. S. Army, as a "subsistence department."

Labor: 1,828 men employed in the U. S., as against 3,038 the year before, while the number employed on the Isthmus increased from 2,780 to 3,382. 500 more Europeans and 1,000 more West Indians on the work than at the close of the previous year. 4,150 West Indians and 3,650 Europeans imported. Excess of immigration over emigration, 18,000. "The labor problem may be considered solved."

Quarters: 700 American families brought; quarters accommodating 250 families recommended for construction. No such congestion for married quarters as existed a year ago. Laborers' quarters ample; increasing tendency to go into the bush or tenements in the towns; doubtful if move is beneficial.

Subsistence: 20 hotels operated for Americans, 25 mess halls for Europeans, and 31 kitchens for West Indian laborers. Inspection instituted looking toward cleanliness of messes and better food supplies. **P-08, 23, 24.**

Commissary—Organization: Operated by the subsistence officer of the Isthmian Canal Commission under the direction of the president of the Panama R. R.

Stores: 13 branch stores, along line; 5 new.

Work: Supplies ice, meats, bread, pies, cakes, ice cream, and groceries of all kinds, as well as laundry service, to the hotels, messes, and kitchens, and to employees of the Isthmian Canal Commission.

Sales: \$3,736,607.11.

Equipment: Coffee-roasting, ice-cream, and pie and baking plants added to the main commissary Cristobal.

Employees: Average, 742. Cost, \$430,343.75. **P-08, 30.**

Laboratories. (See No. 108, p. 2363 of this Index.)

Board of health. (See Civil Administration; Sanitation.)

Ration supplied, relative value of, **P-13, 397.**

Table showing those brought to the Isthmus and amount expended for transportation, **P-07, 140; P-08, 248.**

Ladder Dredges. (See Dredges.)

Lake Bohio. (See No. 17, p. 2361 of this Index.)

Lake Gamboa.

Probable area, **P-05, 13.**

Lake Gatun. (See Locks; Dams.)

Views, **P-13, 138, pl. 25.**

Lamps, Electric.

Gatun Locks, **P-14, pls. 87, 88, 89, 90.**

Landings.

Small boat, **P-13, 220.**

Small boat, Pacific terminals, **P-14, 196.**

Lands. (See Buildings; Damages; Civil Administration; see Nos. 60, 115, 188, pp. 2362, 2363, 2365 of this Index.)

Acts relating to acknowledgment in zone of deeds, etc., of U. S. and D. C. lands, **P-11, 560.**

Acts relating to survey of zone lands, **P-11, 570, 576.**

Acts relating to use, control, and ownership of U. S. lands, in zone, **P-11, 569.**

Commissioner, **P-14, 569.**

Division of lands and buildings, **P-07, 157.**

Expropriation proceedings, **P-05, 53.**

Geological classification, zone, **P-13, 580.**

Land matters of the Isthmian Canal Commission, **P-13, 518.**

Land office, **P-11, 433.**

Leases, **P-11, 433.**

Leases, commercial uses, terminals, **P-12, 221.**

Leasing of lands transferred to land office, **P-11, 418.**

Orders relating to all zone lands being necessary for canal purposes, **P-13, 614.**

Panama R. R. leases, **P-13, 523.**

Private, exemption of "Las Sabanas" from Executive order making all private lands necessary for canal purposes, **P-13, 616.**

Public land service, **P-08, 258; P-09, 259.**

Reclamations, terminals, **P-14, 207.**

Survey of zone lands, **P-10, 299; P-11, 275.**

System, recommendations and suggestions, **P-11, 498.**

Lands, Isthmian.

Recent rise of, geological data, **P-13, 574.**

Landslides. (See Slides.)

Lands, Zone.

Land agents appointed to care for the U. S. lands, etc. Survey in progress of location of towns and villages. **P-05, 67.**

Leasing of lands for agricultural uses being encouraged; 121 leases made of this kind. Ever-present market for fresh vegetables, etc. **P-06, 33.**

Difficult to foresee uses to which land in zone may be put. Within limits of zone 436 sq. m., of which about 73 sq. m. in private ownership and 363 sq. m. owned by U. S.; of latter, 96 sq. m. occupied by canal.

Large part of U. S. land required for military and naval purposes; not unlikely that additional lands will be required by other departments of U. S. Position of Republic and its two cities with respect to zone makes it necessary in interest of harmony that Spanish laws now in force shall obtain. Rules and regulations for government of zone, made effective subsequent to 58th Congress, should be approved and changes should be authorized to meet new conditions as they arise.

Under existing law, lands may be leased for not exceeding 25 years, with understanding that cost of improvements shall be reimbursed to lessee in case lands needed for other purposes. Generally the rule that land taken for U. S. purposes never sufficient and must always be extended, and from experience gained in prices agreed upon for lands taken for canal purposes, improvements always expensive. For most part, configuration of ground not suitable for extensive farming; material obstacles tend to hinder agricultural development; perpetual title can not be assured; and Spanish system of taxation must be continued to avoid friction on account of unfair competition with Panamans. Inducements offered not likely to attract Americans. Other occupants are desirable. Town sites already established populated by laborers, a class which should be repatriated after work can no longer be given, and growth of such towns should be discouraged. Greater the

amount of land leased and number of town sites established and occupied, greater will be cost of sanitation and civil government. For several years to come believed that best policy will be to keep all U. S. lands for U. S. purposes. Military force located on Isthmus will be charged with its own sanitation. Reservation of all lands for U. S. use would result, therefore, in minimum costs for these two items.

Zone occupies unique position among outlying possessions of U. S., and on this account requires special treatment. Construction of canal is original purpose, and to this purpose everything within zone subordinate. After completion everything must be subordinated to operation of canal. Assuming that canal built for benefit of commerce of world, nevertheless is military asset to U. S. and condition may arise in which military necessities of U. S. will be paramount. During certain periods operation of canal for commercial purposes, entirely separate and distinct from military; there are times when military necessities predominate. **P-11, 62.**

Larvacide.

Application, against mosquitoes, **P-10, 434, pl. 71.**

Laterals.

Form for connection of side wall culvert and laterals, **P-11, pl. 111.**

Laundry.

Interior of, Cristobal, **P-11, 384, pl. 76.**

Law, Department of. (See Civil Administration; see Nos. 116, 252, pp. 2363-2368 of this Index.)

Civil cases, **P-12, 520.**

Judiciary department, work of, **P-07, 171.**

Library of, **P-11, 492.**

Organization, chart of, **P-11, pl. 138; P-12, pl. 123; P-13, pl. 137.**

Revision of laws, **P-11, 497.**

Salary increases, **P-12, 590.**

Law, Department (Operation.)

1911. By Executive order of the President, Apr. 16, 1910, position of counsel and chief attorney created with specific duties, and filled by appointment of Judge Frank Feuille.

Under the order he is legal adviser to Isthmian Canal Commission, chairman, and head of department of civil administration; in addition, he has direction and control of all litigation, as well as supervision and direction of all prosecutions for offenses against law. Executive order, Jan. 8, 1908, created a department of law, charged with general supervision of legal matters pertaining to Isthmian Canal Commission, including acquisition of right of way and adjustment of land damages. Under this order, land questions handled through prosecuting attorney on Isthmus by general counsel in Washington. After resignation of general counsel, Apr. 30, 1909, only such land matters considered by prosecuting attorney as

needed immediate attention. Land titles on Isthmus are in unsettled state, and with completion of canal construction in sight it became necessary to adopt some measures looking to adjustment of land situation as soon as possible. Decided, therefore, that all questions affecting lands on Isthmus should be handled by counsel and chief attorney, and with this in view department of law placed under direction of counsel and chief attorney.

Questions affecting lands belonging to Panama R. R. handled by land office of that organization, and those affecting lands owned by Isthmian Canal Commission handled by legal department; and though counsel and chief attorney is also attorney for Panama R. R., deemed advisable to consolidate all land matters on Isthmus. Effected May 1, 1911, under Executive order of Jan. 19, 1911, by creation of land office, to which were transferred all papers, maps, records, and other documents relating to lands owned or controlled by U. S. in zone and lands auxiliary to canal.

Act Feb. 27, 1909, relating to use, control, and ownership of lands in zone, authorizes President to lease land. No leases made under this act, but practice of issuing leases by authority of Sec. of War adopted and continued. By Executive order Oct. 7, 1910, such leases to be executed by officer in charge of land office, with approval of head of department of civil administration.

Aug. 6, 1908, to June 30, 1910, 11 joint commission awards paid by U. S. for lands taken over for canal purposes, amounting to \$142,515, and joint commission having failed to agree in 3 claims, they were settled in accordance with findings of umpire for \$61,000. During same period 16 tracts of land acquired by U. S. for canal purposes under private agreements with owners for \$47,215.74, and 50 claims for damages to crops and improvements settled for \$5,037.95. In addition, 68 claims, amounting to \$8,796.55, paid between Apr. 8, 1910, and June 30 following on account of fire at Nombre de Dios.

During year island of Margarita in Manzanillo Bay near Colon and one or two other small holdings acquired by payment of \$4,250. In addition, 112 claims for damages arising in connection with excavation work, surveys, road building, and other canal activities settled for sum of \$4,532.37. Ten additional claims for fire at Nombre de Dios settled for \$436.20. 208 claims in area of Lake Gatun, including valleys of Chagres, Gatun, and Trinidad Rivers, adjusted and paid for \$46,704.50. \$33,964.85 paid to Caribbean Cocomat Co. by Panama R. R. for damages from cancellation of lease held at Toro Point. Total paid on claims during year, \$90,442.92.

Executive order outlining duties of counsel and chief attorney gives to latter equal authority with judges of courts of zone to issue subpoenas for witnesses in criminal cases and to examine witnesses under oath

in investigation of offenses against laws of zone. Information in civil case may also be filed by prosecuting attorney, assistant prosecuting attorney, or other counsel specially designated by head of department of civil administration, as well as by counsel and chief attorney. Order contained substantial modification of existing-law, providing more expeditious method of prosecuting criminal cases.

Conflicts between agents of Isthmian Canal Commission engaged in canal construction and shipping interests began to arise relative to rights of parties to use of waters. Resulted in enactment of legislation to prevent interference with canal construction, authorizing Isthmian Canal Commission to establish rules and regulations respecting use or passage through canal channel and all other navigable waters, and fully protect such navigable channels from injury or obstruction.

During existence of municipal governments in zone taxes assessed, levied, and collected by municipal authorities for benefit of local treasuries. Municipal governments abolished by Executive order Apr. 15, 1907, and functions of municipal officers vested in district tax collectors, under supervision of collector of revenues. Confusion resulted as to right of forfeiture of property to zone government in default of bidders at tax sales. To remedy existing conditions, Executive order Oct. 4, 1910, abolished office of district tax collector, and powers and duties of this office vested in collector of revenues, to be exercised by him through deputies. Order also provided that property sold for taxes should be forfeited to zone in default of bidders at tax sales.

Counsel and chief attorney calls attention to necessity of compiling, revising, and adding to existing legislation so as to establish simple, complete, correlated, and efficient system for civil government of zone. Administrative laws also in need of revision, so that duties of various departments may be clearly defined and coordinated. Law of civil procedure, criminal code, and law of criminal procedure also need revision. Held in abeyance until policy of U. S. with reference to zone determined. P-11, 54-56.

1912. Congressional legislation affecting canal not enacted until after close of fiscal year. Aug. 24 Panama Canal act made effective and sundry civil act approved on same date, making appropriations for current fiscal year, contains legislative provisions affecting canal. In addition, 16 Executive orders having effect of law issued to provide for cases and conditions which had arisen and which necessitated enactment of provisions to cover them.

Attention already called to necessity of a revision of Canal Zone laws, in order that legislation might be brought under one complete correlated system. Head of department of law advocates remedying condition

by embracing in one code all Colombian and Panaman laws deemed expedient to keep and repealing the others. Revision of administrative laws also necessary.

Assistant prosecuting attorney handled criminal matters in the zone during the past year; 615 cases disposed of in three circuits; 398 resulted in convictions, 139 in acquittals, 66 in dismissals, and in 12 defendants were fugitives and not arrested. Makes considerable increase in number of criminal cases, due in part to large number of prosecutions for gambling and for violations of navigation laws; increase in idle population probably responsible. Four criminal cases passed upon by supreme court of zone; two resulted in affirmance, in one trial court's finding reversed, and fourth was habeas corpus proceeding brought originally in supreme court.

Cases arise occasionally in which unlawful intrusions made upon public lands; no authority for anyone in zone to submit title of U. S. to judicial ascertainment. If land be needed for canal purposes, intruders ordered to leave; on failure to do so are ejected by police. When lands intruded upon not needed for construction purposes, appeal taken to courts to evict occupants. On this theory several suits instituted on behalf of Isthmian Canal Commission and 225 acres of land between cemetery at Mount Hope and quartermaster's corral at Cristobal recovered for U. S. and Panama R. R. Several disputed land claims pending which might be adjusted amicably if commission were authorized by Congress to agree upon boundary lines with claimants.

Several small tracts acquired from private persons by deed, and claims will not be submitted to joint commission for adjustment. Amount aggregated 979 hectares and consideration \$9,318. In addition, 31 quitclaim deeds taken by Panama R. R. from squatters at Toro Point; consideration, \$5,578.

295 revocable licenses issued for 315 lots in town sites, calling for annual rental of \$2,529.09. \$1,536 obtained from monthly licenses covering 27 rooms in houses belonging to Isthmian Canal Commission at Gorgona, and \$900 additional for rental of 1 house at same place. P-12, 62-64.

1913. In anticipation of inundation of Gatun Lake area, number of towns along line of old Panama R. R. between Gorgona and Gatun cleared of population; as result, administrative district of Gorgona abolished and its territory added to district of Empire for judicial, administrative, and political purposes, by Executive order Sept. 2, 1912. Order also abolished office of senior district judge and reduced number of district judges to 3.

Panama Canal act Aug. 24, 1912, authorized President to declare all land and land under water within zone necessary for construction, maintenance, operation, sanitation, and protection of Panama Canal. Executive order

issued Dec. 5, 1912, directed all land and land under water within limits of zone be taken possession of and to extinguish, by agreement when practicable, all claims and titles of adverse claimants to occupancy. Negotiations pending between U. S. and Panama for exchange of lands known as Las Sabanas, lying contiguous to Panama, in zone, for certain harbor areas in Colon; Executive order Feb. 18, 1913, issued, modifying provisions of order of Dec. 5, 1912, exempting privately owned lands in territory under negotiation from being acquired by U. S. Mar. 19, 1913, order issued protecting from wanton killing or injury birds of zone. Order Mar. 20, 1913, amending order Feb. 5, 1912, collector of revenues authorized to administer upon estates which consisted of personal property only, regardless of value of estates, maximum value previously fixed being \$1,000. Under existing law, estates of deceased or insane employees of Isthmian Canal Commission, zone government, and Panama R. R. administered by collector of revenues free of cost. Actions of collector subject to supervision and approval of Circuit Court of First Judicial Circuit of zone.

Complaints that agents of foreign corporations whose financial condition doubtful doing business in zone. Order issued Mar. 20, 1913, requiring foreign corporations or joint-stock companies to file articles of incorporation with collector of revenues for zone, together with information to enable collector of revenues to base conclusion as to solvency of concern. In addition, foreign corporations required to file authorization with collector of revenues to represent them in all suits and legal proceedings in zone, and to pay annual tax of \$50. Order has had effect in keeping out undesirable concerns.

Apr. 15, 1913, maritime quarantine regulations for zone and harbors of Panama and Colon in Republic established by order, to take effect upon the date on which Panama Canal is officially and formally opened by President of U. S. Regulations promulgated in advance that shipping interests and public may have information in regard to quarantine requirements of canal and zone.

Prosecution of criminal cases conducted by assistant prosecuting attorney; 621 cases disposed of in 3 circuits; 449 convicted, 111 acquitted, charges against 54 dismissed, and in 7 cases defendants fugitives. One disbarment proceeding brought in supreme court against attorney of zone, and defendant disbarred.

\$27,806.50 paid by Isthmian Canal Commission in settlement of claims presented by squatters and occupants of lands. Several tracts acquired from private persons. Quitclaim deeds obtained for U. S. for holdings at Santa Isabel, El Encanto, Victoriano, and Paja. Mar. 31, 1913, all unexpired Isthmian Canal Commission leases for building lots and agri-

cultural property terminated; on that date there were 174 leases, covering 99 hectares of agricultural land and 108 building lots, which would have remained in force until June 30, 1913, had it not been for cancellation.

312 revocable licenses, covering 347 building lots, in force June 30, 1913, calling for annual rental of \$2,816.96. P-13, 65-67.

(See Executive department, p. 2368 of this Index.)

Law, Eight-hour.

Act eliminating aliens from operation of, P-11, 560, 562.

Laws. (See Nos. 30, 152, pp. 2362, 2364 of this Index.)

Administration of estates of deceased U. S. employees, P-05, 199.

Canal Zone, P-05, 195.

Laws passed by preceding commission (Isthmian Canal Commission No. 2) subsequent to last annual report, P-05, 195.

Legislation, P-11, 433.

Municipal governments, relating to organization of, P-05, 197.

Navigation, P-14, 263.

Ports of entry, relating to, zone, P-05, 198.

Right of expropriation, relating to real estate and immovable property within the zone, and as to personal property and property that is partly personal and partly real, and providing the method of procedure for exercising that right, P-05, 195.

Zone government, relating to organization of the executive branch of, P-05, 198.

Lawsuits.

Civil cases involving the U. S. and the Panama R. R., P-14, 521.

Lay-overs.

Act relating to prohibition of allowance for, P-11, 571, 577, 580.

Leakage.

Gatun Spillway gates, P-14, pls. 109, 110.

Test for correction for leakage of cylindrical valves, P-13, 88.

Leases. (See Lands.)

Land, terminals for commercial uses, P-12, 221.

Panama R. R. leases in effect, P-13, 525.

Leaves, Lock-gate. (See Gates; Locks; Dams.)

Legal Department.

Department created by act 8, Isthmian Canal Commission. Charged with all litigation before courts of special tribunals of the zone, and advises the governor and the commission respecting questions of law arising in the administration. Presents the interests of the U. S. in the courts of Panama. Charged with the duty of negotiating for the purchase of real estate; only 3 cases of latter kind had to be settled on an expropriation basis. Many cases of damages caused by municipal engineers and the department of health settled; one unsatisfied

claim led to examination of all titles on the Isthmus, with the result that it developed all the land belongs either to the U. S. or to Panama R. R. Aug. 16, 1904, penal code enacted and put in force; natives adapted themselves instantly. Zone considered practically free of crime. Gambling suppressed. Immediate trials, avoiding expense and delay. **P-06, 41.**

Reorganization, Sept. 6, 1906, of legal department of Isthmian Canal Commission and zone in conjunction with legal department of Panama R. R., **P-06, 43.**

Legislation, P-07, 145; P-08, 255; P-09, 257; P-10, 363; P-11, 482; P-12, 455; P-13, 459; P-14, 421, 511. (See Civil Administration; see Nos. 45, 160, pp. 2362, 2364 of this Index.)

Department of law, **P-12, 515.** (See Law, above.)

List of laws, orders, etc., **P-11, 433, 543; P-12, 593; P-13, 605; P-14, 553.**

Understanding of relation of legislation of Congress to Isthmian Canal Commission. Assumed that Isthmian Canal Commission "does not possess legislative powers as to the national endeavor of constructing the canal." * * * "The commission exercises the powers of legislation appertaining to the government of the Canal Zone." **P-04, 70.**

Lepers. (See Asylum.)

Colony, **P-10, 434, pl. 69.**

Leprosy, report of Palo Seco Asylum, **P-13, 549.**

Palo Seco Leper Asylum, **P-09, 304; P-10, 430; P-11, 526; P-12, 551.**

Levees.

Atlantic division, **P-11, 127.**

For retaining hydraulic fill near Mindi, east of Panama R. R. relocated line, **P-11, 104; P-12, 111.**

Levels, Precise. (See Surveys; Triangulation; Benchmarks.)

Levels, Water.

Oscillations of, Pedro Miguel Locks, **P-14, pls. 74, 75.**

Libraries. (See Recreation.)

Licenses.

Executive order relating to practice of medicine, **P-12, 611.**

Fees, **P-08, 258; P-09, 260; P-10; P-11, 419; P-12, 461; P-14, 265, 409.**

Navigation, canal, **P-14, 266.**

Lighting and Buoying. (See Electricity; Beacons; Illumination.)

Balboa, **P-14, 174, 225.**

Breakwater, **P-13, pl. 87.**

Canal, costs, **P-12, 305.**

Central division, **P-11, 148; P-12, 159.**

Division of lighthouses, **P-14, 93.** (See No. 259, p. 2368 of this Index.)

Electricity for beacons, plan, **P-12, pl. 77.**

Electric lighting plants, **P-12, 275.**

Electric light and air compressor division, **P-12, 274.**

Front range towers, Gatun Lake section, and beacons for Culebra Cut and Gatun Lake section, **P-11, pl. 93.**

Light and power, locks, **P-11, 81.**

Lighthouse service, **P-14, 262.**

Maintenance of building and street lighting system, **P-14, 88.**

Operation of plant, **P-10, 273; P-13, 266.**

Plant, **P-07, 85; P-11, 241.**

Proposed project, **P-11, pl. 89.**

Ranges, **P-12, pl. 75.**

Subdivision of, **P-10, 269; P-11, 240.**

Ranges, clearing, **P-12, 101.**

Range towers, plans, **P-11, pls. 90, 91.**

Range towers, Gatun Lake section, **P-11, pl. 92.**

Terminal construction, **P-14, 168.**

West breakwater light and fog signal, **P-13, pl. 87.**

Lights and Fog Signals.

West breakwater, vertical section and plans (floor), lighting and buoying canal, **P-12, pl. 76.**

Limestone.

Deposits, zone, **P-13, 577.**

Emperador limestone beds near Las Cascadas, **P-13, 582, pl. 73.**

Line, Alternative Canal.

Surveys begun for, between Gatun and Bohio, **P-04, 41.**

Line, Pipe. (See Fuel, Oil.)

For handling plant, Gatun, **P-09, 61.**

Lines, Electric. (See Electricity.)

Manholes, covers, ducts, etc., **P-11, 82.**

Tie lines, **P-11, 82.**

Transmission system, **P-14, 100.**

Lines, Transmission.

Electric, 44,000 volts, **P-13, 11.**

Electricity, **P-13, 98.**

Stations, **P-14, 315.**

Substation, Miraflores, **P-14, pl. 70.**

Lining.

Timbering and lining of tunnel, Miraflores, **P-09, 142, pl. 70.**

Liquor. (See Orders, Executive.)

High license for, advantages, **P-05, 71.**

Statistics, **P-11, 432.**

Lithography. (See No. 137, p. 2364 of this Index.)

Live Stock.

Livery, **P-07, 105.**

Stabling and foraging, statement of details, **P-08, 234, 246.**

Loading.

Unloading plant, Gatun Locks, **P-11, 114.**

Unloading plant, material for Gatun Locks, **P-12, 124.**

Lobnitz Rock Breaker. (See Breaker, Lobnitz.)

Lockages, P-14, 74, 115-119.

"Alliance," **P-14, 116.**

"Ancon," **P-14, 119.**

Lock and Dam Construction, Department of. (See No. 220, p. 2366 of this Index.)

Lock and Sea Level Canals. (See Nos. 174, 176, 182, 212, p. 2365 of this Index.)

Comparative danger of two types, **P-06*, 137, 142.**

Transformation, report of committee on lock canal. Appendix **P. P-06*, 411-413.**

Lock Canal. (See Nos. 159, 181, 183, 190, 216, pp. 2364, 2365 of this Index.)

Act prescribing lock canal, **P-11, 560.**

Estimates, supplementary to minority report. Appendix **T. P-06*, 425, 426.**

Map showing line of proposed, summit elevation 85', **P-06*, 7, pl. 8.**

Profile, cross sections, **P-06*, 7, pls. 9, 10.**

Profile of proposed, with summit elevation at 60', approved by Board of Consulting Engineers for comparison with sea-level canal project, **P-06*, 7, pl. 4.**

Traffic capacity, with summit level at elevation 85. Appendix **L.** By Alfred Noble and Joseph Ripley. With tables showing actual capacity experiences at St. Marys Falls Canal, Mich. **P-06*, 397-402.**

Locks, P-07, 5; P-08, 7; P-09, 33; P-10, 47; P-11, 66; P-12, 69; P-13, 73; P-14, 6. (See Cranes; Gates, Lock; Gates, Sea; see Nos. 13, 186, 209, 231, 239, 249, 255, pp. 2361, 2365, 2366, 2367, 2368 of this Index.)

Anchorage and compression tests, Gatun, **P-09, 46, 47.**

Anchors, details, **P-10, pl. 76.**

Approach, lake, Gatun, **P-13, 138.**

Approach, side, and wing walls, Pedro Miguel, **P-10, pl. 75.**

Approach wall, north, bird's-eye view from hill at east end, Pedro Miguel, **P-12, 204, pl. 47.**

Approach wall, north, forms for, Pedro Miguel, **P-12, pl. 90.**

Approach wall, north, interior view of, Gatun lower locks, May 26, 1913, **P-13, 138, pl. 21.**

Approach wall, north, looking northwest; dredge grounded 55' below sea level, June 14, 1913, **P-13, 138, pl. 22.**

Approach wall, north, placing iron girders on; Gatun lower locks, May 23, 1913, **P-13, 138, pl. 20.**

Approach walls, designs, **P-10, 48; P-11, 66; P-12, 70.**

Approach walls, Gatun, **P-10, 123.**

Back fill, Gatun, **P-10, 123.**

Borings, Gatun, **P-13, 192.**

Borings, Miraflores, **P-08, 65.**

Borings, Pedro Miguel, **P-08, 64.**

Buffer casting, details, **P-10, pl. 76.**

Cable, electric, **P-12, 91.**

Caissons, floating, **P-13, 8.**

Caissons, sinking, Miraflores, **P-13, pl. 98.**

Castings for, made on Isthmus, **P-10, 49; P-11, 67; P-12, 72.**

Chain anchorage, machinery pits, and electric tunnel, lower end of center wall, looking north, Pedro Miguel, **P-11, 192, pl. 49.**

Chain anchorage, machinery pits, and electric tunnel, lower end of center wall, looking south, Pedro Miguel, **P-11, 192, pl. 50.**

Chamber, east, looking north, Pedro Miguel, **P-11, 192, pls. 45, 46.**

Chambers, east and west, lower lock and, of middle and upper locks in distance, **P-11, 132, pl. 15.**

Chamber, west, of middle lock, with upper lock and guard gates in distance, **P-11, 132, pl. 14.**

Chamber, west, looking north, Miraflores, **P-12, 204, pl. 51.**

Compression tests, Gatun, **P-09, 47.**

Concrete, cost of, Gatun, **P-12, 125.**

Concrete handling plant, Gatun, **P-09, 66, pl. 17; P-11, 114; P-12, 124; P-13, 121.**

Concrete handling plant, Miraflores, **P-12, pls. 91, 92.**

Concrete material, Gatun, **P-11, 114; P-12, 123; P-13, 120.**

Concrete placing, Gatun, **P-10, 121, pl. 99; P-11, 115; P-12, 124; P-13, 117.**

Concrete placing, Pacific, **P-12, 179.**

Concrete placing, Miraflores, **P-10, 171; P-11, 164, pl. 114; P-12, pl. 93; P-13, pl. 99.**

Concrete progress sheet, Pedro Miguel, **P-10, pl. 112; P-11, 159, pl. 110; P-12, pl. 89; P-13, 162, pl. 97.**

Concrete temperature curves, Gatun, **P-10, pl. 98; P-11, pl. 100.**

Cofferdam, east chamber, looking north, showing temporary, at extreme end of lock chamber, **P-12, 142, pl. 22.**

Construction, methods of, plan showing, Gatun, north end, **P-10, 136, pls. 10, 11, 12; P-13, pl. 89.**

Construction of, success dependent on cement, Panama, **P-07, 23.**

Construction of, special wooden forms, Pedro Miguel, **P-11, 162.**

Contracts, **P-12, 105.**

Control and indicating equipment, **P-12, 89.**

Control board, **P-14, 74.**

Control board, Miraflores, **P-14, pl. 15.**

Control house, Gatun, **P-13, 122.**

Control house, Pedro Miguel, **P-14, pl. 13.**

Control houses, **P-14, 321.**

Control, remote, **P-14, 14.**

Control scheme, arrangement, **P-13, 10.**

Coping, drainage, **P-11, 81.**

Cranes, chamber, performance of, Miraflores, **P-13, pl. 101.**

Cranes, chamber, performance of, Pedro Miguel, **P-13, pl. 101.**

Cranes, mixing, Pedro Miguel, **P-10, 196, pl. 44.**

Culvert details and typical section of walls, Gatun upper lock, **P-09, 42, pl. 7.**

Culvert forms, lateral, Miraflores, **P-10, 196, pl. 46.**

Culvert transition curve, 18', leading from a Stoney gate chamber, Gatun, **P-11, 132, pl. 17.**

- Culvert, looking west, lower end of center wall, showing drop curve in, Pedro Miguel, **P-11**, 192, pl. 47.
- Culverts, 18' diameter side wall, with collapsible steel forms in place, Gatun, **P-11**, 132, pl. 16.
- Culverts, side-wall, characteristics, Pedro Miguel, **P-14**, pl. 72.
- Discharge, culverts and, Pedro Miguel, **P-14**, pl. 2.
- Discharge system, tests of, **P-13**, 77.
- Discharge, tests of, Gatun, **P-11**, 117.
- Diversions, Miraflores, **P-09**, 96.
- Dredging from ocean to Gatun Locks, Gatun, **P-13**, 191.
- Dredging, Miraflores, **P-09**, 96; **P-10**, 170.
- Dredging, site, Miraflores, **P-09**, 134, pl. 62.
- Electrical conduit and floor culvert at upper end of east lock, Miraflores, lower, looking east, **P-12**, 204, pl. 52.
- Emergency dam, east, testing, Gatun, **P-13**, 110, pl. 6.
- Emergency dams and lake, looking south, Gatun, June 20, 1913, **P-13**, 138, pl. 25.
- Emergency dams, deflection of chords, Gatun, **P-14**, pls. 93, 94.
- Emergency dams, designs of, **P-09**, 42, pl. 11.
- Emergency dams, erection tracks, **P-13**, pl. 86.
- Emergency dams, leakage, Gatun, **P-14**, pl. 95.
- Emergency dam, swinging across lock, Gatun, **P-13**, 110, pl. 9.
- Emergency dam, testing, Gatun, **P-13**, 110, pls. 7, 8.
- End, upper, of locks, with Gatun Dam and spillway in distance, Gatun, **P-11**, 132, pl. 8.
- Entrance caisson, lock, general drawing, **P-13**, pl. 81.
- Entrance, caisson, typical cross frames, and cross frames at center line No. 6, and No. 12, **P-13**, pl. 82.
- Entrances, caissons, **P-13**, 85; **P-14**, 71.
- Equipment, control and indicating, **P-13**, 96.
- Equipment, Gatun, **P-08**, 60.
- Equipment, transformer room, **P-12**, 91; **P-13**, 94; **P-14**, 110.
- Equipment, transformer room, high-tension oil switch group, Pedro Miguel, **P-13**, 110, pl. 12.
- Equipment, transformer room, low-tension switchboard, Miraflores, lower, **P-13**, 110, pl. 13.
- Excavation by dredges, Gatun, **P-09**, 46.
- Excavation, dry, Miraflores, **P-10**, 169.
- Excavation, Gatun, **P-07**, 56, pl. 42; **P-08**, 58; **P-10**, 120; **P-11**, 113; **P-12**, 122; **P-13**, 115.
- Excavation, lower chamber, Gatun, **P-09**, 66, pl. 14.
- Excavation, middle chamber, Gatun, **P-09**, 66, pl. 15.
- Excavation, Miraflores, **P-12**, 175; **P-13**, 167.
- Excavation, Pedro Miguel, **P-10**, 165; **P-11**, 158; **P-12**, 172; **P-13**, 162.
- Excavation, plant for, Gatun, **P-10**, 121.
- Excavation progress sheet, Gatun, **P-10**, pl. 97; **P-11**, pl. 99.
- Excavation, steam shovel, in lower locks looking south from berm crane, Miraflores, **P-11**, 192, pl. 58.
- Excavation, upper chamber, Gatun, **P-09**, 66, pl. 16.
- Excavation, upper locks for lateral culverts and laying concrete, Miraflores, **P-11**, 192, pl. 55.
- Excavation with steam shovels, Gatun, **P-09**, 46.
- Features of, general, **P-09**, 33.
- Fender, chain, diagram showing stopping power of chain fender for vessels of different tonnage and varying speeds, **P-11**, pl. 82.
- Fender, chain, general arrangement, showing post brake, **P-11**, pl. 80.
- Fender, chain, tests, **P-13**, 7.
- Fenders, chain, **P-10**, 51; **P-11**, 71; **P-13**, 81.
- Fenders, chain, arrangement, **P-13**, 8.
- Fenders, chain, assembly, **P-11**, pl. 81; **P-13**, pls. 79, 80.
- Filling with ship in chamber, Miraflores, **P-14**, pl. 14.
- First boat through, Gatun, **P-14**, pl. 6.
- Flight of three locks, general formula for lifts, **P-10**, 76.
- Flight of, general formula for, cross filled, **P-10**, 87.
- Float wells, mechanism of, **P-11**, 81.
- Floor construction, beginning of, Gatun, **P-11**, 132, pl. 11.
- Floor, lock, and crane, Pedro Miguel, **P-10**, 196, pl. 43.
- Forebay and work in progress in upper locks, Gatun, **P-11**, 132, pl. 9.
- Forebay, east side looking north, showing flaring approach wall, Gatun, **P-12**, 142, pl. 21.
- Forebay and construction of lift sills, upper locks looking east, showing lower part of, Miraflores, **P-11**, 192, pl. 56.
- Forebay, looking south, Pedro Miguel, **P-11**, 192, pl. 52.
- Forebay, west, with emergency dam sill, looking south, **P-12**, 204, pl. 48.
- Foundation, north approach wall, looking north, sinking caissons for, Miraflores, **P-12**, 204, pl. 54.
- Foundations, **P-10**, 166.
- Foundations, excavation of, Pedro Miguel, **P-13**, 163.
- Foundations, Gatun, **P-08**, 121-125.
- Foundations, materials in, Gatun, **P-08**, 121.
- Foundations, Miraflores, **P-12**, 176; **P-13**, 166.
- Foundations, Pedro Miguel, **P-12**, 172; **P-13**, 163.
- Foundations, profiles, Gatun, **P-08**, 126, pl. 55.
- Foundations, tests, Pacific division, **P-09**, 92.
- Foundations, water under, examination for, Gatun, **P-08**, 124.
- Foundry work, **P-11**, 82.
- Gate erection, Gatun, **P-11**, 117; **P-13**, 121.
- Gate-boisting machinery, assembly of, emergency dam, Gatun, **P-11**, pl. 84.

- Gates. (See Gates, Lock.)
- Gatun, **P-07**, 54; **P-08**, 57; **P-09**, 66, pl. 13; **P-10**, 120, 136, pls. 10-12; **P-11**, 113; **P-12**, 122; **P-13**, 115; **P-14**, 6.
- Ground, and hydraulic condition of, Gatun, **P-08**, 70, pl. 41.
- Guide wall, south, looking north, Miraflores lower, **P-13**, 186, pl. 50.
- Hodges formula, application of, 1,000' lock, Gatun, **P-10**, 77.
- Illuminated, when, general view and, Pedro Miguel, **P-14**, pls. 11, 12.
- Illumination, **P-12**, 92; **P-13**, 96; **P-14**, 14.
- Illumination, reflector system, Gatun, **P-14**, pls. 87, 88, 89, 90.
- Intermediate and lower locks, Gatun Locks, looking north, June 25, 1913, **P-13**, 138, pl. 23, La Boca, **P-07**, 56.
- Lighting, poles, etc., **P-13**, 10.
- Location of Gatun Locks and Dam, breakwaters in Colon Harbor and Channel, excavation to date, general map showing, Gatun, **P-09**, 66, pl. 13; **P-11**, pl. 98.
- Location of, Pedro Miguel to Balboa, **P-09**, 134, pl. 51.
- Lockages, first, **P-14**, 74, 115-119.
- Looking north from east bank, Pedro Miguel, **P-11**, 192, pl. 44.
- Looking south from mixing cranes, Pedro Miguel, **P-11**, 192, pl. 51.
- Lower locks, Gatun, **P-11**, 132, pl. 13.
- Lower locks, looking south from cofferdam, showing west chambers of upper and middle locks, Gatun, **P-12**, 142, pl. 20.
- Machinery, assembly of, **P-13**, pls. 83, 84.
- Machinery, contracts for, **P-10**, 53.
- Machinery, drawings, **P-11**, 83.
- Machinery erection, **P-12**, 94.
- Machinery erection, special force for, **P-11**, 83.
- Machinery inspection, **P-12**, 93.
- Machinery installation, tile ducts, **P-12**, 87.
- Machinery, lock, **P-09**, 39; **P-10**, 51, 53, pls. 78-80; **P-11**, 70; **P-12**, 82; **P-13**, 87; **P-14**, 74, 102. (See Operating machinery, below.)
- Machinery rooms, cover seats for crank gear, **P-13**, 98.
- Machines, numbering system for, **P-10**, pl. 86.
- Map, general, Gatun, **P-09**, 66, pl. 13; **P-10**, pl. 96; **P-12**, pl. 78.
- Map of locks and dams proposed, Gatun, **P-06***, 7, pl. 11.
- Masonry, cost of, Pedro Miguel, **P-11**, 292.
- Masonry of, comparative statement of costs, concrete work, Gatun, **P-13**, 119.
- Material, floating equipment for handling, Gatun, **P-09**, 50.
- Material-handling cranes, arrangement of, Pedro Miguel, **P-10**, pl. 109.
- Material-handling cranes, Miraflores, **P-10**, pl. 111.
- Material under, classification of, Miraflores, **P-09**, 134, pl. 53.
- Middle lock view, Gatun, **P-11**, 132, pl. 12.
- Miraflores, **P-08**, 63; **P-09**, 94; **P-10**, 169; **P-11**, 163; **P-12**, 175; **P-13**, 166, pl. 51; **P-14**, 9.
- Operating, general remarks, **P-12**, 95.
- Operating, layout of electrical circuits, **P-10**, 57.
- Operating machinery, **P-09**, 39; **P-10**, 51; **P-11**, 83; **P-12**, 82. (See Machinery, above.)
- Operating machinery and electrical installation, **P-13**, 87.
- Operating machinery, installation of, **P-12**, 300.
- Operating machinery, limit switches, **P-10**, 53; **P-12**, 85.
- Operating machinery; lock, pumps, and motors of, **P-12**, 90.
- Operating machinery, rising stem and cylindrical valve machines, **P-12**, 82.
- Operating, transmission or power line, **P-12**, 93.
- Operation, **P-14**, 19.
- Operation, Gatun, **P-14**, pls. 6, 7.
- Operation, hydroelectric station, **P-12**, 88.
- Operation, ship in chamber and lock filling, Miraflores, **P-14**, pls. 3, 4.
- Operation, test of emergency dam, Gatun, **P-14**, pl. 5.
- Outlet, rectangular, study for, lower lock dam, **P-11**, pl. 95.
- Outlet, study for, Gatun, **P-11**, pl. 96.
- Outlet, study for, lower lock, Gatun, **P-11**, pls. 94, 97.
- Parts, contracts for, **P-11**, 66; **P-12**, 70.
- Parts, drawings of, **P-11**, 66.
- Pedro Miguel, **P-07**, 55; **P-08**, 64; **P-09**, 92; **P-10**, 165; **P-11**, 158; **P-12**, 172; **P-13**, 162; **P-14**, 8.
- Piles and piling, **P-08**, 59, 60; **P-11**, 117; **P-13**, 117.
- Plan and profile of, general, showing all gates, fender chains, and emergency dams, **P-10**, pl. 95.
- Plan, Gatun, **P-10**, 76; **P-13**, pl. 90.
- Plan, Miraflores, **P-10**, 93.
- Plan, Pedro Miguel, **P-09**, 42, pl. 2; **P-10**, 43.
- Plant, construction, Gatun, **P-09**, 66, pl. 22.
- Plant, handling, proposed layout, Miraflores, **P-10**, pl. 110.
- Plant, handling, proposed layout, Pedro Miguel, **P-10**, pl. 108.
- Position, change of, Pacific slope, **P-08**, 63.
- Power, graphic wattmeter curve, Gatun, **P-14**, pl. 86.
- Protective devices, **P-09**, 38; **P-10**, 49; **P-11**, 68; **P-12**, 74; **P-13**, 77; **P-14**, 68.
- Protective devices, contracts, **P-12**, 82.
- Ready for entrance of Atlantic waters, Gatun, **P-13**, 110, pl. 1.
- Recesses, **P-12**, 82.
- Sea gates under full pressure, Gatun, **P-13**, 110, pls. 2, 3.
- Sills, **P-11**, 192, pl. 56. (See Gates.)
- Sites, change from La Boca to Miraflores, **P-08**, 63.
- Site, lower, looking south, Miraflores, **P-11**, 192, pl. 57.
- Sites, contours showing head of water under, Gatun, **P-08**, 128, pls. 57, 58, 59, 60, 61.
- Sites, Gatun, **P-10**, 136, pls. 3, 8, 9.
- Sites, Pedro Miguel, **P-08**, 70, pls. 36-39.
- Sites, topography, Gatun, **P-08**, 126, pl. 56.

Slide back of west wall, looking south, Miraflores, lower, **P-12**, 204, pl. 53.

Structures, castings made on Isthmus, **P-13**, 77.

Structures, contracts for, **P-13**, 75.

Structures, drawings, **P-12**, 70; **P-13**, 75.

Surge, on locking, Pedro Miguel, **P-14**, pl. 112.

Switchboards, lock control, **P-14**, 122.

Tests, final, **P-13**, 3.

Towing locomotive, current duty, Miraflores, **P-14**, pl. 85.

Towing, log tests, Gatun, **P-14**, pl. 91.

Unloading plant, Gatun, **P-12**, 124.

Upper locks and forebay, Gatun, **P-09**, 35, 42, pl. 1; **P-11**, 132, pl. 10.

Upper locks, looking north, general view of, Miraflores, **P-11**, 192, pl. 53.

Upper locks, looking northwest from lower end, Miraflores, **P-11**, 192, pl. 54.

Valves, **P-09**, 36; **P-10**, 39; **P-11**, 48, 66; **P-12**, 70; **P-13**, 3. (See Valves.)

View, Gatun, **P-09**, 66, pl. 22; **P-12**, 108, pls. 1, 2, 3, 7.

View, general, Gatun, looking southwest, showing north end of locks, with temporary cofferdam in place, **P-12**, 142, pl. 23.

View, general, looking north, Miraflores, **P-12**, 204, pls. 49, 50; **P-13**, 186, pl. 49.

View, general, Pedro Miguel, **P-10**, 186, pl. 42; **P-12**, 108, 204, pls. 4, 46; **P-13**, 186, pl. 47.

Wall, east side, lower end of, and arch in center wall, Pedro Miguel, **P-11**, 192, pl. 48.

Walls, lock, forms for, Pedro Miguel and Miraflores, **P-10**, pl. 113.

Water level, oscillations, Pedro Miguel, **P-14**, pls. 74, 75.

Water saved by intermediate gates, **P-10**, 79.

Wedges, rise of, measurement of, Gatun, **P-14**, pl. 92.

Weights, fixed irons, embedded in concrete, **P-13**, 81.

Work accomplished, estimates of, Gatun, **P-11**, 118.

Locks and Dams. (See Locks, above; see Nos. 161, 220, pp. 2364, 2366 of this Index.)

Approach wall, south center, and forebay of Gatun Locks, with dam and spillway in distance, looking west from water tower showing, **P-12**, 142, pl. 24.

Borings, Pedro Miguel, **P-08**, 64.

Borings, table of, Pacific division, **P-09**, 121.

Construction, organization, chart, **P-07**, pl. 138.

Electrical designs, **P-08**, 67.

Excavation, Gatun, **P-08**, 70, pl. 32. (See Locks.)

Excavation, Miraflores, **P-09**, 94. (See Locks.)

Excavation, Pedro Miguel, **P-09**, 92. (See Locks.)

Gatun, view, **P-09**, 66, pl. 13. (See Locks.)

Geology of sites, **P-07**, 124.

Material under east and west dams, showing classification of, Miraflores, **P-09**, 134, pl. 53.

Material under east and west dams, showing classification of, Pedro Miguel, **P-09**, 134, pl. 52.

Miraflores, **P-08**, 65; **P-09**, 94; **P-10**, 169; **P-11**, 163; **P-12**, 175.

Pedro Miguel, **P-07**, 55; **P-08**, 64; **P-09**, 92; **P-10**, 165; **P-11**, 158; **P-12**, 172; **P-13**, 162.

Sites, exploration of material of, Pacific division, **P-09**, 92.

Sites of, compression tests, **P-07**, 125.

Locks and Dams, Operation. (See Locks and Lock Gates, below.)

1906. After determination of canal-level policy, Isthmian Canal Commission No. 3 fixed definitely location on the Atlantic side of 3 sets of locks and a great dam at Gatun, and on the Pacific side of 1 set of locks at Pedro Miguel and 2 sets at La Boca and 2 dams in the vicinity of La Boca, a large one between Sosa Hill and Corozal and a smaller one between Sosa Hill and San Juan Hill, **P-06**, 14.

1907. Department of construction embraces Gatun Locks and Dam, locks and dam at Pedro Miguel, and locks and dam at La Boca; meteorology and river hydraulics. Project embraces 3 flights at Gatun, 2 at La Boca, and 1 lift at Pedro Miguel. Locks in pairs. Usable lengths, 1,000'; widths, 100'. Previous borings have been criticised; 5 test pits each 6' by 8' sunk to depths of the lock walls at Gatun, 2 at Pedro Miguel, and 1 at the spillway in Gatun Dam. Satisfactory rock at La Boca. Board of Consulting Engineers (Alfred Noble, F. P. Stearns, and John R. Freeman) examined borings, and reported, May 2, 1907: "We found that all of the locks of the dimensions now proposed will rest upon rock of such a character that should furnish a safe and stable foundation." Subsequent borings made to plat contours of the rock surface, with a view to economical adjustment of locks to sites. Studies begun of locks, gates, and sluices. Method of filling and emptying the locks, and the number and type of gates, decided. Gates in duplicate; miter type, but rolling gate of Ohio River type to be substituted for duplicate set at lower end of each summit lock. Auxiliary pair of gates at the lower end of each flight to be used as cofferdams in emergency. Tentatively determined to adopt swing bridge dam for emergency. Designs of locks and gates under way. **P-07**, 5.

Gatun Locks and Dams: Excavation of lock site begun Sept., 1906; 4 shovels working Mar., 1907; total of 484,362 c. y., p. m., earth and rock removed. 573 acres of site of dam cleared of timber; pile trestle built for rock depositing. Contracts made for two 20" pipe-line suction dredges. Cross section of dam slightly changed. Excavation of spill-

way begun Apr., 1907; 1 steam shovel at work; 3,832 c. y., p. m., removed and dumped in near vicinity. Topographical survey made of basin of lake to 100' contour; area of lake found to be 164.23 sq. m. No stone for concrete in immediate vicinity; quarry opened at Porto Bello; contracts made for rock-crushing plant, and for barges for conveying product to Gatun. **P-07, 6.**

Pedro Miguel Locks and Dam: Test pits made; 162,094 c. y., p. m., removed from lock site, considered as part of work on Culebra Cut. **P-07, 6.**

La Boca Locks and Dams: Preparatory work arrangements made for diversion channel; Borings along the lines of the two dams, La Boca-San Juan and Sosa-Corozal. **P-07, 6.**

Meteorology: Three stations operating, at Naos Island, Ancon, and Bas Obispo. Fourth begun at Cristobal. **P-07, 7.**

River hydraulics: Object of this division the collection of data necessary to predict freshets in time to take measures for preservation of property. Also for determining amount of water to be relied on for supplying lakes to exist upon completion of canal. Rain gauge and fluviograph observations at Alhajuela, Gamboa, and Bohio. Gaugings at Trinidad and Gatuncillo started. Arrangements made for discharge measurements of several channels at Gatun. **P-07, 7.**

1908. Limits: Embraces Gatun Locks and Gatun Dam divisions, the Pacific division of locks and dams, and the division of meteorology and river hydraulics.

Locks: Locks in pairs. Dimensions increased to make locks 110' wide, usable length 1,000', in response to ideas of General Board of the Navy; modification approved by the President Jan. 15, 1908. Designs for locks in preparation.

Dams: Steps taken to build Sosa-Corozal Dam; trestles failed; examination of foundation area revealed unctuous blue clay instead of the stiff clay reported by the Board of Consulting Engineers, 1906. Careful examination of canal route made from Pedro Miguel to Pacific by wash and diamond drill borings and test pits to ascertain if a more suitable place for the locks and dams, originally proposed for La Boca and Pedro Miguel, could be found. One lock at Pedro Miguel and two at Miraflores recommended (dams of lower height, less length, resting on rock could be more easily constructed, and works would be under better geographical protection in war); change approved by the President Dec. 19, 1907. **P-08, 8, 9.**

Gatun Locks; borings: Disclosed presence of ground water, under pressure; small. "There is no question that the various materials will bear the greatest loads that will be transmitted to them by the lock walls, if provision is made to prevent the underground flow of water through the softer materials on which part of the walls will

rest." Curtain walls to be built to prevent access of the ground water to the foundations. (See special report of C. M. Saville, assistant engineer, on Gatun Dam investigations, **P-08, 127-196.**)

Lock excavation: Nine shovels on work. Nearly 1,800,000 c. y. removed (190,013 c. y. being placed on the south toe of the dam).

Drainage: By gravity; pumping plant being installed.

Stone for concrete: To be procured from Porto Bello, and preparatory work being done there.

Sand for concrete: As the result of searches, etc., deposits in vicinity of Nombre de Dios selected. **P-08, 9, 10.**

Gatun Dam; foundation investigations: Test pits dug and borings made. Examination of spillway reveals rock of sufficient strength to bear safely any of the loads to be placed upon it; what underground flow there is to be cut off by means of curtain walls. Studies show top layer of dam site to be fine sand with a large proportion of clay intermixed, for about 80'; next comes, for about 100', a thick marine deposit of blue clay (impervious material); under this and directly overlying the rock is a deposit, up to 20' thick, of small boulders and gravel consolidated. What seepage occurs is in top stratum; proposed to cut it off by sheet piling projecting up into the core of the dam and down into the impervious layer. "The material encountered is of such character as to be amply strong for supporting the proposed structure." Materials for dam construction can be procured readily from vicinity, and sufficiently. **P-08, 11.**

Experimental dams: Two built with dimensions on a scale of 1" to 1'. Tests for seepage, etc., showed not only the suitability of the available material, but also that a stable and water-tight dam could be built by hydraulic methods. (See report of Assistant Engineer C. M. Saville. Appendix E. **P-08, 127-196.**)

Operations: 918,920 c. y. removed from spillway (this channel 300' wide with a flare to 500' on the upstream side, and it was decided to maintain the elevation of its bottom at the south end at 10' above sea level, so as to preserve as thick a layer as possible of argillaceous sandstone over the conglomerate). The fill at the south toe was extended across the French canal; in this toe 36,669 c. y. of Bas Obispo rock were placed, and 329,257 c. y. from the spillway and the lock site. Trestle built along a portion of the north toe of the dam; 2 lines of sheet piling driven across Chagres River to form cofferdams prior to pumping area dry. Old village of Gatun moved. **P-08, 11, 12.**

Pedro Miguel Lock and Dam; operations: Culebra division excavated the lock site down to reference 40, removing 1,071,696 c. y. (included in total yardage of Culebra division). Locks and dams division began work June, 1908, installing 1 shovel, and

constructing trackage. 7,493 c. y. moved from lock site.

Lock and dam plans: Lock to be connected to the rock portion of an adjacent hill by prolonging the east wing wall. West dam will be of earth, and will be 1,400' long; top elevation to be 107, and width 40' with side slopes of 4 on 1. Width will be increased, as it will form a convenient dump for the Culebra division. Maximum pressure will be due to a head of 40'. **P-08, 12.**

Miraflores Locks and Dams; lock foundations: Tests show foundations of ample strength; hard limestone at upper part of site, sandstone at lower end; no variation in formation like those at Gatun.

Lock construction: Site cleared; 2 steam shovels installed Jan., 1908; additions thereafter. Total of 8 shovels assigned to division. 341,786 c. y. removed, nearly 300,000 c. y. being from prism of the locks. Excavated material deposited on either side to be used as foundations for the erecting plant. Pit drained.

Dam foundations: Good.

Dams: Concrete dam from locks to Miraflores Hill, to be 750' long. West dam to be of earth, 2,300' long.

Diversions: Cocoli River diversion under way; channel being cut through the hills 1½ miles west of the lock site, a dam required to force stream through this diversion; 73,592 c. y. being removed.

Concrete material: Sosa Hill quarry selected. Sand located at Chame (about 20 miles west of La Boca), in large quantities. **P-08, 12, 13.**

River hydraulics: Work of previous year continued. Flood-warning station established at Vigia.

Meteorology: 3 first-class and 3 second-class meteorological and 13 rainfall stations established. Fog observations begun. Tidal measurement work transferred to this division. Seismograph station under way. **P-08, 13.**

1909-1913. (See Atlantic and Pacific divisions, and Fifth division.)

1914. Gatun Locks: As noted in last report, concrete of locks assigned to Atlantic division finished June 14, 1913, with exception of lamp-post bases, bases for snubbing buttons and mooring posts, stairway parapets, and closing of openings left for construction purposes. During year 525 c. y. concrete laid in locks structure; in construction of control house, 94 c. y., and 9,785 c. y. in connection with installation of machinery. Mixers ceased Aug. 16, 1913. Cableways handled 4,111 c. y. concrete and were utilized for transfer of material across locks after removal of bridges used by contractors in erection of gates. Amount of concrete laid in Gatun Locks, exclusive of construction of control house, from beginning of work to close of fiscal year, 2,067,731 c. y. at an aver-

age cost of \$7.2122 per c. y. No rock or sand handled by unloading cableways during year, but they were used for transferring material from stock piles to tunnel hoppers and for unloading coal for use on west side of locks. Back filling of side walls continued until Dec. 19, 1913. Amount placed during year, 91,576 c. y. Total material used for back fill to June 30, 1914, 2,119,406 c. y. placed behind side walls, and total of 113,163 c. y. placed in center wall. Tegms and scrapers, locomotive cranes, and hand labor used to bring back fill to final grade. Concrete paving of slope between locks and Panama R. R. completed. Lamp-posts, snubbing buttons, and mooring posts completed. Construction of control house, begun Apr., 1913, continued by forces of Atlantic division until Oct. 15, 1913, when it was taken over by first division with other unfinished work in Atlantic division. Completed by close of fiscal year, with exception of door and window frames.

Gatun Spillway: Completing fill of openings of valves in body of dam, raising piers to full height, setting valves, and completing bridge. Structure finally finished Oct., 1913. 7,047 c. y. concrete laid, inaking total concrete placed in structure 231,179 c. y., at an average cost of \$7.5273 per c. y. Steps on either side and back fill in connection with them completed by May, 1914.

Gatun Dam: Placing material on portions east and west of spillway to bring dam to full height, bringing slopes generally to final grade, completing fill around and over core wall connecting dam with locks, paving upstream slope, and laying such permanent tracks as advisable to maintain order to make quick repairs in case of necessity. Two steam shovels at work until Mar., 1914, borrowing material from north of dam, and in grading and completion of fill; 314,160 c. y. handled. Paving upstream slope, as outlined in last report, completed Aug., 1913, and 9,860 c. y. large riprap rock from Sosa Hill and from excavation for dry dock at Balboa used. Total large and crushed rock used for paving, 94,330 c. y. Permanent tracks 5,780' in length laid. Observations for settlement continued. Seepage from dam negligible. At close of rainy season two small streams found issuing from north toe in west portion of dam, but with advance of dry season these ceased. No seepage of any kind apparent in east portion of dam.

Pedro Miguel Locks: Masonry construction carried on at these locks consisted of lamp-post bases, bases for snubbing buttons and posts, stairway wells, and the control house. Concrete laid in lock structure, 1,087 c. y.; in construction of control house, 592 c. y.; and 10,961 c. y. in connection with installation of machinery. As machinery and wiring not all installed, additional concrete required. Total concrete laid at Pedro Miguel Locks, from beginning of work to close of

year, 928,326 c. y., and the cost was \$5.6575 per c. y. Work on control house begun May, 1913; completed by close of year, with exception of doors, windows, and plumbing. Back filling of side walls completed Mar., 1914, and filling of center wall Feb., 1914. During year 27,750 c. y. placed behind side walls and 5,619 c. y. in center wall. Total material used for back fill to June 30, 1914, 834,288 c. y. placed behind side walls, at a cost of \$0.4131 per c. y., and 220,768 c. y. placed in center wall, at cost of \$0.4777 per c. y.

Miraflores Locks: At close of previous year concrete of locks proper completed, except lamp-post bases, bases for snubbing buttons and mooring posts, parapets around the stairways, and nosing at end of south-approach pier. During year 2,844 c. y. concrete laid in locks structure; in construction of control house, 949 c. y.; and 18,241 c. y. in connection with installation of machinery. Additional concrete remained to be placed, as installation of machinery and wiring not completed. Building lamp-post bases on southeast wing wall interrupted by necessity of transferring sand operations to Miraflores. Concrete laid in Miraflores Locks from beginning of work to close of year was 1,507,794 c. y. at cost of \$5.1695 per c. y. Total concrete laid in Pacific Locks at close of year, 2,436,120 c. y., at cost of \$5.3555 per c. y. Back filling lock walls at Miraflores continued. Back filling of side walls completed May, 1914, and filling of center wall Mar., 1914. During year 360,198 c. y. placed behind side walls and 92,244 c. y. in center wall. Total back fill to June 30, 1914, 2,366,252 c. y. placed behind side walls, at cost of \$0.3855 per c. y., and 249,457 c. y. placed in center wall at cost of \$0.5846 per c. y.

Miraflores Dam and Spillway: During year total concrete laid in spillway 10,112 c. y., of which 9,570 c. y. were plain concrete and 542 c. y. reinforced concrete. Total concrete laid in spillway to June 30, 1914, 74,254 c. y., at cost of \$6.2160 per c. y. Last concrete laid Feb., 1914. Dry filling on west dam completed Feb., 1914. During year 98,424 c. y. placed in this dam. Total dry fill placed in dam since beginning of work, 1,758,423 c. y., at cost of \$0.4582 per c. y. Design, construction, and inspection of lock gates, chain fenders, emergency dams, operating machinery, and electrical installations continued in charge of Col. H. F. Hodges, U. S. Army, as assistant chief engineer until Apr. 1, 1914, and subsequently as engineer of maintenance.

Lock gates: Construction and erection of gates under contract continued and completed in accordance with supplemental agreement of Jan. 14, 1913. At Gatun all gates for west flight completed Sept. 24, 1913; all gates for east flight Dec. 30, 1913. At Pedro Miguel all gates for east lock completed Sept. 30, 1913, and for west lock Dec. 30, 1913. At

Miraflores gates for west flight completed Sept. 30, 1913, and for east flight Jan. 10, 1914. All gates completed within time specified in supplemental contract, time at Miraflores being anticipated by about 2 months. Original contract provided that contractor should paint gates with 2 coats of red lead, at his expense, and with third coat of some other pigment to be furnished by the Isthmian Canal Commission, applied to gates at contractor's cost. Agreement modified and at Gatun arrangement made for additional coat, making 2 of red lead and 2 others, instead of 1. Additional coats consisted, 1 of U. S. Navy anticorrosive and 1 of antifouling paint, and applied to those parts of gates in lower locks constantly under water. On remaining gates at Gatun 2 coats of equal parts of graphite and red lead applied. Intended that no red lead should be used at Pedro Miguel except for upper guard gates, protection to consist of 3 coats of damp-proof paint. At Miraflores gates in lower lock from elevation -6 to bottom to be given 2 coats of red lead, followed by 1 coat of anticorrosive and 1 coat of antifouling paint. All other gates to be given 3 coats of proprietary paint consisting of a hydrocarbon mixture. On account of delay in receipt of damp-proof paints intended for use on Pedro Miguel gates, some of these painted with hydrocarbon paint from Miraflores and, conversely, a few of Miraflores gates painted with damp-proof paint. In all of these cases the third and fourth coats were applied by Isthmian Canal Commission forces. Due to impurities in water of Gatun Lake, none of paints, except bitumastic, which was applied directly to metal on small sections of several of the gates at Gatun, has proved satisfactory, and paint on those parts constantly under water in very poor condition. Action of gates in service entirely satisfactory; leakage at quoin and miter posts small. Cost of gates complete, \$8,471,806.99, of which \$5,632,942.33 paid under contract, and balance of \$388,864.41 for inspection, painting, recess covers, fixed steel, special tracks, and services furnished the contractor.

Gate machines: All parts for mechanical and electrical installation of machines for operating miter gates emplaced. Forty machines required at Gatun completed Feb. 28, 1914, 24 machines at Pedro Miguel on Mar. 28, 1914, and 28 machines at Miraflores on May 28, 1914. Tests conducted to determine conditions under which most satisfactory operation might be obtained, and results show advisability of reducing duty of motor by starting one gate ahead of the other by interval of 20 seconds. Benefit derived, with only 1 gate operating; when gates are near mitering position entire area of chamber is available for storage of water displaced. Cost of miter gate moving machines complete, \$822,410.03, of which \$704,744.78 ex-

pended under the contract, and balance for installation.

Miter gate forcing machines: With the material of miter gate forcing machines on hand, erection progressed with completion of the gates. Twenty machines required at Gatun completed Feb. 14, 1914; 12 at Pedro Miguel completed Mar. 27, 1914; and 14 at Miraflores, Mar. 26, 1914. No special tests conducted. Total cost of machines, \$57,200.16; of which \$40,225.88 expended under contract and balance for installation. Machinery for operating handrails on gates installed complete; 36 machines at Gatun, 20 at Pedro Miguel, and 24 at Miraflores. Operation satisfactory. Total expended, \$29,652.32, of which \$17,078.58 under the contract and balance for installation. Installation of pumps for unwatering gates completed; 40 pumps at Gatun, 24 at Pedro Miguel, and 28 at Miraflores. Total expended, \$28,516.31, of which \$18,979.98 paid out under contract. Installation of electrical appliances for operating various gate machines completed. Total expended, \$207,653.42; of which \$132,326 paid out under contract.

Rising stem valves: Placing of valves, stems, roller trains, and crossheads remaining to be done at close of last year completed, and 116 machines required for operation erected and electrical installation completed. Of the machines placed during year, 5 were at Gatun and 28 at Miraflores; making total of 56 at Gatun, 24 at Pedro Miguel, and 36 at Miraflores. Mechanical and electrical work in connection with installation completed at Gatun Feb. 12, 1914; at Pedro Miguel on Mar. 30, 1914; and at Miraflores on Mar. 30, 1914.

Guard valves: At end of year all guard valves and machines erected in place at all locks except Miraflores. Six at Gatun completed Apr. 25, 1914; 6 at Pedro Miguel June 29, 1914; and those at Miraflores were 62 per cent completed. Tests made of guard valves showed machines would not operate satisfactorily as originally designed; changes necessary. Amount expended on rising stem and guard valves and their machines to close of year, \$1,508,735.59, of which \$1,127,725.38 paid under contract.

Auxiliary culvert valves: Mechanical and electrical work in connection with installation of these completed; 4 machines installed at Gatun and completed on Mar. 10, 1914; 4 at Pedro Miguel completed Mar. 5, 1914; and 4 at Miraflores completed Mar. 31, 1914. Cost in place, \$22,805.80, of which \$16,062.84 paid under contract.

Cylindrical-valve machines: Setting of all cylindrical valves completed during previous year and 41.6 per cent of electrical work finished. Total cost for machines, \$228,222.04, of which \$161,290.79 in payment of contracts for furnishing material. Remaining electrical work completed on 60 at Gatun, Mar. 30, 1914; on 20 at Pedro Miguel, Jan. 27, 1914; and on 40 at Miraflores, Feb. 27, 1914.

Chain-fender machines: After tests completed on 2 sample chain-fender machines, arrangements made to order balance. Of 16 at Gatun, mechanical work on 14 completed, with exception of chains; of 16 at Pedro Miguel, mechanical work on 7 completed, with exception of chains; and at Miraflores, of 16, mechanical work on 1 completed, with exception of chains. Work in progress on all the units, with exception of 4 lower ones at Miraflores. Electrical work progressed with mechanical work. Manufacture of chain for fenders progressed rather slowly, but orders placed for all chains required with one exception, before close of year. Total expended thus far, \$830,726.89; of which \$661,140.30 for payments under contract for delivery of the material, and \$169,586.59 for erection. Cost of inspecting lock-operating machinery to June 30, 1914, \$167,926.06.

Spillway gates: Gates placed by construction divisions in connection with building spillway dams. Mechanical equipment and electrical installation completed on 14 machines at Gatun, Dec. 13, 1913. At Miraflores mechanical work completed on 8 machines on Oct. 13, 1913, and electrical work on June 5, 1914. Gates at Gatun have all been operated satisfactorily under full head, controlled from switchboard in hydroelectric station. Tests of Miraflores gates indicated defects in mechanical work, necessitating overhauling and correction. Changes not completed at close of year. Total expended, \$337,529.11, of which \$236,045.26 under contract.

Towing-track material: All towing-track material purchased under original contract delivered previous to June 30, 1913. Tests with locomotives brought out fact that it was necessary to provide additional rack sections at top and bottom of inclines at locks, and 606 linear feet of additional rack sections made at Balboa shops. At Gatun Locks 1,182 linear feet of rack section laid, 3,438 linear feet concreted in, and total of 4,082 linear feet completed; making total completed to date 22,185 linear feet. At Pedro Miguel Locks 1,518 linear feet of track laid, 3,901 linear feet concreted in; making total of 13,696 linear feet completed to date. At Miraflores Locks 4,007 linear feet laid, 8,160 linear feet concreted in; making 9,104 linear feet completed during year, or total to date of 18,144 linear feet. Of total to be completed, 54,365 linear feet, 99.3 per cent completed at close of year. Conductor-slot material, consisting of steel and copper conductor rails, insulators, brackets, and cover plates, laid, and during year 12,485 linear feet completed, or complete total to date at Gatun Locks of 45,084 linear feet; at Pedro Miguel 21,760 linear feet during year, or total to date of 36,292 linear feet; and at Miraflores 22,232 linear feet during year, or total to date of 28,162 linear feet. For the conductors copper tee rails used for all towing tracks,

inclines, and crossovers, steel conductors being used on return track. Installation of single and double crossovers and turnouts completed during year at all locks. Total cost of all towing-track material installed, \$1,182,044.06, of which \$767,173.93 expended under original contract.

Towing locomotives: As noted in last report, contract entered into with General Electric Co. for furnishing 40 towing locomotives of their design and manufacture, first locomotive to be delivered by Jan. 15, 1914, and 4 locomotives each month thereafter. Twenty-one locomotives delivered and in operation. Total cost under contract, \$527,015; \$301,859.21 expended on contract and \$22,329.40 for erection and alterations. Tests made by actual service not sufficient to warrant announcement they are satisfactory.

Illumination of locks: Exterior lighting of locks described in previous report. Exterior lighting circuits all locks completed except for 5 posts at Miraflores, where erection of posts delayed by sand operations transferred to this point from Balboa to allow for construction of terminal docks. Installed at Gatun 206 standards, 116 single arm and 90 double arm; at Pedro Miguel, 130 standards, 80 single arm and 50 double arm; at Miraflores, 163 standards, 96 single arm and 67 double arm. Suitable sockets, with lights, installed for illuminating operating tunnels and valve wells. Total expended to June 30, 1914, on electrical lighting equipment of locks, \$126,234.52.

Remote control: General Electric Co. awarded contract for furnishing lock-control switchboards for Gatun, Pedro Miguel, and Miraflores Locks. Original specifications of Isthmian Canal Commission departed from as to general construction of board and also with regard to method of accomplishing required interlocking of control switches. Detail design of board left entirely to contractor, work being subject to approval of Isthmian Canal Commission's inspector in U. S. Switchboards located on second floor of control houses and interlocking racks on mezzanine floor. Boards designed to represent locks in miniature, all machines being represented by individual control switches, and wherever important for operator to know exact position of machines being controlled, indicators provided which operate in synchronism with machines in lock wall tunnels. With exception of cylindrical valve, auxiliary culvert valve, and miter forcing machines, operator provided with definite information with regard to exact position of valve or machine being operated by means of synchronous indicators electrically connected with transmitting devices mechanically connected with large machines in lock tunnels. Operation of cylindrical valve, auxiliary culvert valve, and miter forcing devices indicated by use of red and green lamps on control board. Arrange-

ment also made on switchboard by which water levels in lock chambers indicated. Control board completed at Gatun May 9, 1914; at Pedro Miguel June 26, 1914; and at Miraflores June 25, 1914. Switchboards of all locks satisfactorily used for remote control. Total cost of lock-control switchboards, \$108,079.50, of which \$73,693.33 paid under contract.

Hydroelectric plant: Erection of hydroelectric station continued under Atlantic division until Sept. 8, 1913, when work transferred to building division of quartermaster's department. With exception of doors and some carpenter work, building completed at close of year. Installation of equipment continued; turned over to operating force June 18, 1914; plant took over load from Gatun steam plant July 13, 1914. Expended on installation of machinery, \$300,355.60. In connection with power-transmission system, underground duct lines constructed from hydroelectric power house at Gatun to locks and to transformer substation at the point, and from Miraflores transformer substation to Pedro Miguel and Miraflores Locks. As noted in previous report, decided to install for transmission line overhead system of 44,000 volts, extending from Balboa to Cristobal, and connecting existing Miraflores steam-power station with Gatun hydroelectric station, that they may be operated separately or in parallel. Four substations provided, located at Cristobal, Gatun, Miraflores, and Balboa. Excavation for Gatun substation begun Nov. 26, 1913, and steelwork, furnished and erected under contract, completed Feb. 19, 1914. Installation of electrical equipment of building governed by progress made in building construction, and at close of year 37 per cent completed. Total expended on building \$145,717.92 and on installation of machinery \$40,818.11. Cristobal substation installed for purpose of furnishing power required by coal-handling plant, Mount Hope pumping plant, and miscellaneous requirements in vicinity of Cristobal. Excavation for this structure begun Mar. 4, 1914, and erection of steelwork under contract completed May 6, 1914. Amount expended on building \$111,858.01 and on electrical installation \$8,557.96. Miraflores substation being installed for purpose of caring for power requirements of Miraflores and Pedro Miguel Locks, and also for purpose of serving as step-up transformer station for Miraflores steam plant. Foundation work commenced Oct. 29, 1913, and steelwork under contract completed Mar. 9, 1914. Electrical equipment 22 per cent completed. Amount expended thus far, \$155,532.20, of which \$103,509.04 for building construction and \$52,023.16 for electrical installation. Balboa substation, located for purpose of supplying power to Balboa shops, air-compressor plant, dry-dock pumping plant, coal-handling plant, and Ancon pumping

plant, as well as other local purposes. Work begun on this substation Apr. 27, 1914, and steelwork erected under contract completed June 27, 1914. Four per cent of electrical equipment installed. Total expended thus far, \$49,173.84, of which \$45,565.12 for building construction and \$3,608.72 for electrical installation. To supply power to power house of Darien wireless station, being constructed by Isthmian Canal Commission for Navy Department, arrangements made to install small substation of 400-kilowatt capacity, tapping transmission line and stepping voltage down to 440 volts. Change in location of pumping plant from Miraflores to Gamboa necessitated installation of substation at this location. To supply necessary power in connection with pumping plant arrangements made for installation of two 500-kilowatt power transformers and necessary equipment for stepping 44,000-volt transmission line pressure down to 2,200 volts.

High-power transmission line: Under contract of Mar. 31, 1913, 794 double-track span bridges and 20 single-track span bridges to be delivered on Isthmus. All erected with exception of 5 special towers, required at Cristobal and Balboa terminals and 1 bridge at Cristobal. Purchased and received for transmission line, 1,562,208' of 2/0 Brown & Sharpe gauge stranded copper and 512,065' of five-sixteenths inch copper-clad wire. At close of year 1,408,443' of 2/0 conductor cable erected. Total expended on transmission line, \$1,014,333.29, of which \$701,222.62 covered by contracts.

Cables: Total cable on order, received and installed to end of year, 2,659,403', of which 1,531,528' lead sheathed and 1,127,875' rubber covered, double-braid wire and cable. At close of year 1,462,684' lead-covered cable pulled into ducts and 911,816' rubber-covered used for conductor-slot feeds, control connections, etc.

Telephone system: Elaborate system of telephone communication designed for operation of locks and contract awarded for complete equipment. To consist of 3 subdivisions: First, for control of vessels passing through locks; second, upkeep and maintenance work in lock tunnels; and third, local public service.

Emergency dams: Dams at Gatun completed before close of last fiscal year, but final acceptance tests not finished. Two dams at Gatun accepted and dams at Pedro Miguel and Miraflores finished and accepted, the first at Pedro Miguel Sept. 16, 1913, and second Oct. 17, 1913; at Miraflores the first completed and accepted Jan. 14, 1914, and second Feb. 7, 1914. Test made at Gatun May, 1914; dam swung, girders and gates lowered, and pipes driven to close spaces between ends of gates. Upper lock then filled to lake level, upper guard gates and upper operating gates opened, and inter-

mediate and lower gates of lock closed. Upper lock emptied through culverts until water level was below guard-gate sill. This brought full head of 47½' on emergency dam; leakage, 950 cubic feet per second; no dangerous current in lock; would have been easy to close any of lower gates in face of stream. Another purpose of test to determine whether dam could be used in lieu of caisson for unwatering locks to permit access to gates for painting, but leakage too great. Experiments being made to devise means of stopping flow. Total expended for emergency dams, \$2,206,984.67, of which \$1,958,329.90 covered by contract for delivery of material and its erection.

Floating caissons: Description of caissons for closing entrance to locks, including pumping plant for unwatering lock chambers, given in last report. Bids invited May 21, 1913; 2 bidders, the lowest bidder offering to construct 2 caissons and deliver them at Balboa for \$648,300; price for 1, \$330,760. Contract entered into for 1 caisson Aug. 22, 1913.

Pontoon bridge: To maintain communication across canal with west side, finally decided to construct pontoon bridge at Paraiso for Panama R. R. Constructed at expense of Panama R. R. Co., but design and construction undertaken by Isthmian Canal Commission. Approaches and abutments built under direction of A. S. Zinn, resident engineer; pontoon and superstructure by dredging division under W. G. Comber; track work by Panama R. R. Co.; and operating machinery by first division, O. C. E. Bridge revolves about pivot at one point, similar to pontoon bridges successfully operated for many years on upper Mississippi. Pontoon is 378' long over all, 55' wide, and 6' 3" deep at center line. Base of rail 33' above bottom of barge, or 30' above water level. Apron girders 64' long, resting on hinged supports at both ends, and consist of spare lock gate parts. Arrangement is made at each end of girder for automatically providing for variation of 6' in water level. When bridge is turned, girders lifted clear of concrete piers by electrically driven mechanism and temporarily supported by blocking on ends of barge. Bridge revolved by means of 1" anchor chain fastened at each bank, which passes around electrically driven wildcat on deck of pontoon. Mechanism for lifting apron girders, turning bridge, and operating rail lift, rail latches, and main latch at pier, operated from central panel. Total cost, \$218,331.78.

Operation of locks: Lockages during year gave opportunity to try out locks and machinery. First one at Gatun, Sept. 26, 1913, when tug "Gatun" put through, followed on Oct. 14, 1913, when part of dredging equipment locked through Pacific Locks to lake level. From these dates craft belonging to Panama Canal passed back and forth, in addition to

tows instituted for handling freight from Balboa terminals to Colon and Cristobal for Panama R. R. To try out towing locomotives, Panama R. R. steamers "Allianca" and "Ancon" locked through Gatun Locks and returned, and through courtesy of agent of W. R. Grace & Co. the "Santa Clara" locked through Pacific Locks and returned. Operation developed facts in regard to action of flowing water not anticipated. Gates of upper locks of each flight and of Pedro Miguel Locks duplicated. Upper pair called guard gates and lower pair of the upper two the lock gates. At lower end of locks the upper pair called safety gates and lower pair lock gates. Space between guard gates and lock gates regulated by auxiliary culvert, while space between safety gates and lower gates regulated by tee culvert. When water in upper lock is low and valves are open there is sudden drop of water level in forebay. More noticeable at Pedro Miguel, where canal above forebay is narrow, than at Gatun and Miraflores, where forebay opens immediately into lake. Drop faster than can be followed by water in space between guard and upper gates, and result is reverse head on guard gates, causing them to open at miter. Reverse lasts but short time. In first lockages tee culvert regulating space between lower safety gates in free communication with side wall culvert near lower end, but about lower valves. When upper valves were raised water in space between these gates rose faster than in lock; consequently there was reverse pressure on safety gates, causing them to open at miter, pressure being sufficient to compress springs in gate-manuevering struts. Due to possible danger of crippling moving apparatus by such reverse stress, valves in tee culvert partly closed, choking communication between side-wall culvert and space between gates. Experimenting, a degree of closure reached which caused water in space between culverts to lag behind water in lock when filling, and at same time to fall more rapidly when emptying. In this way positive pressure always kept against safety gates. With use of both side and center wall culverts, as rapidity with which water level in lock changes is increased, different adjustment necessary. When valves in side culvert are raised and water enters lock flow of water greater through those openings in laterals nearest middle wall than through those nearer side culvert. As water rises in greatest volume next to middle wall, results a slight slope of surface toward side wall. When both side and middle culverts used no such action noticeable. First gush of water from side culverts appears to come from highest laterals and then successively from the others. Can not be stated that discharge greatest from any one of laterals. In filling or emptying small canal lock water levels approach each other with rapidity

depending upon square root of diminishing head. Toward end of operation change in level becomes slower, and flow of water supposed to cease either just before or at equalization of levels. Frequently the gates are opened with slight head against them to avoid loss of time involved in waiting for head to vanish entirely. In filling or emptying locks of Panama Canal there is noticeable overtravel of water, so that water in chamber which is filled rises slightly higher than level in chamber from which water drawn, and gates separating chambers become subjected to reverse head. At Pedro Miguel noticed that water rises from 0.3 to 0.6 of a foot higher than water in forebay, tending to throw upper gates open. Difference in head of short duration, but very noticeable; taken as indication of instant when apparatus for opening gates should be put in motion. This acts as safety device to motors which operate gates. In report of Isthmian Canal Commission for 1911 is described method used for overcoming differences in pressure on lower gates at lower lock, Miraflores and Gatun, due to difference in density of water above and below gates, in consequence of which culverts were turned up at outer end to reduce pressure to manageable quantity. Possible that overtravel of water from the emptying lock into tailbay may result in continuing flow of fresh water through culvert beyond point at which in theory it should cease; therefore, in obviating danger of resultant pressure. No trouble experienced from resulting pressure against lower gates. Difference in density of water above and below gates is noticeable in another way. When lower gates are opened fresh water rushes out with considerable velocity on surface of salt water below, and there is corresponding rush of salt water along lower strata. This current continues for considerable time and has noticeable effect on vessels leaving lock, sheering them away from middle wall as soon as they pass angle of side wall. Slope given to water in lock by use of side culverts already been noted. Same effect noted during filling of lowest lock with fresh water when lower gates have been left open long enough to insure salt water filling lock. Slope is from middle wall so that ship moves to side wall and towing locomotives unable to hold large vessel central in lower lock during entire process of filling when side culvert only used. As noted in previous reports, in formula for filling and emptying locks coefficient of flow C , used to determine real velocity, assumed at 0.65, this being slightly more favorable than experience at other locks has shown to be readily obtainable, but nature of design and construction warranted assumption. From experiments made at Pedro Miguel when lake level was at reference 84.8 and water in lock at reference 50.9, value of C for side culvert, with both

valves open, determined to be 0.886, much more favorable than anticipated. Similar observations, using only one valve, made both at Pedro Miguel and upper lock at Gatun as check, and value of C found to be 1.177 and 1.272 at two locations, respectively. Value of coefficient for emptying lock at Pedro Miguel somewhat less favorable than for filling coefficient C for side culvert being found to be 0.804 when both valves used. At Gatun and Miraflores, where culvert turned up at discharge, coefficient of flow for emptying lower lock about 8 per cent less than through level discharge at Pedro Miguel. When middle wall culvert used in combination with side culvert time of operation greatly reduced. Pedro Miguel Lock can be filled or emptied in about 8 minutes without causing too great a disturbance in the chamber. Observations not yet made with middle culverts at Gatun and Miraflores. **P-14**, 6-21.

Locks and Lock Gates. (See above.)

1899. Study of locks for Nicaragua and Panama routes. By S. H. Woodward. Appendix A. Report of Isthmian Canal Commission No. 1. **P-99**, 179-196.

General description of the methods of calculation of the stresses and stability of the walls, floors, and various other parts of the locks, and memoranda of the assumptions made, the stresses computed, the dimensions determined, and the estimates of cost of the locks designed for the two routes. Designs and computations made under the direction of the Isthmian Canal Commission No. 1 committee on locks. General drawings show the principal features of the locks; pls. 24, 25, 64, 65, 66. Twin locks were designed in all cases. Estimates made of the cost of building single-lock system, but with provision that second lock could be added later by simply building a floor and one side wall. General dimensions of locks: Clear length, 740'; clear width, 84'; depth, 35'. Total length of lock masonry to depend upon the kind, number, and arrangement of the gates, as well as upon the clear length required. Lateral dimensions of the lock walls dependent upon the height of the walls and upon local conditions.

Lock gates: Exhaustive study of steel lock gates had been made by the U. S. Board of Engineers on Deep Waterways,¹ in their investigation of the various plans for a canal from the Great Lakes to tidewater; estimates made for several hundreds of gates varying in width from 60' to 80', and lifts varying from zero to 50'. Isthmian Canal Commission No. 1 committee on locks decided to make use of these studies as a basis of estimate for isthmian lock gates. Lock masonry designed with a view to the use of the same type of gate as developed by that

board. Type of gate the steel mitring gate, with horizontal framing, straight on the downstream side and curved on the other. Rise of sill one-fifth the width of the lock; when the gate is closed the line which joins the centers of the quoin and miter posts makes an angle with the normal to the side wall, the tangent of which is 0.4. Gates sheathed on the upstream side only; where the gates are extremely heavy; they are made partially buoyant by sheathing the downstream face below the level of the lower pool. Upper and lower gates, and an intermediate gate. Intermediate gate forms a lock chamber 400' clear. Upper and lower guard gates. Formula for the weight of the lock gates. **P-99**, 180.

Special estimates made for gates between the upper and lower locks of the Bohio and Pedro Miguel flights of locks on the Panama route, the head of 84' at Bohio and 62' at Pedro Miguel being considerably greater than those for which the formula was developed.

Side walls: Masonry of all the locks rests upon a rock foundation. Figs. 1 to 12 showing sections of the side walls of all the locks of both the Panama and Nicaragua routes. Computation formulas, etc. **P-99**, 181. Table of forces, etc., **P-99**, 182.

Middle walls: Typical cross section shown by Fig. 14. Computation formulas, etc. **P-99**, 183. Diagrams, etc., **P-99**, 180-181.

Lock floors: Floors inverted arches; rock foundations; floors thicker near the gates. Computation formulas, etc. **P-99**, 188.

Miter sills: Stone arches 3' thick and of varying depth; faced with timber-bearing piece. Drawing shows sills of the lower and intermediate gates to be straight; all others curved.

Approach walls: Quay wall 1,200' long provided, for tie-up of vessels.

Culverts and valves: Contained inside walls, 2 for each lock, 12' 6" high and 6' 6" wide. Each culvert connected with the lock by 18 ports 2' high and 4.5' broad. Lining of cast iron and brick. Second set of culverts at lower end of Miraflores Lock and Lock No. 8 of the Nicaragua route; made necessary by the difference in density between fresh and salt water. Computation formulas, etc., **P-99**, 189. Culvert valves to be of Stoney sluice type; used very successfully on the Manchester and other canals, **P-99**, 190.

Time of filling and emptying locks: Table giving time for filling and emptying locks, ranging from 10 minutes 39 seconds to 16 minutes 19 seconds for the Panama route, and from 10 minutes 42 seconds to 14 minutes 56 seconds for the Nicaragua route, **P-99**, 190.

¹ Report, June, 1900. Members of board: Lt. Col. C. W. Raymond, Corps of Engineers, U. S. Army, chairman; Alfred Noble, and George Y. Wisner.

Use of water for lockage of vessels: Outline of possible conditions; computation formulas, etc., **P-99**, 191.

Leakage of locks: Amount dependent on accuracy of fitting; serious leakage might occur at culverts and gates; leakage around quoin posts can be made small; should be no leaking through gates. Computation formulas, etc. **P-99**, 192, 193.

Water for lockage: At Panama, as follows: Lockage, 411 cubic feet; leakage, 225 cubic feet; power, 200 cubic feet; total, 836 cubic feet per second. Nicaragua route: Lockage, 367 cubic feet; leakage, 215 cubic feet; power, 233 cubic feet; total, 815 cubic feet per second. **P-99**, 193.

Costs: Locks, Nicaragua route. Tables showing cost of double locks, exclusive of excavation, but embracing concrete, cut stone, steel, bronze, timber, brickwork, machinery and plant, and approach walls with their concrete and piles. Estimate for single locks, exclusive of excavation. Double locks. Single locks. **P-99**, 194-196.

1906. Lock dimensions: As a basis for all plans, the Board of Consulting Engineers voted 11 to 2 that locks should have minimum usable dimensions of 40 by 100 by 1,000', **P-06***, 3.

Lockages: Time required to pass a flight of locks at Bohio or at Gatun, on the Panama Canal. By J. W. Welcker. Appendix M. **P-06***, 403-404.

1907-1914. (See Construction and engineering; Projects; Atlantic division; Pacific division; and Locks and dams, above.)

1911. Every known precaution taken to insure safety of locks. Accidents to locks have in nearly every case resulted from misunderstood signals in engine room. To avoid possibility of accident which might render canal useless, authorities should assume charge of all vessels during transit of locks; under such conditions any damage that may

result to vessels should be assumed by the U. S., and legislation looking to this end necessary. **P-11**, 62.

Locks, Poe.

Delays in, **P-06***, 421, 423.

Vessel movement in, **P-06***, 7.

Locks, Separate or Scattered.

Effect upon water expenditure, **P-10**, 108.

Lock Structures. (See Structures, Lock.)

Lock, Weitzel. (See Waterways, Artificial.)

Delays in, **P-06***, 421, 423.

Locomotives, **P-10**, 266; **P-11**, 235, 241; **P-12**, 271.

Blacksmith shop, **P-10**, 266; **P-11**, 235.

Engine room, locomotive department, **P-10** 267.

Gorgona, **P-09**, 144.

Hostling, **P-14**, 260.

Number working, average, central division, **P-11**, 140; **P-13**, 147.

Number working daily, average, central division, **P-10**, 144; **P-12**, 151.

Oxy-acetylene plant, **P-11**, 236.

Repairs, **P-13**, 264; **P-14**, 259.

Repairs, number of, **P-10**, 271.

Repairs to all equipment except locomotives and cars, **P-10**, 273; **P-11**, 241; **P-12**, 275.

Locomotives, Towing, **P-13**, 92; **P-14**, 14.

Current duty, Miraflores Lock, **P-14**, pl. 85.

Design for, canals, **P-13**, 9.

Distribution, etc., **P-14**, 109.

Electric, proposed, **P-10**, pl. 85.

Steel girders for tracks, Gatun, **P-12**, 108, pl. 7.

Longevity.

Act relating to prohibition of allowance for, **P-11**, 571, 577, 580.

Lubricants.

Consumption, **P-11**, 211.

Consumption and cost, **P-13**, 248.

Inspection of, **P-13**, 247.

M.

Macadamizing. (See Roads.)

Oiling and macadamizing roads, fifth division, **P-13**, 183.

Macdonald, Donald F. (See No. 223, p. 2366 of this Index.)

Geologist, report, **P-13**, 565-582.

Machinery. (See Dams; Spillways; Locks; Valves; Gates; see Nos. 43, 221, 243, pp. 2362, 2366, 2367, of this Index.)

Erection division, **P-14**, 73.

Erection, locks, **P-12**, 94.

Erection, special force for, lock work, **P-11**, 83.

Foundations, **P-13**, 201; **P-14**, 206.

Inspection, **P-13**, 99.

Installation, locks, vitrified tile ducts, **P-12**, 87.

List of, by classes and location, **P-10**, 210.

Mechanical appliances, inspection, repair, etc., **P-11**, 204.

Miter, perfect, proposed machinery for forcing, lock gates, **P-10**, pl. 84.

Repairs, total cost of, per service day, **P-13**, 245.

Shops, permanent machine, **P-11**, 205.

Terminal plant, **P-14**, 191.

Machinery and Electrical Equipment.

Inspection department established, **P-11**, 82.

Machinery and Equipment.

Status, Aug., 1905, **P-05**, 141.

Status of bureau work, July 1, 1905, **P-05**, 135.

Machinery, Department of.

Report, **P-07**, 59-102; **P-08**, 74.

Machinery, Motive Power and.

Duties of superintendent, **P-08**, 71.

Machine Shop.

Atlantic division, **P-10**, 132.

Cristobal, **P-07**, 50.

La Boca dredging division, **P-07**, 53.

Machine Shop and Dry Dock.

Colon dredging division, **P-08**, 49.

Magazines, Storage.

Dynamite, Cruces, **P-09**, 220, pl. 91.

Magoon, C. E. (See Nos. 64, 77, p. 2363 of this Index.)

Governor, zone, **P-05**, 28.

Maintenance. (See Costs; Sewers; Waterworks; Panama R. R.; see No. 11, p. 2361 of this Index.)

Act, **P-12**, 599.

Maintenance, Engineer of. (See No. 259, p. 2368 of this Index.)

Report, **P-14**, 67.

Maintenance, Engineer of, Panama R. R.

Chart of organization, **P-14**, pl. 139.

Malaria. (See No. 81, p. 2363 of this Index.)

Cases of, **P-10**, 434; **P-11**, 530; **P-12**, 556; **P-13**, 554.

Preventives, **P-05**, 54.

Statistics, **P-09**, 331.

Malaria: Physical efficiency of working force impaired more by malaria than by yellow fever. May to Aug., 1905, 47 deaths from yellow fever, 108 from malaria. Most common of all diseases on the zone. Due to Anopheles mosquito. More difficult to exterminate than the Stegomyia. Gangs employed with machetes to clear away undergrowth and other breeding places. New arrivals instructed as to cause of malaria, and advised to take 3 grains of quinine a day. **P-05**, 34.

Maltby, F. B. (See No. 202, p. 2365 of this Index.)

Manholes, Covers, Ducts, Etc.; Electric Lines,

P-11, 82.

Manufacturing.

Building articles made at Lirio, **P-08**, 105.

Consolidation of repair and manufacturing work, **P-11**, 223.

Orders for, **P-08**, 226.

Maps. (See Charts; see No. 137, p. 2364 of this Index.)

Atlantic division, **P-09**, 66, pl. 13.

Borings, vicinity of La Boca, **P-06***, 7, pl. 7.

Canal Zone, etc., **P-07**, 1; **P-08**, 1; **P-09**, pl. 113; **P-10**, 1; **P-11**, 1; **P-12**, 1; **P-13**, 1.

Canal Zone and watershed of Chagres, **P-09**, 358, pl. 113; **P-12**, pl. 96.

Canal Zone, showing Panama R. R. relocated line, **P-11**, pl. 117.

Canal Zone, triangulation system, **P-11**, pl. 127.

Conditions, Pacific side, **P-13**, pl. 102.

Contour map and profile, central division, **P-09**, 90, pl. 28.

Contour map and sections, Cucaracha slides, **P-10**, pl. 104.

Cucaracha slide, **P-11**, pl. 107.

Excavation, general map of, **P-10**, pl. 96.

Gamboa Dam, profile showing depth to rock, **P-06***, 7, pls. 5, 6.

Gatun and vicinity, showing location of proposed dam, etc., **P-06***, 7, pl. 11.

Gatun Dam, **P-10**, pl. 96.

Gatun Locks, **P-10**, pl. 96.

Gatun Locks and Dam, breakwater in Colon Harbor, and channelexcavation, **P-12**, pl. 78.

Gatun works, Colon Harbor, and channel excavation, **P-11**, pl. 98.

Isthmus with completed canal, **P-12**, 1; **P-13**, 1, frontispiece.

Las-Cascadas slide, **P-11**, pl. 108.

Lock canal, 85' summit level, **P-06***, 7.

Making of, **P-08**, 55; **P-09**, 119.

Map making and lithography division: Maps made of all encampments, and of Isthmian Canal Commission buildings on the Isthmus, of profiles, soundings, benchmarks, old maps, city maps, boundary lines, and some for the Panaman Government. Work in 5 colors done. Some printing and bookbinding done before transfer of latter work to bureau of material and supplies. **P-05**, 116.

Panama R. R. relocated line, **P-09**, 142, pl. 69; **P-10**, pl. 120.

Panama, showing zone and watershed of Chagres, **P-09**, 358, pl. 113.

Pedro Miguel to Panama Bay excavation, **P-09**, 134, pl. 54.

Proposed line of sea-level canal, **P-06***, 7.

Stage of triangulation completion, **P-10**, pl. 137.

Territory between Caribbean Sea and Gatun Lake, **P-13**, pl. 88.

Work of preceding year continued, **P-06**, 114.

Marines.

Appropriation for barracks, etc., **P-13**, 607.

Market.

Culebra, **P-08**, 280, pl. 186.

Marshal.

Courts, **P-14**, 419.

Mason, C. F. (See No. 270, p. 2368 of this Index.)

Masonry. (See Costs.)

Contracts for, **P-13**, 75.

Cost, **P-11**, 292; **P-12**, 297; **P-13**, 278; **P-14**, 446.

Cost, Gatun, **P-11**, 292.

Cost, Pedro Miguel Locks, **P-11**, 292.

Drawings, **P-12**, 70. *

Designing department, lock and dam construction, **P-08**, 68; **P-09**, 33; **P-10**, 47; **P-11**, 65; **P-12**, 69; **P-13**, 75.

General drawing, lock sill on masonry, **P-09**, 42, pl. 10.

General drawing, sill on masonry, mitering lock gates, **P-12**, pl. 72.

Locks, costs, Gatun, **P-13**, 119.

Locks, drawings, **P-13**, 75.

Master Builder. (See Builder, Master.)

Duties of, **P-08**, 72.

Material and Soils.

Analysis, Gatun Dam, **P-08**, 131.

Classification of, Pedro Miguel to Balboa, **P-09**, 134, pl. 51.

Classification of, under locks and dams, Miraflores, **P-09**, 134, pl. 53.

Classification of, under Pedro Miguel Lock and Dams, **P-09**, 134, pl. 52.

Construction material in vicinity, Gatun Dam work, **P-08**, 129.

Deposited in experimental dam, Gatun Dam studies, **P-08**, 196, pls. 131, 132.

Determining porosity, effective size, etc., Gatun Dam study, **P-08**, 169.

Diagram showing effect of variation in material on hydraulic slope, Gatun Dam studies, **P-08**, 196, pl. 167.

Filtration through different materials, Gatun Dam study, **P-08**, 153.

Foundations, Gatun Locks, **P-08**, 121.

General description of, from drilling, Gatun Dam study, **P-08**, 158.

In prism, explorations, Pacific division, **P-09**, 92.

Mechanical analyses, Gatun Dam studies, **P-08**, 144, 159, 160.

Mechanical analysis curves, Gatun Dam, **P-08**, 196, pls. 148-154.

Permeable, discharge and velocity, table showing, as referred to Gatun Dam studies, **P-08**, 196, pl. 172.

Physical properties of, Gatun Dam investigations, **P-08**, 135.

Seepage tests, Gatun Dam studies, **P-08**, 132, 134.

Slopes of, during construction of experimental dam, Gatun Dam studies, **P-08**, 196, pl. 108.

Test of, Gatun Dam study, **P-08**, 136.

Test of, Gatun study of soil friction, **P-08**, 138.

Material and Supplies Department. (See Nos. 43, 69, 222, pp. 2362, 2363, 2366, of this Index.)

Chief, E. C. Tobey, paymaster, U. S. Navy, **P-04**, 38.

Material and Supplies, Division of. (See above.)

Organization, **P-07**, 104; **P-08**, 235.

Report, W. G. Tubby, Aug. 1, 1908, **P-07**, 103-107; **P-08**, 221-246.

Materials and Supplies, P-09, 210; P-10, 309; P-11, 357; P-12, 381; P-13, 376; P-14, 277. (See above.)

Care and custody of, **P-08**, 224.

Classification of, in storehouses, **P-13**, 393; **P-14**, 304.

Conductor-slot material, **P-14**, 108.

Construction material, wharf for, Cristobal, **P-09**, 51.

Contracts for, permanent shops, **P-14**, 177.

Contracts for, terminals, **P-13**, 268.

Diversity of, **P-07**, 103.

Electric transmission line, **P-14**, 96.

French material, **P-09**, 211.

General value of, **P-08**, 231.

Handling plant, Gatun Lock, **P-09**, 66, pl. 17.

Important items, **P-08**, 234, 244; **P-09**, 212;

P-10, 311; **P-11**, 359; **P-12**, 381; **P-13**, 391.

Important items since work began, **P-11**, 359.

Inspector of, **P-11**, 240.

Issue and transfer of, **P-08**, 225, 226; **P-13**, 377.

Issued, value of, **P-08**, 231.

Near at hand for dam constructions, Gatun, **P-08**, 129.

Quantities available for Gatun Dam from vicinity, **P-08**, 130.

Received, value of, **P-08**, 239; **P-09**, 212; **P-10**, 311; **P-11**, 359; **P-12**, 382; **P-13**, 399;

P-14, 300.

Requisition for, **P-08**, 222.

Returned to stock by departments and divisions, **P-13**, 394.

Sale of old or condemned, reports to be submitted concerning, to Congress, act, **P-11**, 577.

Sale of, when no longer required for canal work, authority for, act, **P-11**, 581.

Stock on hand, value of, **P-10**, 311.

Towing-track material, **P-13**, 91.

Transportation by water, **P-11**, 112.

Unloading construction material, Mindi, **P-10**, 112.

Material and Supplies (operations).

1904. Query by Sec. of War Taft as to policy governing purchases of material, supplies, etc., from foreign or American sources, **P-04**, 12.

Department found necessary at once. Isthmian Canal Commission No. 2, Aug. 31, 1904, while at Isthmus, resolved there should be such a division, charged with the receipt, inspection, custody, care, shipment, transfer, issue, and disposition of all supplies, material, equipage, and floating equipment unissued and not in actual use. Governor of zone and chief engineer to have authority to decide on the suitability of supplies, etc. E. C. Tobey, paymaster, U. S. Navy, appointed chief of the department. Proposed later to extend its scope to include a commissary; in view of need for supplying satisfactory food to American employees. Board of inventory appointed to list, etc., the property taken over at transfer; work in progress. List of some of the matter, valued at 98,379,841.60 francs. Transferred material, etc., in better condition than expected. Considerable purchases made at first in open market, but usual U. S. policy of competition to be followed rapidly. **P-04**, 54.

1905. Some of the delay of work of construction due to slowness of getting material asked for months previous, **P-05**, 139.

Regulations governing purchase, delivery, etc.:

Purchases; delivery; assistant purchasing agent on the Isthmus; assistant purchasing and forwarding agents in the U. S.; custody and issue of material and supplies; requisitions made on material and supplies division; articles manufactured; scrap material; record of material and supplies; property records; storekeepers; inventories by storekeepers; requisitions for material and supplies to be purchased; inspection; board of surveys; sales. **P-05**, 159-170.

1906. Purchasing offices maintained in various places in the U. S.; circulars, also, distributed through Army offices; total of purchases, year ending June 30, 1906, \$3,743,482.05. One general storehouse established near Atlantic terminus, local storehouses supplied therefrom. **P-06**, 11.

1907. Division of material and supplies: Charged with the purchase and proper handling of all material and equipment. Marked diversity of work. All departments rely on this department for their wants. Wants anticipated by frequent purchases in the U. S., based on estimates submitted by divisions, etc. \$9,500,000 spent; 90 per cent of purchases being made in U. S. Entailed handling of 37 full cargoes, and 150 partial cargoes. Some items: 23,000,000' lumber, 254,000 cross-ties, 4,000 piles, 50,000 tons miscellaneous cargo. Most of the material received at Mount Hope storehouse. Large amount of French plant (boilers, pumps, track, cars, locomotives, cranes, etc.) repaired and placed in service. About 11,000 tons old French material scrapped to U. S. dealers. 4,000 tons used as ballast by Panama R. R. vessels going north. Storehouses located at various points. Fire damaged Mount Hope storehouse to extent of \$100,000 Apr. 1, 1907. No delay caused. Building rebuilt in 3 sections. Division charged with care and operation of corrals and equipment used in land transportation on the Isthmus. Corrals located at various points. Over 600 horses and mules, with wagons, etc., in this service. Cost (net) of teams, about \$110 per month, one-fourth cost proposed by U. S. contractor. Printing plant, caring for all work on the Isthmus, operated. Organization modified to secure better efficiency. 1,289 employees; expenditures, \$755,321.89. **P-07**, 13, 14.

1908. Duties: Charged with the purchase and handling on the Isthmus of all material needed. Charged with the care and maintenance of local transportation and the operation of the Isthmian Canal Commission print shop, and of a typewriter repair shop. Purchases: Special classes of material and supplies are purchased on requisitions by the purchasing department of the Isthmian Canal Commission in the U. S. The stock of other material is replenished as the rate

of consumption at the various storehouses along the line dictates. Local purchases on the Isthmus consist of material and supplies which are not carried in stock, and which are urgently needed—supplies for engineering parties, for subsistence department, and for hospitals.

Supply: Stock material for general use is distributed from 9 warehouses at important points.

Receipts and distributions: Received to value of \$11,607,094.63. Disbursed, \$11,685,158.33 of the latter, \$182,894.56 covers old French material utilized. Among the items issued the following are notable: 38 steam shovels, 800 cars, 10 unloaders, 10 spreaders, 6 ballast plows, 9 cranes, 8 dredges, 5 tugboats, 12 steel barges, 2 air-compressor plants, 172 rock drills, 13 rock channellers, 508,000 pounds track bolts, 1,684,000 pounds track spikes, 119,150 pounds angle bars, 470,000 tie plates, 481 15' split switches, 628 frogs, 15 oil fuel tanks, 2 launches, 4 concrete mixers, 1 road roller, 3 motor cars, 1 material-handling plant, 1 15-ton rock crusher, 4 saddle-tank locomotives, 19,254½ tons steel rails, 501,876 ties, 3 electric cranes, 18 hoisting engines, 38,985,521' lumber, 34,657 piles, 501,574 switch and cross-ties, 246,000 brick, 8,852,000 pounds dynamite, and 54,000 pounds blasting powder.

New buildings: Rebuilding of large general storehouse at Mount Hope completed; restocked. New storehouses built at various places. Four storage magazines for dynamite, etc.

Transportation: Handled at 16 corrals, for 632 animals. Isthmian Canal Commission owns 397 vehicles (wagons, carriages, ambulances, scrapers). **P-08**, 23.

Printing shop: Supplies all the stationery and printing; 14 presses in plant. Cost of printing, \$38,513.10. Stationery and engineering supplies cost \$32,758.

Employees: 1,220. Pay roll, \$665,126.07. **P-08**, 22, 23.

Meals. (See Hotels; Labor; Kitchens; Messes; Subsistence.)

Cost of, at hotels, **P-09**, 229.

Mears, Lt. F. (See No. 234, p. 2367 of this Index.)

Mechanical Analysis, Materials.

Gatun Dam studies, **P-08**, 144.

Mechanical Committee.

Shops, **P-11**, 231.

Mechanical Division. (See Nos. 133, 251, 265, pp. 2364, 2368 of this Index.)

1905. Repair of locomotives and rolling equipment, erection of cars, steam shovels and heavy and light repairs to almost every class of machine in the zone. Over 170,000 pounds of castings made. Some shop construction done. Nearly 300 machines installed in shops. Large list of equipment under order. Old, obsolete machinery

cleared away. All new machinery expected to be soon in operative condition. **P-05**, 113.

1906. Operations of this division begun with shop organizations at Cristobal, Bas Matachin, Empire, and Culebra. On June 30, 1906, organization consisted of 1,812 men. Principal work the repairing and enlarging of shops, building of new ones, repairing and maintaining locomotives, dump cars, and miscellaneous equipment of the old French stock until it could be replaced with more modern and American plant. Division handicapped by unsatisfactory employees. Air-compressor and pipe-line plants erected at Rio Grande, Empire, and Las Cascadas; plans made for capacity of 30,000 cubic feet per minute for air compressors throughout the cut. Installation of electric plants. Table showing nature of miscellaneous work done. "Division * * * has had to create its own plant, to repair old, practically worn-out, and dismantled equipment * * *; it has had to keep up repairs on all machinery and equipment, and it has also had to design, make specifications, receive and erect, ready for service, new and modern equipment." **P-06**, 107.

-1907-08. (See Municipal Engineering; Motive Power and Machinery.)

1909. Mechanical division (second division, O. C. E.).—Organization: Placed under the supervision of the second division of O. C. E. At the beginning of the year shops at Gorgona, Empire, and Paraiso in charge of a master mechanic having jurisdiction over the field repair shops. There was also an electrical subdivision under an electrical engineer.

Concentration of work: During the year shops at Paraiso closed; heavy work there transferred to Gorgona and Empire. Running repairs to cars and locomotives transferred to Pedro Miguel engine house. Work of electrical subdivision consolidated with the work of the Gorgona shops; both placed in charge of the electrical engineer. All heavy repairs to equipment other than steam shovels and steel cars, as well as manufacturing work, performed at Gorgona shops. Heavy repairs to steam shovels and steel dump cars made at Empire.

Gorgona shops: Extensions made to machine shop, boiler shop, and planing mill. Car shop made for car repairs. Lye vat built for cleaning engine parts. Oil fuel adopted; great saving. 4,586,342 pounds iron castings made, and 333,416 pounds brass castings. Extensive repairs made to Lidgeerwood flat cars, as hard usage necessitated practically rebuilding larger portion of those on hand.

Electrical subdivision: Controls all electric lighting on the Isthmus, except in Cristobal and Colon; latter operated by Panama R. R. Panama R. R. power plant at Balboa trans-

ferred to the Isthmian Canal Commission July, 1908. Plant augmented; electric current extended to various places.

Empire shops: Various extensions made. Machinery of Paraiso shop, when closed, transferred, most of it to this place. **P-09**, 19, 20.

1910. Second division, O. C. E., has charge of all mechanical questions and supervises expenditures, preparation of estimates, allotments for work, and cost keeping. Under H. H. Rousseau, U. S. Navy.

To reduce delays on account of breakdown of machinery, etc., which reflect largely in unit cost of work, and to provide proper facilities for overhauling plant and equipment, as well as manufacturing necessary repair parts, large shops provided at certain points on Isthmus, in which are employed 1,399 "gold" men and 2,992 "silver" men. Other small shops employing one-half dozen or less men distributed around. Cars converted into portable machine shops are also used, and in a similar way floating machine shops provided for repairing marine equipment.

Repair shops and equipment on Isthmus adequate to meet requirements during construction. Nothing as yet done toward permanent shop facilities needed after completion of canal; but Isthmian Canal Commission declared itself in favor of policy of confining permanent shop facilities to two points.

Special attention paid to reducing cost of maintenance and operation of equipment in shops, including the standardization of salaries and wages, and of material and supplies. Two traveling engineers appointed, who have been instructing and supervising engineers, firemen, and hostlers, in use of fuel and oil in connection therewith. Saving resulted of fully 50 per cent in amount of lubricants used, and of approximately 10 per cent in coal consumption per train-mile.

On Apr. 29, 1910, position of inspector of shops established, and toward latter part of year traveling engineer appointed to inspect fuel and oil consumption on Isthmus, except on locomotives and marine equipment.

Gorgona shops: Empire shops transferred to central division for performance of steam shovel, general repairs, and manufacture of steam shovel repair parts. Repairs to steel cars, formerly done at these shops, transferred to Gorgona shops, centralizing at latter shops all repair work to rolling equipment other than steam shovels, as well as all manufacturing work. Car-repair yards at Las Cascadas and Gamboa abolished. Work at Pedro Miguel yard confined to lightest running repairs only. Under new car-inspection service, every car in service given thorough inspection once a day.

To provide for increased work at Gorgona shops, additions to buildings and equipment made. Among the former a new 2-story building 42' by 100' for storage of patterns aggregating

16,000; estimated value, \$150,000 to \$200,000. Old pattern-storage building converted into brass foundry and 3 crucible melting furnaces installed. This enabled enlargement of iron foundry by addition of 4,160 sq. ft.; 4,820,762 pounds iron castings and 393,995 pounds brass castings made.

Division continued operation of all electric-power plants, except those at Gatun and Miraflores, furnishing current for about 31,000 lights. Pole line $5\frac{1}{2}$ miles long constructed between Gatun and Cristobal to convey current from Gatun plant to Panama R. R. old plant at Cristobal.

Air compressors also under this division, and 7,227,203,513 cubic feet of compressed air generated. Additional compressors installed at Empire and Rio Grande plants, and 18,810' of main pipe line removed and re-built on account of slides occurring through Culebra Cut, and 3,600' of 8' main installed between Balboa plant and Ancon crushing plant of Pacific division.

Appropriations: Available to close of fiscal year 1909, \$210,146,468.58, or 56 per cent of total estimated cost, fixed at \$375,201,000. June 25, 1910, \$37,855,000 appropriated for fiscal year 1910-11, leaving \$127,199,531.42 of estimated cost of canal to be appropriated. Total classified expenditures for canal work to June 30, 1910, \$191,258,113.93, of which \$31,188,426.37 were net expenditures during fiscal year. Of total classified expenditures to June 30, 1910, \$25,699,450.81 for plant and equipment for construction work, of which \$4,388,511.55 expended during fiscal year. P-10, 32-34.

1911. The employees in all shops on Isthmus totaled 4,405, of which 1,532 "gold" employees and 2,873 "silver" men. Hourly "gold" men taken on during year, 94 per cent of force employed, indicating that average length of service on the Isthmus for mechanical trades continued to be about one year.

New shop erected and put in operation, Toro Point, for repairing locomotives, cars, and other equipment used in construction of breakwater. Equipped with machines taken from other shops. Shed at Pedro Miguel shop used for repairing cars doubled in size to save time previously lost by workmen during rains. At Gorgona shops addition to erecting shop made for pipe, tin, and copper shop, so as to move equipment therefrom boiler shop, the latter needing additional space. Small building erected for oxy-acetylene plant, and small building erected and provided with 25-ton crane, affording facilities for making large iron castings. Order placed for steel casting plant consisting principally of a 2-ton converter, blower, and sand grinder; when installed, stock of steel castings kept on hand can be reduced and practice stopped of making repair parts urgently required of cast iron and brass. Permanent equipment

augmented by addition of one 6" turret lathe for making bushings, two heavy milling machines for cutting gears and general work, one automatic tool grinder, oxy-acetylene plant, one washer cutter for making washers out of scrap metal, 25-ton overhead crane for use in foundry, and Taylor-Barth belt outfit.

Work in Cocoli shop transferred to mechanical division Sept. 1 and shop closed Sept. 15. Lirio planing mill closed and manufacture of woodwork consolidated at Gorgona. Keeping of permanent gang of craftsmen and helpers for making repairs to cableways and concrete mixers at Gatun Locks and day repairs to steam shovels done away with. Consolidation of heavy repairs at Gorgona and transfer of repairs to vessels and other apparatus in vicinity of Colon and Cristobal to dry-dock shops enabled closing of blacksmith machine, boiler, and erecting shops of Panama R. R. in Cristobal. So that repair and manufacturing work could be done with greater dispatch, night shifts put in machine, erecting, and boiler shops in Gorgona, Aug. and Sept. While work of the class involved usually more expensive at night than during day, night shifts have proven efficient and save expense by elimination of overtime. Another advantage was in reducing length of time required for completing urgent orders. By putting on night shift in wood-car repair shop Feb. 1, Lidgerwood flats cut out of service for light and medium repairs on one day returned to service next morning. According to program, Gorgona shops to be retained in operation until waters of Gatun Lake reach elevation 70. By that time, manufacturing and repair work, especially in connection with locomotives, cars, and excavating machinery, will have largely diminished and steps can be taken for erection of necessary buildings to which transfer of machines now at Gorgona can be made. Shops at Balboa and Cristobal in operation, together with Panama R. R. machine shops, to afford necessary repair facilities while transfer of machinery from Gorgona in progress.

At beginning of year additional traveling engineer appointed to have supervision over fuel and oil consumption and to supplement work of two traveling engineers, whose jurisdiction extended to locomotives only, and later to supervising and instructing engineers in respect to handling oil, and firemen in regard to methods of firing and fuel consumption. Duties of new traveling engineer covered steam shovels, unloaders, spreaders, and all stationary plants, and subsequently extended to marine equipment. Satisfactory results in saving both fuel and lubricants. Current for lighting and power generated at 5 stations—Balboa, Miraflores, Empire, Gorgona, and Gatun. Output of Gatun and Miraflores plants largely used in construc-

tion work in Atlantic and Pacific divisions. Cost per kilowatt hour averaged \$0.026. Oil fuel used in all stations. Current generated at Gatun and Miraflores plants by steam turbines, at Empire and Gorgona plants by noncondensing engines, and at Balboa plant by condensing engines.

Principal air-compressor plants located at Las Cascadas, Empire, Rio Grande, and Balboa, and furnish compressed air to central and Pacific divisions, and along high line around Gold Hill on relocation of Panama R. R. Output aggregated 8,261,199,541 cubic feet. Air for Gorgona shops furnished by smaller plant.

Total appropriations by Congress available to June 30, 1911, \$248,001,468.58, or 66 per cent of total estimate of \$375,201,000 for canal. By act Mar. 4, 1911, additional appropriations made for fiscal year 1912, \$45,560,000, exclusive of fortifications, leaving \$81,639,531.42 of total estimate of canal to be appropriated. By June 30, 1911, \$225,470,053.26 charged into work. Of this, \$33,048,607.97 expended during fiscal year 1911. Of total classified expenditures to June 30, 1911, \$27,580,724.37 for plant and equipment for construction, of which amount \$626,330.86 expended during fiscal year 1911. P-11, 33-36.

1912. Second division, O. C. E.: This division has charge of all mechanical questions that may arise and supervises expenditures and allotments for the work. The third division of O. C. E. abolished Jan. 24, 1912, after resignation of C. M. Saville, assistant engineer formerly in charge, and work transferred to second division. To this division also assigned design of dry dock, coaling stations, shops, and appliances in form of harbor tugs, cranes, and barges. Division in charge of H. H. Rousseau, U. S. Navy, as assistant to chief engineer.

On the assumption that favorable legislation would be provided, general and detailed plans of terminals undertaken with view to beginning work of construction as soon as funds become available. General layout of terminals at Atlantic and Pacific entrances arranged with object of affording sufficient wharves and piers to meet all requirements when canal is opened, and to permit extension. In addition to wharf space, the general plan provides necessary facilities for docking and repairing all classes of vessels and for furnishing them with fuel, fresh water, and supplies of all kinds. As these facilities may be required for military purposes as well as commercial, all general plans submitted to Navy Department for its views, which have been followed in final designs.

Main coaling plant at Atlantic end of canal will be located on north end of island opposite Dock No. 11, at Cristobal, with railroad connection across French canal. It will be capable of handling and storing 200,000 tons of coal, with possible increase of 50 per cent;

100,000 tons will be in subaqueous storage. Coaling plant at Pacific terminus will be located at Balboa, adjacent to site of dry dock, and will be capable of handling and storing 100,000 tons of coal, with possible increase of 50 per cent; subaqueous storage will be provided for 50,000 tons. Arrangements are made for supplying fuel oil, and 4 tanks of 40,000 barrels capacity each under advertisement, to give initial storage capacity of 80,000 barrels at each terminus.

Piers or docks on Atlantic side to be protected against storms by mole or breakwater extending out in prolongation of line separating zone from Colon; to be 1,000' in length, 209' in width, and 300' apart. At present the Panama R. R. Co. engaged in building one of the piers, with slip on either side, and a 1,000' wharf, together with necessary length of mole or breakwater to afford protection. On Pacific side piers for commercial use will be placed at right angles to axis of canal, with ends of piers 2,650' from center of 500' canal channel. Piers will be 1,000' long and 200' wide, with 300' slips between piers. One pier is to be undertaken. Superstructure of commercial piers and wharves will be one-story steel sheds, with clear height of 25'. Sheds, of fireproof construction, will cover entire pier, except for space of about 18' along each side and outer ends. Track will extend along each edge of piers at floor level, and two tracks will run through center of pier sheds, depressed to bring car floor level with floors of sheds.

Plans provide for one dry dock capable of accommodating vessels passing through locks; usable length, 1,000'; entrance width, 110'; depth over keel blocks, 35' at mean sea level. Dock will be built in the rock, which will be lined with concrete. Borings indicate that rock is strong, solid, and well suited for such construction. In lieu of marine railway at first contemplated for smaller vessels, auxiliary dry dock will be provided, and suitable foundation on similar rock found for it. This dock will have usable length of 350', entrance width of 71', and depth over keel blocks of 13½' at mean tide. On Atlantic side "present" dry dock at Cristobal, which has usable length of 300' and width at entrance of 50', with depth over sill of 13' at mean sea level, will be retained.

Plans for various shops, foundries, storehouses, and subsidiary buildings approved, and specifications prepared for furnishing material, as it is desirable to have erection completed and machine shops moved from Gorgona by July 1, 1913. Machines now in use will be installed in new shops, and they will be electrically driven, individual and group drives being used. Floor area of buildings in connection with shops aggregates 491,880 sq. f. Until further requirements more definitely developed, shop facilities for emergency repairs will be retained in vicinity of dry dock at Cristobal.

For expeditious and convenient handling of lock gate leaves, as well as for commercial and other canal needs and for general wrecking purposes, necessary to provide floating crane of largest practicable capacity at each terminus. An investigation under way to determine best manner in which these requirements can be filled.

For handling vessels of largest size, harbor tugs of high power required and must be secured, as tugs now owned by Isthmian Canal Commission will not be satisfactory or economical for that service. Intended to provide two large harbor tugs at each end.

Expected that large quantity of coal will have to be furnished to shipping in barges or lighters; canal must be equipped with sufficient number, not only for this service, but also for supplying fuel oil and fresh water. Navy Department recommended provisions be made for sufficient lighters to give capacity of 16,000 tons of coal for Atlantic terminus and 8,000 tons for Pacific end.

Locations of permanent administration building and canal headquarters and permanent settlements for employees determined. Permanent administration building will be on knoll west of Ancon quarry, and quarters for employees attached thereto will be erected in general area adjacent to and northeast of this building. Employees connected with shops, docks, and other terminal facilities will be housed in quarters erected in area surrounding slope of Sosa Hill and on fill adjoining Ancon-Balboa highway. There will be permanent settlement at Pedro Miguel for employees of Pacific Locks and one at Gatun for employees of Atlantic Locks. Settlement at Cristobal will be maintained and also one at Ancon.

During year applications received from individuals and companies for leases of land in vicinity of Atlantic and Pacific terminals for various purposes connected with operation of the canal.

Three first-class meteorological stations at Ancon, Culebra, and Cristobal continued. Two second-class stations at Gatun and Pedro Miguel, at which wind velocity, temperature, and rainfall recorded. Twenty-six rainfall stations in operation, 15 of which equipped with standard and 11 with automatic rain gauges. Evaporation stations in operation at Ancon, Rio Grande Reservoir, Gatun Lake, Brazos Brook Reservoir, and Colon. Two seismograph stations in operation, one at Ancon and the other on Guarapo Island, near Gatun. Duplicate automatic tide registers located on Dock No. 1 at Colon and two on the Panama R. R. dock at Balboa. Gauging stations maintained throughout the year, one on Chagres River at Gatun, one at Gamboa, and one at Alhajuela. Automatic water-stage registers put in operation above and below spillway at Gatun and on Chagres River at Bohio, Gamboa, Alhajuela, and Vigia. Automatic registers on Trinidad

and Pedro Miguel Rivers continued in operation throughout the year at the old locations. July 1, 1911, to July 1, 1912, minimum dry season and total flow for 12 consecutive months for years of record occurred. Previous minimum dry-season flow occurred during calendar year 1908. Total flow for 1911 was minimum flow for calendar years of record since 1905, and new low-water records established at Alhajuela and Gamboa. At Alhajuela minimum 91' on Apr. 20, 1912, and at Gamboa 43.5' on May 7 and 8, 1912. Previous low-water records, 91.86 at Alhajuela on Apr. 26, 1905, and 44.40 at Gamboa on Apr. 4, 1911. According to discharge measurements at Gamboa, heaviest freshet of year occurred Aug. 21, 1911, when there was a rise at that point of 11.4' and discharge 35,120 cubic feet per second. Minimum flow at Gamboa on Apr. 10 and 11, 1912, discharge 250 cubic feet per second. Backwater from Lake Gatun interfered with gauging work on Trinidad River, at Bohio, and on Gatun River.

Temperature for 1911 generally above normal. July was warmest month in Ancon and Culebra and Dec. at Colon. Highest temperature recorded, 95° F., at Ancon, Oct. 16, and lowest 65° F., at Culebra, Mar. 27.

Rainfall in zone below normal, being lightest of record at Gamboa, Bohio, and several of stations for which only few years' records available. Deficiencies ranged from 10 per cent at Balboa to 41 per cent at Bohio. Dry-season rainfall 12 per cent of annual total in Pacific section and 8 per cent and 9 per cent, respectively, in central and Atlantic sections. Average rainfall for 1911, 67.20" in Pacific section, 79.10" in central section, and 116.45" in Atlantic section. Rainy days in Pacific section 172, in central section 214, and in Atlantic section 265. Heaviest precipitation occurred at Porto Bello, Nov. 29, when during the storm 7.60" of rain fell in 12 hours, maximum fall for 5 minutes being approximately 2.48".

There was moderate excess of wind movement at the various stations during 1911. Prevailing direction from northwest at Ancon and Culebra and from north at Colon. Relative humidity generally below normal during 1911 and first half of 1912; mean for 1911, 81 per cent at Ancon and 84 per cent at Culebra and Colon.

Slight seismic disturbances of frequent occurrence. Stadia survey made to locate ridge line between upper Gatun River and Atlantic Ocean, and 19 miles of line run between Mount Bruja and Santa Rita Mountain.

Stadia survey made of Atlantic coast, line in vicinity of Margarita Island, near Colon, and triangulation station established on island. Majagual and Escondido Rivers run up to limits of tidewater. Several islands and inlets not heretofore shown on maps located.

No marked changes in conduct of mechanical work. Constant efforts made to reduce cost of repairs to equipment. General repairs were required to greater extent.

Principal shops at Gorgona, and policy of concentrating manufacturing work and repairs to rolling equipment at these shops continued. With construction work drawing to a close, general policy of gradually reducing repair parts and other material carried in storehouses caused mechanical division to handle more and more manufacturing work on short notice, and also resulted in installation of Tropenas 2-ton converter, blower, sand grinder, and all necessary apparatus for manufacture of steel castings. Two additional pipe cutting and threading machines—one 8" and one 12"—installed in main shops, and in planing mill French horizontal compound engine replaced by stationary engine removed from Lirio planing mill and supplemented with 50-horsepower motor.

Engine houses and repair shops operated at Pedro Miguel, Gatun, Las Cascadas, Gamboa, and Gold Hill. Removal of material from top of slides on Gold Hill side of cut required establishment of engine house, and temporary repair shop and storehouse, made of two old box cars, were installed, with necessary storage and cleaning tracks. Gatun machine and repair shop transferred to mechanical division, and July 1, 1912, Empire shops for repair of steam shovels also transferred to same division.

Operation and maintenance of air-compressor plants at Las Cascadas, Empire, Rio Grande, and Balboa under mechanical division, as well as operation and maintenance of electric power and lighting plants at Cristobal, Gorgona, Empire, and Balboa. Output of air-compressor plants operated during the year, 8,795,157,453 cubic feet of free air at 70° F. Increased construction work on Pacific division and decrease of work on north end of Atlantic division increased air consumption at Pedro Miguel and Miraflores so as to necessitate removal from Las Cascadas plant and installation in Aguadulce pumping plant of Pacific division of two 2,200' Ingersoll-Rand compressors. Mechanical division's electric plants totaled output of 4,966,953 kilowatt hours, which, with 2,279,151 kilowatt hours furnished by construction divisions to mechanical division, makes total of 7,246,104 kilowatt hours.

Total appropriations by Congress to June 30, 1912, \$293,561,468.58. Act Aug. 24, 1912, additional appropriations made for fiscal year 1913 amounting to \$28,980,000, exclusive of fortifications. June 30, 1912, \$259,653,236.74, or about 69 per cent of the total estimate, had been charged into the work. Of this amount, \$34,183,183.48 expended during fiscal year 1911, or about 9 per cent of total estimate of canal. Of total classified expenditures to June 30, 1912, \$32,547,720.75, or about 12½ per cent, for plant and equipment for construction and

for 4 steamships; of this amount, \$1,254,697.70 expended during fiscal year 1912. P-12, 39-45.

1913. Act Aug. 28, 1902, authorizing construction of canal directed President to "also construct such safe and commodious harbors at the termini of said canal as shall be necessary for the safe and convenient use thereof." Estimate of cost of canal, in Dec., 1908, made provision for construction of necessary breakwaters, but did not include anything for such harbor improvements as may be classed as terminal facilities, which had been operated and provided heretofore by the Panama R. R. Co. in connection with handling of its commercial and other business. Early in the work it was apparent that terminal facilities required by the Panama R. R. would not be adequate for probable needs of shipping, and, in view of the fact that savings on estimates would probably enable their construction as part of canal work, this advocated in 1910. Act Aug. 24, 1912, authorized President to "establish, maintain, and operate, through the Panama R. R. or otherwise, dry docks, repair shops, yards, docks, wharves, warehouses, storehouses, and other necessary facilities for the purpose of providing coal and other materials, labor, repairs, and supplies for vessels for the Government of the U. S. and, incidentally, for supplying such at a reasonable price to passing vessels." Act Aug. 24, 1912, made necessary appropriations. While, in anticipation of favorable action by Congress, some preliminary work undertaken, active operations could not be begun until last fall; consequently terminal facilities can not be completed by time canal ready for passing vessels.

Pacific terminals, being constructed by Isthmian Canal Commission, will consist of main dry dock capable of docking any vessel that can utilize the locks, a smaller dry dock for use of smaller craft, plant for supplying coal and fuel oil to vessels, necessary wharves and piers for commercial purposes, and permanent shops for use in connection with dry docks.

Atlantic terminals consist of wharves and piers at Cristobal, including Cristobal mole, all being constructed by Panama R. R. at its own expense, and main plant for supplying coal and fuel oil to vessels; cost of coaling plant will be divided between Isthmian Canal Commission and Panama R. R. Co., while Isthmian Canal Commission will furnish facilities for oil. General drawings showing layout of these terminals will be found in report for 1912.

General design of dry docks worked out and preparation of detail drawings commenced. Mitering lock gates will form closure to dock, and beyond gates proper a seat for floating caisson which will be constructed for general canal use. Dock will be flooded by longitudinal ducts in side walls communicating with

dock body through grated openings in floor along bottom of walls. Water will be controlled by 4 metal "wagon-body" valves operated by suitable machinery. Time required for flooding at extreme high water estimated at 25 minutes. Pumping plant for emptying dock, 4 vertical shaft centrifugal pumps driven by electric motors. Discharge from pumps will be carried through concrete duct entirely separate from flooding ducts. Time required for pumping out estimated at 2 hours and 20 minutes at mean high water. Suitable tracks for a 50-ton locomotive jib crane will be provided around dock. Capstans and bollards will be installed and a pipe tunnel, with suitable outlets, will be constructed around dock. Stairways leading to floor will be built. Contract entered into Oct. 22, 1912, for one pair of steel mitering leaves and fixed irons to be fabricated and delivered on Isthmus.

Smaller dry dock will be closed by a floating steel caisson bearing against granite sills when in place. Flooding will be similar to that for larger dock and flow of water will be similarly controlled. For emptying dock pumping plant of larger dock will be utilized. Access to floor of dock will be by means of 4 stairways.

Wharves and docks contemplated will consist of quay wall 1,238' long between head of Slip No. 1 and northeast end of Panama R. R. concrete dock, and 1 pier 1,000' long by 201' wide. Permanent walls will be built at ends of slips, each 303' wide, so constructed that part of length of each will afford landing places for small boats. Including length of wharf constructed for Panama R. R. Co. and completed during previous year, total water frontage under construction will be 4,650' long. Quay walls and all of Pier No. 1, excepting center section 50' wide, will be supported on circular reinforced concrete piers sunk to rock; 50' center section of Pier No. 1 will be rock fill. Slips will be excavated to 45' below mean tide. Elevation of Pier No. 1 and the adjoining wharves at head of slips placed at 16' 6". Level of quay wall adjoining Panama R. R. dock fixed at elevation 17, same level as Panama R. R. dock.

Coaling station on Pacific side will be adjacent to site of dry dock and will be capable of handling and storing 100,000 tons of coal, with possible increase of 50 per cent. Subaqueous storage will be provided for 50,000 tons. Specifications issued for coal-handling plants at the two terminals. Bids opened June 14, and when award is determined plans conforming with machinery will be prepared for substructure. Specified rate for unloading coal from vessels into storage piles fixed at 250 tons per hour for each machine; desire is to unload 2 vessels at one time at Atlantic plant, with 2 unloading machines to each vessel, and 1 vessel at Pacific plant with 2 machines. Reloading capacity—that is, transferring coal from

storage into collier or barge—fixed, after consideration of reloading capacity of modern commercial plants in U. S., at rate of 500 tons per hour for each machine. Proposed to equip Atlantic plant so that 2 vessels can be loaded at one time, with 2 machines serving each vessel, and on Pacific side so that 1 vessel can be loaded with 2 machines.

Main machine shops located at Gorgona, which will be flooded by lake as waters rise. Shops at Balboa and Cristobal generally adequate for maintenance and repair of dredging fleet. With adoption of policy of giving repair facilities to any vessel that could use the locks, as well as to Navy, construction of new shops near dry docks became necessary. Permanent shops will consist of 18 buildings for machine, erecting, and tool shops; forge shop; steel storage shed; boiler and shipfitter shop; general storehouse; paint shop; car shop; planing mill; galvanizing plant; lumber and equipment shed; pattern storage; foundry; coke shed; boiler house; roundhouse; gas house; paint house; and sand house. In addition to office building, 9 auxiliary buildings. On Pacific terminals preparatory work begun; operations pushed. Site cleared by removal of settlement at Balboa, as well as buildings which formed old town. Panama R. R. yard abandoned after new yard and track facilities provided for temporary use. Considerable difficulty experienced in carrying on work expeditiously and economically because of interests of other divisions and departments whose work and operations could not be interrupted. To provide room around head of location of main dry dock for tracks and highway leading to old French pier, northwest slope of Sosa Hill removed, 184,682 c. y. rock and 181,729 c. y. earth, or total of 366,411 c. y. excavated. Total quantity excavated in preparing site, 389,567 c. y. Greater part of material used to fill in adjacent swamp to bring area up to adopted grade, and some rock furnished Atlantic division for paving south slope Gatun Dam. Original surface elevation of dry-dock site was 18; deepest general excavation for foundation will therefore be about 74'. Lowest shovel cut June 30, 12' below sea level, on coaling-plant site at southwest end of excavation. From this site 203,699 c. y. removed, of which 56,900 c. y. rock. Site for smaller dry dock at present occupied by shipways and shops of dredging division. To protect entrance of main dry dock and entire area to be occupied by smaller dock, and to enable removal in dry of as much rock as possible from entrance basin of main dry dock, as well as to facilitate construction of coaling-plant quay wall and basin, cofferdam around these various works begun Apr. 1, 1913. It will be about 1,000' in length. For construction of quay walls and pier rock found at an average elevation of 60' below mean tide, in some cases being as high as

33' and in others as low as 66' below this level. Elevation of original swamp was about 9 and material through which concrete cylinders to be sunk is fine, sticky, black clay with thin strata of sand. Cylinders are sunk by open-caisson method. They consist of sections of reinforced concrete shell in 6' lengths, 1' thick, and 73' outside diameter. About 4,750 sections required and special plant for their manufacture built. Steel collapsible forms used. Bottom section of each cylinder 8' outside diameter and 6" thick, with cutting shoe on the bottom. Excavation done by hand and by orange-peel buckets. When cylinders would not sink of their own weight, descent facilitated by use of cast iron and concrete weights in conjunction with water jet. Not considered advisable at this late date to increase plant, so progress of sinking cylinders depended on crane service available. After cylinders were sunk several feet into rock they were filled with concrete. They are to be capped by reinforced concrete beams for supporting floor. Area within which quay walls and pier to be constructed inclosed by dike begun July, 1912. Of 28,500' of cylinders required, 12,435' placed. Of this, 8,450' were for main quay wall, 289' for walls at head of Slips 1 and 2, and 3,696' for Pier No. 1. Greater portion of area to be occupied by shops brought up to grade by filling low, swampy land. Natural surface of ground not sufficiently stable to hold up buildings; necessary to reach rock for foundations by excavating to it where sufficiently near the surface, or by driving piles to rock, in places as low as 56' below sea level. Near water front necessary to use 4' steel cylinders, filled with concrete and sunk to rock, as foundations. Piles driven, 3,750, and 7,787 c. y. concrete placed in footings and in tunnel. Operating tunnel, running through center and at right angles to length of main shop buildings, under construction for carrying and making accessible all pipe and cable conduits. Main trunk will have clear height of 6' and width of 4' 6", with branches of same height and width of 3' 6". Tunnel will contain all power, light, telephone, and fire-alarm cables, and water, steam, fuel oil, and compressed air mains, and main sewer. Rain water will be carried off the area occupied by shop buildings by means of surface gutters and drains. For its construction steam shovel mounted on skids, with special boom, commenced work Mar. 20, 1913. Where hard rock is not deeper than about mean sea level tunnel built on piers excavated to rock; at all other points carried on wooden piles driven to rock and cut off below mean elevation of ground water. Built in sections 15' in length, special means being provided to make tunnel as water-tight as practicable. Work started June 5, 1913, on foundations for machines for planing mill; considerable portion of concrete necessary for these and for floor of building completed during year.

25 miles of track laid, of which amount 9,212' permanent tracks for Panama R. R., remainder for construction purposes. Road at foot of Sosa Hill reconstructed, 3,300' long. Steel framework for shop buildings, about 6,000 tons, being furnished and erected under contract dated Oct. 22, 1912.

Contract made Oct. 24, 1912, for 6,500 squares of reinforced cement tile roofing for all quarter-pitched roofs of the machine shops. All tile being manufactured on Isthmus, at Paraiso. Contract required all plant to be on Isthmus by Jan. 25, 1913, and completion of manufacture by June 25, 1913.

For Atlantic terminals quay wall and one pier practically completed by Panama R. R. during year, the material purchased for steel work for sheds, and subsequent contract made for erection. Panama R. R. also made diamond-drill borings at site of coaling station, and work begun by dredging division June, 1913, drilling and blasting preparatory to dredging alongside proposed coaling pier. In designing permanent shops principal aimed at to reduce to minimum cost of repairs and renewals, without exceeding reasonable first cost.

Selection and location of equipment in different shops practically completed. Greater number of machines and tools for permanent shops will be taken from "present" shops. Electric power at 44,000 volts is to be delivered by transmission line to substation adjacent to pump well of Dry Dock No. 1, where voltage will be reduced to 2,200 volts. Shops have been arranged in 4 groups as regards electric distribution and each group provided with transformers and switchboards for reducing voltage. Power used in plant will be 3-phase, 25-cycle, 220-volt, except 220-volt direct current in machine shop for variable-speed tools. Duplicate motor-generator sets will be installed.

Investigations and inspections made of the principal floating cranes in U. S. and Canada, as well as abroad, with view to determining type of crane to best meet canal requirements; conclusion that 2 floating cranes of largest size would be necessary. Oct. 30, 1912, proposals invited for delivery of 2 floating cranes of revolving type, having maximum lifting capacity of 250 gross tons. Award made Apr. 17, 1913, to the Deutsche Maschinen Fabrik, A. G., for approximately \$327,550 for the 2 cranes, delivered in 580 days.

Investigation and inspection of most modern and largest harbor tugs in use on Atlantic coast of U. S. and in leading ports of England also made during last 2 years, and estimates for year 1913-14 included amount considered sufficient for purchase of 4 such tugs. Arrangements made at close of past year for preparation of plans and specifications for suitable tugs.

Numerous applications received from coal dealers for loading space for handling of coal in supplying vessels. No authority exists for leasing any land or land under water in zone,

except act of Feb. 27, 1909, which provides for leasing of land for agricultural purposes only. Never intended that U. S. should exercise monopoly of coal business on Isthmus, but to utilize coal stored here for use of Navy in maintaining uniform prices of this product to shipping. To encourage individuals and companies in business of furnishing coal to vessels which use the canal, policy adopted of providing storage in connection with both coaling plants for coal piles of individuals and companies who desire to participate. There will be certain rental and a real estate tax of 1 per cent of value of improvements, should any be made, and a merchandise tax of 5 cents for each 2,000 pounds of coal sold. U. S. will do all handling; charge for putting coal into storage and taking it out; for use of coal barges and other labor in connection with this service will be fixed at cost price to the U. S. for such service. Same policy adopted with reference to oil. Proposed to equip wharf in vicinity of coaling station at Pacific terminus and Docks 13 and 14 at Mount Hope on Atlantic side with fuel-oil supply and delivery mains in duplicate, together with necessary pumps, so that the U. S. will be able to handle satisfactorily all fuel oil, including fuel oil of individuals and companies who may wish to participate in fuel-oil business on Isthmus, on same general terms as those applying to coal business. Contract was entered into Oct. 1, 1912, for 4 storage tanks 93' in diameter and 35' in height, each having a capacity of 40,000 barrels, to be erected at cost of \$62,800. At end of year tanks had been practically completed, 2 at Mount Hope and 2 at Balboa dump, southeast of Sosa Hill, and plans under way to connect them with water front.

Three first-class meteorological stations at Ancon, Culebra, and Colon continued. Wind records kept at Gatun, Pedro Miguel, Sosa, and Miraflores. 26 rainfall stations in operation, 15 of which equipped with standard and 11 with automatic rain gauges. Evaporation stations maintained at Ancon, Rio Grande, Gatun Lake, Brazos Brook Reservoir, and Colon. Seismograph stations in operation at Ancon and Gatun. Duplicate automatic tide registers located at Colon and Balboa. For use by Fortification Board, maximum and minimum temperatures recorded on Miraflores dumps. Regular gauging work discontinued on smaller streams at end of 1912, work being interfered with by backwater from Gatun Lake.

Most important hydrological change was rise of Gatun Lake. On July 1, 1912, elevation was 31. Stage of water fluctuated, as regulated at spillway, reaching extreme height of 56.28' above sea level on Nov. 29. From studies it appears that lake basin is subject to very little seepage or other underground losses. Records of Chagres River and tributaries show year 1912 to be second in order of dryness since U. S. occupation in 1904.

Largest freshet since Dec., 1910, occurred Nov. 28 and 29, 1912; rise of 19.6' at Vigia and 12.3' at Alhajuela; discharge at latter point being 54,000 cubic feet per second.

Average temperature for year 1912 well above normal. Mar. warmest month at Ancon and Apr. at Culebra and Colon. Highest temperatures recorded Apr.—97° F. at Ancon and 96° F. at Culebra—established new high temperature records at these stations. Nov. coolest month at all stations, minimum recorded being 65° F. at Culebra.

Rainfall of 1912 below normal everywhere except immediately along Pacific coast, although generally heavier than annual rainfall for 1911. Heaviest precipitation 147.61" at Porto Bello and minimum rainfall 71.78" at Ancon.

Notable excess in wind movement in 1912. Average velocities abnormally high during dry season; maximum velocity of 49 miles an hour from the east recorded at Gatun. Prevailing direction was from northwest at Ancon and Culebra and from north at Colon. Relative humidity generally below normal, mean being 81 per cent at Ancon, 82 per cent at Culebra, and 83 per cent at Colon.

Number of seismic disturbances registered, but none so violent as to be sensibly felt in zone.

Surveys made of Miraflores Lake watershed, Corozal Hospital farm, Darien Radio Station Reservation for the Navy Department, Chagres River from Gamboa to the zone boundary to locate gravel banks, and area in vicinity of Mount Hope proposed for oil storage. Boundary line between city of Panama and zone run out and monuments located. Error of 100 meters found in recorded distance between triangulation stations Gamboa and Obispo, recorded distance being 1,093.34 and correct distance, 1,193.34 meters. Considerable survey work done for department of law and joint land commission. P-13, 44-48.

1914. Division in charge of A. L. Robinson until July 19, 1913. Subsequent to and until Mar. 6, 1914, Lt. Col. T. C. Dickson, U. S. Army, performed general duties relating to organization and personnel, while operation of shops under supervision of J. J. Eason. On Jan. 26, 1914, D. C. Nutting, U. S. Navy, reporting for duty, assigned as superintendent and took over all duties.

Establishments under operation by division consisted of Balboa shops (including roundhouse and car shops), Cristobal shops and dry dock, Paraiso shops.

Cristobal roundhouse, small hoisting establishments at Gatun, Empire, and Paraiso, and car-inspecting establishments at Cristobal and Balboa. Cristobal shops and dry dock charged with all repairs to floating equipment; this dock only one available when dry dock necessary, in continuous use. For docking 5 submarines on duty on Isthmus and for docking "Corozal," upper lock of east flight at Gatun used. Paraiso shops reestablished Oct. 22, 1913, for repairs on

dredging equipment in Culebra Cut. Hostling of 4 engines operating in this vicinity turned over to these shops May 25, 1914. Cristobal roundhouse turned over to mechanical division Apr. 1, 1914; all hostling at north end of canal concentrated there. The establishment, in addition to roundhouse, comprises a small boiler plant and 2 air compressors with capacity of 2,000' per minute. Plant supplies air for hostling purposes and also for work on new pier of the Panama R. R. Small hostling plant established at Empire, in shops vacated, Mar. 1. With establishment of electrical division Apr. 1, 1914, electrical plants at Empire, Miraflores, Gatun, and Balboa, previously operated by mechanical division, turned over to that division; air compressors likewise turned over to electrical division. Old shipways shops at Pacific entrance turned over to mechanical division Oct. 22, 1913, and torn down in Mar. and Apr. Machine shops and engine house at Gatun operated for work in connection with installation of lock machinery and caring for locomotives engaged in that vicinity; abandoned Apr. 1, 1914, and work transferred to Balboa and Cristobal. Pedro Miguel engine house abandoned Sept. 15, 1913, and greater portion of equipment moved to Gold Hill engine house and buildings turned over to quartermaster's department and torn down. Engine house established at Gold Hill Sept., 1913, to care for equipment employed in dry excavation north of Gold Hill. Engine house continued in operation until completion of excavation work; discontinued Mar. 31, 1914. Air-compressor plant at Rio Grande, in operation since 1905, shut down Oct. 15, 1913, and such compressed air as was required in district previously supplied by Rio Grande furnished by plant at Empire. Cristobal car shops in operation until Mar. 7, 1914, when abandoned; car work concentrated at Balboa shops. When Balboa roundhouse put into service Apr. 1, 1914, Panama roundhouse of Panama R. R. placed out of use.

Throughout year, while shops in operation, 2 shifts regularly worked at Gorgona, Empire, Paraiso, and Balboa. In addition to double shift, emergencies necessitated overtime. **P-14**, 34, 35.

Mechanical Engineer, Electrical and.

Report, **P-14**, 95.

Mechanical Engineer's Department, P-11, 238. (See No. 260, p. 2368 of this Index.)

Mechanics.

Good craftsmen generally, **P-11**, 231.

Mechanical division, **P-14**, 34.

Special, pay of, **P-11**, 225.

Mechanics, Division of.

Chart of organization, **P-14**, pl. 142.

Medicine.

Executive order relating to practice of, without a license, **P-12**, 611.

Medical treatment of employees, **P-12**, 546.

Membership. (See Clubs, etc.)

Men, Enlisted.

Act relating to payments to enlisted men on the retired list, **P-11**, 573.

Merchandise, Status of.

When entered into the U. S. from Canal Zone, acts, **P-11**, 558.

Messes. (See Meals; Subsistence; Kitchens; Labor; Employees; Hotels.)

Gold Hill, laborers' mess hall, **P-07**, 96, pls. 108, 109.

Operations, **P-09**, 224; **P-10**, 332; **P-11**, 374; **P-12**, 397, 406; **P-13**, 400-409.

Metcalfe, R. L.

Made member Isthmian Canal Commission, **P-14**, 560.

Meteorology, P-05, 130; **P-07**, 57; **P-08**, 69; **P-09**, 185; **P-10**, 275; **P-11**, 247; **P-12**, 221, 223; **P-13**, 220; **P-14**, 26, 91, 141. (See Hydrology; Hydraulics; see Nos. 138, 244, pp. 2364, 2367 of this Index.)

Bureau of, establishment, **P-05**, 130.

Data issued, **P-10**, 278.

Equipment, **P-10**, 275.

Lock and dam department, **P-07**, 57.

Monthly data, Ancon, Culebra, and Colon, **P-12**, 232; **P-13**, 229; **P-14**, 147, 149.

Observations, Chagres River, **P-05**, 13.

Ocean, **P-10**, 277; **P-11**, 251.

River hydraulics and, **P-08**, 68.

Stations, **P-10**, 275.

Meteorology Operations.

1905. Division of meteorology and river hydraulics reorganized. Stations installed; men trained, looking toward systematic and correct reports. **P-05**, 117.

1907. Division of meteorology and river hydraulics organized during fiscal year. Rain gauges established, system being reduced later to observing stations at about 12 places. Highest water in Chagres week ending May 12, rising 13' in 14 hours at Gamboa and 12½' in 16 hours at Bohio. Maximum discharge at Gamboa on Oct. 20, when river gauged 25,532 c. y. per second; on Apr. 3 it showed 417' per second. Temperature 97°, minimum 67°, mean humidity 87.3°. No severe windstorms. Percentage of sunshine, 53. Only 1 earthquake noted by seismograph, slight only; no record of San Francisco movement. **P-06**, 113.

1909. Organization: With resignation of Ricardo Arango, Sept. 18, 1908, because of ill health, division of river hydraulics and meteorology merged into the third division of O. C. E.

Chagres River: Gauging continued at various stations; flow during dry season of 1908

lowest on record. Dry season of 1909 gave a discharge which was notably large; between Jan. 27 and Feb. 1 the largest freshet since the flood of 1906 occurred. First-class gauging stations established at Alhajuela, Bohio, Gatun River, Trinidad River, and Gatun; and river stations at Gamboa and Vigia. Three to eight hours' notice can be given of an approaching flood.

Meteorological stations: Three in operation; 22 rainfall stations, etc.

Earthquakes: Seismograph station completed, and instruments installed at Ancon. Tremors recorded of no greater frequency or magnitude than occur at Washington, D. C.

Surveys: Of Chagres River to more accurately determine its drainage area and run-off of adjacent territory.

Maps: Three general maps continued.

Trinidad River: Investigations begun of low divides at the headwaters of the Trinidad River, looking toward prevention of overflow thereat. **P-09, 21.**

1910. Division in charge of C. M. Saville, assistant engineer.

Gauging stations maintained at Gatun, Bohio, and Alhajuela, on Chagres River, Monte Lirio on Gatun River, and on Trinidad River. River stations maintained at Vigia and Gamboa for predicting floods.

Minimum flow at Bohio in Mar., 1910, when discharge was 1,220 cubic feet per second; maximum in Dec., when it reached 90,000 cubic feet per second. First freshet Sept. 14, when river reached elevation 61.6 at Gamboa. Crest of Nov. flood reached elevation at Gamboa of 72.6' on Nov. 19, 1909, and at Gatun an elevation of 21.50 above mean tide, flooding area of 32.47 sq. m. Three floods occurred in Dec.; first reported from Vigia Dec. 6, due to rainfall in Chagres Basin above this station. Greatest flood of year began Dec. 26; river rose rapidly, and within 8 hours after beginning of rise at Vigia observer's house and water-stage register washed away. At Alhajuela crest of flood reached elevation 121, or 2' higher than flood of Dec., 1906; at Gamboa it reached elevation 78.2, or 3' lower than flood of 1906. Before high water of this flood had subsided another freshet occurred on 30th and 31st, crest of which reached elevation of 112' at Alhajuela. Floods interrupted operation of Panama R. R.; communication between Colon and Panama cut off entirely for 3 days.

Three first-class meteorological stations maintained at Ancon, Culebra, and Cristobal. Twenty rainfall stations also operated, 9 supplied with standard rain gauges and 11 with automatic registers of the tipping-bucket type.

Temperature for 1909 below normal, average being 78° F. at Cristobal and Culebra and 79° F. at Ancon. Minimum, 61° F. at Culebra on Mar. 1, 1910, and maximum at Culebra, Apr. 15, 1909, 94° F.

Rainfall for year greater at all stations; maximum at Porto Bello, where 237.28" recorded. Maximum monthly rainfall at Porto Bello, Dec., 1909, registered 58.17". Hail fell at Alhajuela on May 28, 1910. Deficiency of wind movement during year, though in storm at Ancon July 10, 1909, wind attained maximum velocity for 1 minute of 70 miles an hour, and for 5 minutes of 59 miles an hour, greatest velocity of record on Isthmus.

Slight seismic disturbances of frequent occurrence, very few of which physically observed in zone. Except in cases of minor local tremors, records at Ancon harmonize with records in U. S., Mexico, and Europe.

Careful record of evaporations at various points along line and the time of duration of fogs also kept.

Survey of watershed of Chagres completed.

Triangulation survey under way for combining all existing surveys for different parts of the work and tying them together in complete survey of zone. Nineteen new stations established which, with 3 existing survey stations near Colon wireless station, Colon Light, and Toro-Point Light, comprise system from Atlantic to Pacific Oceans.

Investigations started previous year of low divides at headwaters of Trinidad to determine what steps, if any, should be taken to prevent overflow of lake continued. At one of the Cano saddles distance through the range at elevation 85 is 50', and at no place between 90' contours is it more than 100'. Investigation of this locality indicates it will probably be necessary to increase height, which can readily be done with material easily accessible. East of Gatun another saddle will probably require some reinforcement. **P-10, 34-36.**

1911. Gauging station maintained at Alhajuela on Chagres River, and hydrographer at this station had charge of the gaugings on upper and lower tributaries. Discharge measurements begun at Gamboa Nov., 1910, and continued. According to past records, elevation of river at Gamboa reached minimum during dry season of 1911, and discharge at this point less than on many previous occasions. Bohio abandoned as regular gauging station, though measurements of cross section taken from time to time to permit gaugings in times of flood. As entire run-off from Chagres Basin has passed through spillway since Apr., 1910, regular gaugings made at this point. Back water from Gatun Lake and construction of relocation of Panama R. R. at Monte Lirio interfered with permanent stations heretofore maintained on these rivers.

Vigia, Alhajuela, and Gamboa used as warning stations in times of freshets, and reports sent to construction divisions as soon as indications of rise in river noted.

According to discharge measurements at Gamboa, heaviest freshet Dec. 3, 1910, when there was a rise of 12.7' and discharge

was 57,200 cubic feet per second. Minimum flow at Gamboa during year on Mar. 31, 1911, when discharge was 700 cubic feet per second. Three first-class meteorological stations at Ancon, Culebra, and Cristobal continued. There are also 3 second-class stations at Gatun, Pedro Miguel, and Gamboa, at which wind direction and velocity, temperature, and rainfall recorded. Twenty rainfall stations in operation, 12 equipped with standard and 8 with automatic rain gauges. At request of department of sanitation, anemometer erected at Corozal in Feb., 1911, for use in studies concerning mosquito migration. For determining effects of varied conditions on evaporation from lake surfaces, 3 evaporation pans, each equipped with standard rain gauge, and 2 of them with anemometers, installed in Gatun Lake in vicinity of Gatun, one in an exposed location in open part of lake about 1,000' from shore, the second among the trees near lake border, and third in an extensive patch of tall rushes. Evaporation stations also maintained at Ancon, Cristobal, Rio Grande Reservoir, and Brazos Brook Reservoir. Automatic tide register installed in canal opposite Corozal, in addition to those in operation at Balboa and Cristobal. Two seismograph stations in operation for purpose of recording disturbances, one at Ancon and one erected during the year on Guarapo Island in Lake Gatun near spillway of dam, Apr., 1911.

Temperature for 1910 about normal for all stations. Highest, 94° F., at Ancon, Mar. 13, 1910, and lowest, 61° F., at Culebra, Mar. 21, 1910.

Average rainfall over zone well above normal, unusually heavy in July and Dec., but below that of previous year. For first half of fiscal year 1911 rainfall below normal. Dry season for 1910 above normal. Average rainfall for 1910, 90.83" in Pacific section, 129.18" in central section, and 157.86" in Atlantic section. Average rainy days, 220 in Pacific section, 271 in central section, and 292 in Atlantic section; greatest number being 344 at Monte Lirio and the least 211 at Balboa. Slight seismic disturbances of frequent occurrence.

Triangulation survey continued, primary scheme completed, 15 additional stations having been occupied. Secondary system established containing 42 additional stations. Triangulation scheme designed primarily to serve as framework upon which the lands survey could be hung, and majority of stations established in vicinity of important section corners. Adjustment of secondary system not completed at close of year. Original plan for survey of zone lands, for which specific appropriation made by Congress, contemplated laying out of lands of zone in quadrilaterals 2 kilometers on a side, referring lots and subdivisions to a system of rectangular coordinates. South-

eastern part of zone, including most of territory between Las Cascadas and Panama city, surveyed with this in view. Expense such, however, that method was changed, as it was considered neither necessary nor advisable to secure accuracy attempted, and remainder of zone being surveyed with view of locating principal rivers, mountain ranges, trails, and roads with more topographic detail than the other method contemplated. Number of detailed surveys made for land office of Isthmian Canal Commission and Panama R. R. Co. after consolidation of offices effected.

Investigations continued during previous year of low divides at headwaters of Trinidad and Gatun Rivers continued until Jan., 1911; work completed. Section explored during year between Gatun and headwaters of Gatun River. Investigations included Canoa, Barro, and Egronal saddles. Results show ridges are of such thickness and composed of such materials as to permit no loss of water from Gatun Lake. At Canoa saddle, near headwaters of Trinidad, as reported previously, it will be necessary to construct dike or wall, and similar work will be required at headwaters of Las Guacas Creek, about half a mile east of Gatun. On account of location of the former, this work will not be attempted until waters of Gatun Lake are at sufficient elevation to enable easy access to the locality. P-11, 36-38.

1912. Third division of O. C. E., which formerly had charge of general surveys not embraced with the limits of any construction division, together with the meteorological and hydrographic work, abolished Jan. 24, 1912, when general survey work was practically completed. What remained of this, together with the collection of meteorological and hydrographic data, consolidated with second division of O. C. E. P-12. 1.

1913. See immediately above and below.

1914. Until Apr. 1, 1914, meteorological and hydrographic sections continued under separate heads; on that date consolidated into one division under chief hydrographer reporting to engineer of maintenance, and reduction of 3 "gold" men effected.

Wind records discontinued at Sosa Hill Jan. 1, 1914; wind station moved from Guarapo Island to administration building at Gatun Dec. 14, 1913; and new wind station established at Gamboa Nov. 11, 1913. Evaporation records at Brazos Brook discontinued Apr. 1, 1914. Rainfall station established on Siri branch of Trinidad River Jan., 1914, and similar station established near head of Gatun River branch of Gatun Lake May, 1914. Records from these stations obtained for use in estimating monthly rainfall over lake watershed. Seismic disturbances more numerous and severe than

in any previous year since American occupation, 87 distinct shocks being recorded at Ancon. Practically all shocks seemed to originate in vicinity of lower coast of Los Santos Province, 115 miles southwest of Ancon. Most violent shocks occurred Oct. 2, 1913, and May 28, 1914; in each instance maximum amplitude of 75+ recorded, when the recording pens were thrown off. Shock May 28 resulted in slight damage to new administration building, in course of erection at Balboa Heights; with this exception canal works suffered no damage. For use of Fortification Board, maximum and minimum temperatures recorded on Miraflores dumps. Duplicate automatic tide registers continued at Balboa and Colon.

Main hydrographic features of year were filling of Gatun and Miraflores Lakes and subsequent control of their water levels by spillway gates, auxiliary culvert valves, etc. Total yield of Gatun Lake watershed for calendar year 1913 was 77 per cent of yearly mean since May, 1908, and 70.3 per cent of mean for 24-year period 1890-1913. No large freshets during year.

Average temperature for calendar year 1913 slightly above normal. Apr. was warmest month at Ancon and Culebra and June was warmest month at Colon, 93° F. at Culebra on Apr. 24 established new high temperature record at that station.

Rainfall during 1913 below normal at all stations except Brazos Brook, Colon, and Porto Bello. Heaviest precipitation, 171.19" at Porto Bello, and minimum 59.54" at Balboa.

Wind movement over zone for year slightly above normal. North and northwest winds prevailed. Mar. windiest month at all stations, and Nov. month of least movement. June 27 to Dec. 27, 1913, Gatun Lake level rose from plus 48.22 to plus 84.7. Since latter date has been controlled by spillway gates between 85.14 and 84.13. During year possible for first time to determine velocity which would be caused in prism at Gamboa by floods in upper Chagres. On May 26, with discharge at Alhajuela of 16,000' per second, velocity at Gamboa Bridge 0.65 mile per hour, lake level being at 84.92 and rising to 84.98. On June 30, with discharge at Alhajuela of 20,050' per second, velocity at Gamboa Bridge 1.05 miles per hour, with lake at 84.88 to 84.86. P-14, 26, 27.

Meters.

Meter service, water supply, P-07, 76.

Military Value of Canal. (See No. 10, p. 236 of this Index.)

Milling Machine. (See Machine, Milling.)

Mills, Planing, P-10, 267; P-11, 236; P-12, 272.

Balboa shops, P-13, 254, pl. 57.

Manufactures, Lirio, P-08, 105.

Operating tunnel, Balboa, P-13, 254, pl. 56.

Mind.

Canal near, P-10, 136, pl. 51; P-12, 111.

Minear, A. Bruce, Superintendent Club-houses. (See Nos. 238, 247, p. 2367 of this Index.)

Minerals.

Deposits, zone, P-13, 578.

Mineral analysis, drinking water, P-08, 118.

Mining. (See Blasting; Quarries.)

Ancon stone quarry, P-09, 98; P-10, 195; P-11, 189; P-12, 202; P-13, 184.

Gold in meager quantities, zone, P-13, 575.

Pacific division, P-09, 93, 95; P-10, 166, 170; P-11, 159, 163; P-12, 181; P-13, 176.

Miters.

General drawing of sill on masonry, P-09, 42, pl. 10.

Lock gates, machinery for forcing, P-10, pl. 84; P-14, 107.

Method of erection of mitering lock gates. P-12, pl. 73.

Miter-forcing tests, P-13, 91.

Models.

Gatun spillway, P-10, 64, pls. 1, 2.

Monetary System. (See No. 74, p. 2363 of this Index.)

By agreement, currency of Panama similar to that of the Philippines. The Republic, the Panama R. R., the Isthmian Canal Commission arranged with bankers for a reliable supply of Panama silver currency, etc. P-05, 2.

Money Orders. (See Civil Administration.)

Monitor, Pipe Lines and.

Hydraulic excavation, Pacific division, P-10, 177.

Morison, G. F. O. (See No. 1, p. 2361 of this Index.)

Mosquitoes.

Larvacide, application of, P-10, 434, pl. 71.

Motive Power and Machinery. (See Nos. 221, 243, pp. 2366, 2367 of this Index.)

Division of, report, P-08, 77; P-09, 144.

Duties of superintendent, P-08, 71.

Motive Power and Machinery, Municipal Engineering, and Building Construction. (See above.)

Report of Civil Engineer H. H. Rousseau, member Isthmian Canal Commission No. 4, July 6, 1908, P-07, 59; P-08, 71.

Motors, Pumps and.

Cable crossovers, P-14, 125.

Drainage sump and culverts, P-14, 114.

Lock-operating machinery, P-12, 90.

Miter gate moving and forcing machines, P-12, 87.

Motor and limit switch, cylindrical valve machine, locks, P-12, 108, pl. 11.

Shops, P-13, 207.

Terminal construction, P-14, 169.

Movable Dams. (See Dams.)

Municipal Engineering. (See Nos. 127, 221, 261, pp. 2364, 2366, 2368 of this Index.)

1905. Charge of the designing and construction of waterworks and sewers; care and maintenance of same; construction and repair of roads and works of a like character. 55 per cent of Panama waterworks completed. Ancon Reservoir practically completed. Temporary water supply of Colon in progress. Work being done at Ancon Hospital, La Boca, Culebra, Empire, Las Cascadas, Gorgona, Corozal, Paraiso, and Pedro Miguel. **P-05, 110.**

1906. Reports made on details of constructing Panama waterworks, sewers, paving; Colon water supply. Long and vexatious delays made in the furnishing of material; labor inferior also. Resignations and dismissals another source of delay. Work of the department a "great and satisfying success." **P-06, 92.**

1907. Paving of streets and construction of waterworks in Panama and Colon; paving, road making, grading, construction of waterworks and sewer systems, and other work in the zone; expenditure, \$1,741,953, divided about equally between zone and Panama and Colon. Cost of work in cities named to be reimbursed to U. S. under a contract made after end of fiscal year; U. S. to collect water rates sufficient to reimburse itself. Cost of work to date for Colon and Panama, about \$1,750,000. **P-07, 7.**

13,000' water pipe laid in Panama; extensions mainly to outlying districts. Waterworks system in Panama complete. Connections made to 2,093 houses; average consumption, 20 gallons per person per day. 12,232' sewer pipe laid; piping, etc., provided for storm sewers. Brick paving in city completed; streets made 2-team wide. Waterworks system in Colon complete. Sewerage system of Colon complete; 24,521' pipe laid. Sump built, into which all sewage flows. House connections under way. Paving in Colon under way; marked progress made. Drainage system of streets under way. Road work at Ancon. Filtration plant, etc., added to waterworks system at Ancon. Piping laid, houses connected; sewerage provided for. Similar work of piping, etc., at La Boca, Corozal, Pedro Miguel, Paraiso. 18" Venturi meter installed to measure water consumption from Rio Grande Reservoir, which has an available capacity of 248,230,000 gallons; plans made to increase this by 75,000,000 gallons. Crusher plant enlarged.

Culebra: Pumping station, daily capacity of 160,000 gallons, built; distilling plant placed in operation, supplying distilled water to Culebra and Rio Grande. Piping added, houses connected, standpipes built; sewers laid and connected; roads and paths built.

Camacho: Reservoir with capacity of 258,000,000 gallons completed. In Camacho and Em-

pire water piping laid, standpipes built; sewers laid; roads built. **P-07, 9.**

Las Cascadas: 10" mains put in; condensing plant installed to replace sterilizer; road built.

Bas Obispo, Chagrescito, Santa Cruz, and other places along the line of the canal: Water system installed; sewerage provided.

Gorgona: Storage capacity of Carabali Dam increased from 40,000,000 to 85,000,000 gallons. Condensing plant installed; fire system installed at machine shops; sewers for shops built; road built.

Tabernilla: Water service installed; also sewerage.

Gatun: 5" main laid connecting all white quarters; distilling plant erected; fire protection installed; roads built.

Bas Obispo: Road built.

Cristobal and Colon: Mount Hope Reservoir completed; capacity, 435,000,000 gallons; pumping station constructed; filtration plant working. Roads and paths under way; 2 bridges built at cemetery. Water system extended at Cristobal, to cover docks, ice plant, bakery, laundry, etc.; sewerage extended; road work; open drains and catch basins built; fire plugs installed. **P-07, 10.**

Labor supply: Ample at all times. Average daily force, 2,593. **P-07, 11.**

1908. Duties: Completion of waterworks, sewerage system, and paving in Panama and Colon; and construction of waterworks and sewerage systems, paving, grading, and road making in the zone. Cost of work done, \$1,067,150.52.

Cities of Panama and Colon: In Panama, 60,469' water pipe laid, 2,093 houses connected; 67,925' sewer pipe laid, 1,019 houses connected, and almost 90,000 sq. y. paving laid. In Colon, 69,280' water pipe laid, 1,147 houses connected, 37,896' sewer pipe laid, and 264 houses connected; nearly 70,000 sq. y. paving laid; sewage sump provided.

Cost of city works: To Panama, \$1,018,387.27; Colon, \$894,275.17. Rental to be charged cities for auxiliary water system maintained by U. S. in zone; fixed rentals to be charged to credit of U. S. for water.

City works, maintenance: Sewers, waterworks and pavements of Panama and Colon transferred to division of public works, department of civil administration.

Panama and Colon, further works: Needed because of growth of some districts due to canal population, etc. Estimate, \$1,000,000 (not to be undertaken without specific appropriation by Congress). **P-08, 15, 16.**

Canal Zone: 462,951' of water pipe laid up to June 30, 1908; 2,320 houses connected. Water supplied from 4 reservoirs and 2 pumping stations; former at Rio Grande, Camacho, Gorgona, and Brazos Brook; latter at Tabernilla and Gatun. 12 additional pumping plants maintained as auxiliary and emergency units.

Rio Grande Reservoir: Capacity, 496,670,000 gallons; supplies water to all points south of Culebra, including Panama, Ancon, and La Boca. Annual consumption, 942,200,000 gallons (0.3 for city of Panama). All water for Panama and Ancon filtered at Ancon filter plant.

Camacho Reservoir: Capacity, 295,867,000 gallons. Supplies territory between Culebra and Bas Obispo. Annual consumption, 131,765,000 gallons.

Carabali Reservoir: Located back of Gorgona. Capacity, 80,000,000 gallons. Furnishes water for territory between Matachin and Mamei. **P-08**, 16, 17.

Brazos Brook Reservoir: At Mount Hope. Supplies from Mount Hope to and including Cristobal and Colon. Annual consumption, 457,544,000 gallons, with a capacity of 641,000,000 gallons.

Tabernilla pumping plant: Supplies water to territory between San Pablo and Frijoles. 500,000 gallons pumped daily.

Gatun pumping station: On Gatuncillo River. Pumps to Gatun. 1,200 gallons of distilled water daily.

Ancon Hill: For fire protection, to Ancon, Panama, and La Boca, 1,000,000 reserve storage reservoir to be built.

Locks, Miraflores and Pedro Miguel, water for: Surveys made of valley drained by Pedro Miguel River to ascertain extent of probable water supply for construction work. Daily flow of 674,000 gallons in dry season; ample.

Fires: Two at Panama and 2 at Colon; water service efficient.

Zone sewage: 98 per cent of all Isthmian Canal Commission quarters connected; 217,975' at end of year, 2,163 house connections, 12 catch basins.

Roads: At end of year, 172,148' macadam road built and 18,133' paths laid.

Public works, Culebra Island: Waterworks, sewage system, walks, and landing stage built. Island used as a quarantine station.

Native settlements: Public works of various kinds constructed. Cost paid by Isthmian Canal Commission.

Rio Grande rock crusher: Delivered 57,329 c. y. broken stone. Cost, \$1.75 per c. y.

Employees: 1,015 men on rolls at end of year.

Costs: System for keeping installed. Total cost of municipal works in zone, waterworks and sewers, \$2,358,840.44; roads, etc., \$1,174,778.26. **P-08**, 17, 18.

1909-13. (See Atlantic, Central, and Pacific divisions, respectively.)

1914. All municipal engineering work in zone formerly performed by construction divisions, as well as that performed in Colon and Panama by division of public works, department of civil administration, consolidated July 16, 1913, forming division of municipal engineering, under George M. Wells, resident engineer, reporting to chief engineer. **P-14**, 1.

Division divided into 5 principal sections: Northern district embraces all municipal construction, maintenance, and operation work, exclusive of operation of filtration plants, from and including Colon to Darien, 25.27 miles; southern district embraces similar work from Darien to Balboa, including city of Panama, 22.34 miles; waterworks for southern end of Panama Canal embrace construction of purification works at Miraflores, pumping stations at Gamboa, Miraflores, and Ancon, reservoirs, and laying of new mains; fourth subdivision embraces operation and care of purification plants and care and analyses of zone water supplies; and fifth subdivision embraces all work of design for division.

Improvements in Colon in progress at close of previous year being paid from appropriation by Congress of \$800,000, completed in early part of Aug., 1913, at final cost of \$520,212.57.

Plant at Gatun for manufacture of concrete pipe operated until May. Usual maintenance in connection with reservoirs of northern district performed, and level of water in Brazos Brook Reservoir kept at about same elevation during dry season by letting water from Gatun Lake through tunnel constructed during previous year. New purification plant located at Mount Hope and furnishing water to Colon, Cristobal, and adjacent district completed and placed in service Feb., 1914; has been successfully operated since. Total division cost of plant, \$292,198.10.

In addition to maintenance in southern district a considerable amount of construction work undertaken, including streets, water and sewer systems, and roads in new silver town of La Boca, storm sewers in gold town site of Balboa, water and sewer systems and streets at Pedro Miguel, installation of water and sewer systems for Darien radio station, and work in connection with addition to Panama, for which Republic of Panama made special appropriation of \$76,000.

Question of providing permanent, adequate, and suitable water supply for towns of zone from Pedro Miguel south under consideration for some time. Demands greater than could be supplied by Rio Grande Reservoir, and with depopulation of zone, contemplating elimination of all towns on west side of canal, plan prepared for utilizing Camacho and Rio Grande Reservoirs, connecting them by pipe line, and increasing capacity of Rio Grande Reservoir by raising dam, diverting railroad for purpose. With adoption of policy of quartering troops on west side of canal, utilizing old canal buildings for the purpose, together with fact that rainfall had not been sufficient to raise level of water in reservoir to full height, whole subject taken up anew Mar., 1913. Five projects presented; cheapest contemplated use of water from Miraflores Lake, and adopted. It contemplated laying of mains, construction of purification plant

of the rapid mechanical gravity type on Miraflores Hill, and construction of high-service reservoir on side of Ancon Hill, all to be based on nominal maximum capacity of 12,000,000 gallons filtered water per day. At the time that use of Miraflores Lake water considered, possible objection advanced that chlorine content, by reason of operation of Miraflores Locks, might increase beyond .75 to 100 parts per million, but at the time it did not seem possible this would occur, at least for a period of years, on the assumption that intimate diffusion between salt water admitted by locks and fresh water of lake would not be rapid, especially in view of fact that water could be pumped from one of the fresh arms of the lake. At any rate, the enormous saving that would result seemed to warrant adopting Miraflores Lake project.

In Jan., after pumps from Coccolí had been transferred to Miraflores and increased in capacity to take care of demand, chlorine-sampling stations established in lake; discovered that with continued operation of locks chlorine content steadily rose. By Feb. it became apparent that constant diffusion taking place throughout all areas of lake in general, as high as 15 per cent salt water. To bring this down, temporary pump station installed at Pedro Miguel and approximately 4,000 gallons of water per minute pumped from Culebra Cut north of locks and discharged into Miraflores Lake immediately in front of temporary pumping station. This reduced chlorine content going to Panama, but it increased turbidity of water due to condition in cut. As result of these observations, it became evident that Miraflores Lake would be impracticable for use as source of water supply for southern end of canal, and it was decided to move pumping station to Chagres River at Gamboa, water to be taken from this point through 30" to 36" cast-iron mains laid along line of Panama R. R. to purification plant on Miraflores Hill. Before final action taken, effort made to reduce chlorine content by drawing off water from Miraflores Lake through locks and admitting fresh water through Pedro Miguel Locks, but results not satisfactory. Work commenced on purification plant, Miraflores Hill, Aug. 1, and steam shovel and hand excavation completed Jan. 28 by removal of 91,233 c. y. For high-service reservoir at Ancon there were laid 1,477 c. y. reinforced concrete, and in purification plant, Miraflores Hill, there were laid 5,656 c. y. reinforced concrete. Total expended for new waterworks in southern district estimated at \$1,261,000. Total amount expended at close of year, \$703,585.05. **P-14**, 23-26.

Municipalities. (See Atlantic Division; Central Division; Pacific Division; Water Supply; Waterworks; Sanitation; Civil Administra-

tion; see Nos. 45, 52, 121, pp. 2362, 2363 of this Index.)

Division of municipal engineering, **P-07**, 59; **P-08**, 80; **P-14**, 90.

Engineering, Atlantic division, **P-09**, 61; **P-10**, 126; **P-11**, 125; **P-12**, 136; **P-13**, 131.

Engineering, Colon, **P-11**, 127; **P-12**, 137; **P-13**, 133.

Engineering, Cristobal, **P-12**, 137; **P-13**, 133.

Functions, **P-05**, 71.

Northern division, **P-14**, 128.

Organization, **P-05**, 197; **P-07**, 158.

Panama, **P-09**, 105; **P-10**, 183; **P-11**, 177; **P-12**, 191, pl. 94; **P-13**, 180.

Receipts and disbursements, Tables 22 and 23, **P-05**, 89.

Sanitation, system of, **P-06**, 24.

Southern division, **P-14**, 129.

Tables of statistics, **P-06**, 74.

Toro Point, **P-11**, 130; **P-12**, 140.

Work of, fifth division, **P-13**, 176.

Work, central division, **P-09**, 85; **P-10**, 157; **P-11**, 153; **P-12**, 167; **P-13**, 156.

Work, Pacific division, **P-09**, 103; **P-10**, 80, 192; **P-11**, 174, 187; **P-12**, 188, 201; **P-13**, 180.

Municipalities, operations.

1905. Oct. 24, 1904, legislative enactment of the Isthmian Canal Commission established 5 municipal districts in the zone. Area, 475 sq. m. Population, embracing everyone, estimated at 25,000. Officers of local government, a mayor, judge, secretary, and a treasurer, who are appointed, and whose salaries are fixed by the governor of the zone. Each municipality has a council of 5 members, appointed by the governor of the zone upon the recommendation of the mayor. Various public works projected and in progress under the auspices of the municipalities, such as courthouses, slaughterhouses, etc. Liquor-license tax increased from about \$2.50 to \$10 per month to \$600 gold annually, increasing revenues and reducing disorder, wiping out disreputable places. **P-05**, 71.

1906. Great amount of public work done; finances have improved, and respect and admiration of inhabitants of zone gained. Satisfaction over fact that taxes are not all spent for maintenance of the central government. Slaughterhouses, market houses, schoolhouses, municipal buildings, sidewalks, lighting systems, jails, parks, opening of roads and trails some of the work done. Compulsory attendance of children between 6 and 12 at school increased attendance from 20 to 40 per cent. Cash balance to credit of municipalities of \$145,291.29 silver, as against \$61,054.01 Sept. 30, 1905. **P-06**, 37.

Municipalities, Tropical.

Properties, low value of, **P-04**, 82.

Murders. (See Orders, Executive.)

N.

Natives.

Zone government gaining respect of natives of Panama, **P-05**, 28.

Navigation, and Aids to, P-11, 84; **P-12**, 101; **P-13**, 106; **P-14**, 27. (See No. 215, p. 2365 of this Index.)

Beacon, Culebra Cut, **P-14**, pl. 62.

Central plant for making aids to navigation, **P-12**, 104.

Clearings made in aid of, **P-13**, 108.

Equipment, **P-13**, 108.

Gas buoys, **P-13**, 108.

General data, **P-13**, 109.

Illuminants in aid of, **P-12**, 104.

Laws, **P-14**, 263.

Licenses, **P-14**, 266.

Surveys, aid to navigation, **P-13**, 108.

Navigation, Operation.

1914. Construction and placing of lights and beacons continued. With exception of light at extremity of west breakwater and construction of 6 which can not be placed until work in connection with slides in Culebra Gut is completed, all aids to navigation finished and turned over to superintendent of canal transportation, for maintenance and operation, June 16, 1914. Design for west breakwater light was for rather elaborate structure founded on a caisson built during previous year. Taken to site, but in sinking it valves could not be controlled and caisson sunk. After expending \$8,602.22 in attempt to straighten caisson it was abandoned, as was also the design. Total expended in completing entire system of beacons, lights, and buoys to date, \$514,878.81, exclusive of general expenses. **P-14**, 27, 28.

Navy.

Act relating to compensation to retired officers and men, **P-11**, 573.

Appropriation for marine quarters, zone, **P-13**, 607.

Executive order relating to purchases from persons in, **P-12**, 612.

Visit of Atlantic Fleet, **P-13**, 559.

Negroes. (See Labor; Kitchens; Messes.)

Quarters, family, **P-07**, 96, pl. 117.

Sleeping quarters, **P-07**, 96, pl. 118.

Netherlands. (See No. 164, p. 2365 of this Index.)

New Panama Canal Co.

Act, purchase of rights, **P-11**, 549.

Nicaragua. (See Nos. 6, 12, 21, p. 2361 of this Index.)

Noble, Alfred. (See Nos. 1, 164, 208, 213, pp. 2361, 2365 of this Index.)

Notaries, etc.

Executive order relating to, **P-12**, 612.

Nurses. (See No. 98, p. 2363 of this Index.)

Quarters, **P-07**, 96, pls. 112, 113; **P-10**, 434, pl. 68.

Sisters of St. Vincent de Paul replaced; latter ignorant of American tongue and methods. Sisters removed at expense of U. S. to other countries. Some assigned to duty at Santo Tomas Hospital, under joint authority of U. S. and Panama. **P-05**, 52.

Nutting, D. C. (See No. 265, p. 2368 of this Index.)

O.

Ocean. (See Meteorology.)

Lower guard gates ready for entrance of Atlantic waters, Gatun, **P-13**, 110, pl. 1.

Meteorology, **P-10**, 277; **P-11**, 251.

Office Engineer, P-09, 179; **P-13**, 253; **P-14**, 91. (See No. 243, p. 2367 of this Index.)

Office, Executive. (See No. 103, p. 2363 of this Index.)

Civil administration, **P-12**, 457; **P-13**, 461.

Organization, **P-11**, 415.

Office, Panama R. R. (See Panama R. R.)

Engineer work, **P-08**, 201.

Officers.

List of, zone government, **P-05**, 107.

Officers, Retired.

Act relating to payment to officers or men of the Army and Navy, **P-11**, 573.

Officers, United States.

Bonds, act relating to, **P-11**, 574.

Offices, P-07, pls. 121, 126. (See No. 99, p. 2363 of this Index.)

Cristobal, **P-07**, 104, pl. 129.

Empire, **P-07**, 96, pl. 121.

Permanent locations, terminals, **P-12**, 220.

Administration building at Panama growing inadequate. Other quarters acquired as needs grow. Plans made for other locations for administration buildings. **P-05**, 52.

Panama office buildings inadequate. New ones planned for other locations. **P-05**, 119.

Headquarters of the zone government at Ancon. Various buildings in construction for department offices. **P-06**, 26.

Offices, Washington. (See No. 227, p. 2366 of this Index.)

Moved to larger building, **P-05**, 5.

Oil.

Deposits, zone, **P-13**, 579.

Oiling and macadamizing roads, fifth division, **P-13**, 183.

Oil, Fuel. (See Fuel.)

Consumption, **P-09**, 82, 102; **P-10**, 156; **P-11**, 151; **P-12**, 166; **P-13**, 155.

La Boca dredging division, **P-08**, 54.

Plants, **P-14**, 194.

Terminals, **P-12**, 217; **P-13**, 218.

Oil Pipe Line. (See No. 84, p. 2363 of this Index.)

Union Oil Co. of California granted concession for pipe line over land owned by Isthmian Canal Commission and Panama R. R. Similar concession gained from Panama Oct. 30, 1906. License revokable; \$500 a month to be paid to zone treasury for benefit of special fund for schools. Isthmian Canal Commission and Panama R. R. may purchase oil for 90 cents a barrel. **P-06**, 22.

Opening.

Of canal, act, **P-12**, 599.

Operation and Maintenance of the Canal, P-14, 63.

1899-1901. Data obtained from famous canals; i. e., Suez, Manchester, Kiel, etc. Cost of maintenance and operation of Suez; of Kiel and Manchester Canals; of St. Marys Falls Canal. Maintenance and operation of Nicaragua Canal much greater than for Panama Canal. Former has 4 times the total length of the latter. Has more locks, weirs, etc. Greytown a most difficult harbor to maintain, and is in region of greatest rainfall. Annual cost, for Nicaragua, \$3,300,000; for Panama, \$2,000,000. Commission d'Etudes, using a different method, estimated the cost

for the Panama route at \$1,940,000. **P-09**, 169, 170.

1911. As work nears completion, it is intended to concentrate construction until what remains will be in immediate charge of directing office, thereby reducing costs and overhead charges. Believed that more satisfactory operating force can be secured by selection of suitable men from "present" organization. There has been considerable criticism because of high wage scale, but this due to fact it was difficult to obtain men when work started, on account of bad reputation of country, and also because of temporary character of the work. Complaints made constantly because salaries disproportionate to responsibilities, and because of lack of uniformity in percentage of excess over wage scale for similar labor in States. After inauguration of scale it was not considered advisable to make reduction, and rearrangements made from time to time as necessities required, but inequalities still exist. Conditions different now. Chief sanitary officer declares death rate of zone to be "much lower than that for most parts of the U. S.," and general health of about 8,000 white Americans in the zone to be "fully as good as it was in the U. S.;" also, continuance in employment can be assured. Believed that lower wage scale can be put into effect for operating canal, and that necessary force can be secured from men who will remain in service during next year or two. This an important consideration, since it is essential that cost of operation shall be reduced to minimum consistent with efficiency. With operating organization provided for, steps can be taken to adopt salary and wage scale, after which there can be created from construction force one for operation without delay or confusion.

Total outlay for maintaining the canal will be for wages of force engaged in its operation, expense of engineering work connected therewith, and cost of sanitation and civil administration.

Revenues of canal should go to pay not only operating expenses, but to repay capital invested. Every legitimate means for increasing revenue should therefore be adopted. U. S. should have coal and fuel oil on hand for its own vessels, and these commodities should be sold to shipping using the canal. These should be supplied at established rate and purchased after advertisement. Existing commissary, manufacturing plant, and laundry should be continued for the benefit of U. S. forces and to furnish supplies and service to shipping. Wireless-telegraph station should be established for commercial as well as military purposes. Canal authorities should be authorized to sell tools and appliances needed by ships, and to make repairs as may be necessary while ships in vicinity of canal. Dry dock should

be built with dimensions conforming to locks. Both dry dock and machine shops would be available for use by Navy. If this policy be adopted, early legislation needed that construction necessary to make it effective may be undertaken without delay. **P-11, 60-63.**

1914. As already outlined, organization made effective Apr. 1, 1914, provided for department of operation and maintenance under governor, who was to be assisted in the administration of the department by engineer of maintenance and superintendent of canal transportation. Capt. H. Rodman, U. S. Navy, appointed superintendent of canal transportation, and charged with safe conduct of vessels through Panama Canal, except at locks. Also given supervision of port captains, board of local inspectors, pilots, operation of lights and beacons subsequent to June 15, and inspection and admeasuring of vessels. Offices of captains of ports at Cristobal and Balboa established May 5; charged with duty of assignment of wharves, docking and berthing of vessels, furnishing of pilot service to shipping, admeasurement of vessels for transit through canal, and general supervision and enforcement of canal and harbor regulations relating to shipping. Eight pilots appointed—four at each end; their services have been utilized in piloting vessels in and out of terminal ports, in connection with lightering cargo through canal, familiarizing themselves with aids to navigation and with canal route.

Due to condition of affairs in Mexico and interruption of the Tehuantepec route, demands upon Panama R. R. for transshipment of freight became so great that it was necessary to institute barge service through canal; this made effective on May 15, when barges were towed through canal from Colon to Balboa, and continued rest of year. Tolls paid by Panama R. R., and aggregated for year \$11,610.69.

Maintenance work undertaken at locks covered miscellaneous repairs, as well as care necessary to keep machinery in satisfactory working order. Maintenance charges made applicable only after work had been entirely completed in each instance. Amount expended for such repairs and maintenance work, \$120,287.99. Heavier expenditures were at locks and were incurred in connection with gates, emergency dams, miter gate moving machines, rising stem valve machines, cylindrical valve machines, and in lighting. Work done in repainting gates, caissons, and caring for machines of spillways. Also expended \$16,570.44 of amount above noted for maintenance in clearing vegetation and pulling trees from canal channel, and removing timbers and driftwood from vicinity of locks. **P-14, 63, 64.**

Orders, Executive, P-10, 397; P-11, 433; P-12, 595; P-13, 605; P-14, 555. (See Nos. 152, 276, pp. 2364, 2368 of this Index.)

Administrative districts, consolidation of Gorgona and Empire, **P-13, 614.**
Acts and resolutions, Isthmian Canal Commission, approval, **P-14, 599.**
Arms, **P-14, 562.**
Bail and bonds, **P-14, 561.**
Birds, protecting, **P-13, 616.**
Bull fights prohibited, **P-12, 608.**
Canal opening, **P-14, 600.**
Census, **P-12, 613.**
Civil service, transfers to U. S., **P-13, 616; P-14, 601.**
Clubs, gun, **P-10, 376.**
Code of Civil Procedure, **P-12, 610.**
Counsel and chief attorney, **P-10, 376.**
Courts, **P-11, 433.**
Corruption, **P-14, 581.**
Convicts, **P-10, 376; P-11, 433.**
Cruelties, **P-10, 376.**
Deeds, **P-11, 433.**
Distilleries, **P-11, 433; P-12, 618.**
Duties, tariff, **P-11, 433.**
Dwelling, separation of, **P-10, 376.**
Employees, injury claims, etc., **P-14, 590.**
Employees, permanent, **P-14, 584.**
Estates, administration, **P-12, 615; P-13, 617.**
Extradition, **P-06, 75.**
Firearms, **P-12, 611.**
Foreign business men, **P-13, 619.**
Flying machines, **P-14, 560.**
Gaillard, Lt. Col., retirement, **P-14, 561.**
Hotel registers, **P-10, 376.**
Hunting, **P-10, 376; P-14, 581.**
Injuries, compensation, **P-13, 620, 625.**
Insurance, **P-10, 376.**
Insane, **P-11, 433.**
Interest, **P-14, 563.**
Isthmian Canal Commission, duties defined, **P-08, 1.**
Johnson, Prof. E. R., **P-14, 581.**
Judiciary, **P-14, 589.**
Labor recruiting on zone, **P-10, 376.**
Lands, signs on, prohibited, **P-12, 608.**
Lands necessary for canal, all, except "Les Sabanas," **P-13, 614, 616.**
Lands, leasing, **P-11, 433.**
Land office, **P-11, 433.**
Land commissioner, **P-14, 599.**
Liquor licenses, **P-10, 376.**
Medicine, practice of, **P-12, 611, 613.**
Metcalfe, R. L., made member Isthmian Canal Commission, **P-14, 560.**
Murders, **P-10, 376.**
Municipal improvements, assessments, **P-10, 376.**
Notaries, **P-12, 612.**
Office, Washington, **P-14, 587.**
Organization, permanent, **P-14, 582.**
Pardons, etc., **P-14, 599.**
Penal code, **P-12, 611.**
Persons deported, **P-14, 561.**
Pilots, **P-10, 376.**
Purchase of supplies from persons in Army or Navy unauthorized, **P-12, 612.**
Quarantine, **P-13, 625.**
Radio stations, **P-14, 600.**
Real estate, conveyance by married women, **P-11, 433.**

Rules and regulations, canal work, **P-11**, 433.
 Sanitation, **P-12**, 610.
 Seamen, deserting, **P-11**, 433.
 Savings system, **P-12**, 609.
 Shooting clubs, **P-10**, 376.
 Steam vessels, inspection, **P-12**, 605; **P-13**, 615.
 Taxes, collections, **P-11**, 433.
 Tolls, **P-13**, 615.
 Trespasses, **P-12**, 617.
 Town lots, licenses, **P-11**, 433.
 Trespasses, railroads, **P-11**, 433.
 Trial by jury, **P-13**, 631.
 Vehicles, motor, **P-12**, 617.
 Vessels, bills of, **P-14**, 597.
 Vessels, measurement, **P-14**, 564.

Orders of Isthmian Canal Commission No. 2.

Customs procedure on the zone, Circular 7, Dec. 30, 1904, publishing order of Sec. of War establishing, **P-05**, 207.
 Customs service at zone, Circular 6, Dec. 30, 1904, revoking order of June 24, 1904, relating to, **P-05**, 206.
 Importations, etc., into the zone, Circular 4, Dec. 30, 1904, relating to order of Sec. of War concerning, **P-05**, 202.
 Imports into zone, Circular 5, Dec. 30, 1904, relating to, **P-05**, 206.
 Imports into zone, for U. S. employees of the "above-labor" class, Circular 8, Jan. 10, 1905, publishing order of Sec. of War relating to admission of, **P-05**, 208.
 Traveling expenses, Circular 12, Mar. 1, 1905, publishing regulations governing, **P-05**, 211.
 Circular 9, Jan. 16, 1905, publishing Executive order of President Roosevelt that Joseph L. Bristow be appointed a special commissioner to investigate trade conditions, etc., for benefit of Isthmian Canal, **P-05**, 209.
 Circular 10, Jan. 20, 1905, publishing Executive order appointing T. G. Gaff and Dr. C. A. L. Reed members of joint commission, provided for by Articles VI and XV of the canal convention of Feb. 26, 1904, **P-05**, 210.
 Circular 11, Feb. 13, 1905, publishing order detailing Capt. Hugh J. Gallagher to Isthmian Canal Commission duty, and his assignment as purchasing agent with station at Washington, **P-05**, 211.

Ordinances, P-10, 397; **P-11**, 434; **P-12**, 497; **P-13**, 477. (See Civil Administration.)

Organization. (See Charts; see Nos. 33, 65, 145, 149, 230, 277, pp. 2362, 2363, 2364, 2366, 2368 of this Index.)

Chief engineer, John F. Stevens, appointed July 1, 1905, **P-05**, 108.
 Circular outlining, **P-05**, 146.
 Construction and engineering, table of organization scheme, **P-05**, 154.
 Culebra division, changes, **P-07**, 45; **P-08**, 43.
 Department of civil administration, future, organization of, **P-12**, 472.
 Division of material and supplies, **P-07**, 104; **P-08**, 235.
 Governor, Wm. C. Gorgas, acting, pending arrival of Mr. Magoon, **P-05**, 28.

Isthmian Canal Commission, duties of, defined more clearly; several existing orders combined by Executive order of Jan. 6, 1908; certain details transferred to the chairman, **P-08**, 1.

La Boca dredging division, changes, **P-07**, 53.
 Municipal governments, **P-05**, 197.

Permanent organization, **P-14**, 582.

Police, Geo. R. Shanton, chief, **P-05**, 107.

Special attorney, office of, **P-14**, 514.

Status, Aug., 1905, **P-05**, 140.

Zone government, list of officers of, **P-05**, 107.

Organization. Details. (See Isthmian Canal Cosmns.)

1905. Isthmian Canal Commission No. 3 organized under Executive order of the President and of the Sec. of War, Apr. 1 and 3, 1905.

Contents of order: Practical result of preceding commission not satisfactory. Isthmian Canal Commission No. 3 charged with the general duty of the adoption of plans for the construction and maintenance of the canal and with the execution of the work of the same; with the purchase and delivery of supplies, machinery, and necessary plant; the employment of the necessary officers, employees, and laborers; and with the fixing of their salaries and wages; with the commercial operations of the Panama R. R. and its steamship lines as common carriers; with the utilization of the railroad as a means of constructing the canal; with the making of contracts for construction and excavation; and with all other matters incident and necessary to the building of a waterway across the Isthmus of Panama, as provided by the act of June 28, 1902. Executive committee to act for the commission during the intervals between the regular quarterly meetings. There shall be three executive departments: (a) Fiscal affairs, purchase and delivery of materials and supplies, accounts, commercial operation of railroad, etc.; (b) government of zone, sanitary matters; (c) construction plant, operation of railroad, etc. Officers and employees to be appointed generally by their respective department heads. Contracts to be essentially competitive. Board of 9 civil engineers to be appointed by the President to cooperate with the Isthmian Canal Commission No. 3. **P-05**, 2, 3.

Isthmian Canal Commission No. 3 assumed office Apr. 3, 1905, **P-05**, 1.

Members Isthmian Canal Commission No. 3: Theodore P. Shonts, chairman; Charles E. Magoon, governor of zone and member; John F. Wallace, chief engineer and member; Rear Admiral Mordecai T. Endicott, U. S. Navy; Brig. Gen. Peter C. Hains, U. S. Army (retired); Col. Oswald H. Ernst, Corps of Engineers, U. S. Army; Benj. M. Harrod, **P-05**, 4.

Salaries: \$7,500 per annum; chairman, \$22,500 additional; chief engineer, \$17,500 additional; governor of zone, \$10,000 additional. Foregoing officers to have use of furnished dwell-

ing house on Isthmus. Travel expenses for all members. **P-05, 5.**

Secretary, Joseph Bucklin Bishop; appointed Sept. 7, 1905, **P-05, 5.**

Well fitted to accomplish what was intended, **P-05, 109.**

Chief Engineer John F. Stevens, appointed July 1, 1905, **P-05, 108, 123.**

The following divisions were found in operation on Mr. Stevens assuming charge, July, 1905: Colon construction division, Chagres division, Gamboa division, Culebra division, La Boca division; and bureau of personnel, transportation, and quarters, of supplies, of waterworks, sewers and roads; of machinery and equipment, of architecture and building, of meteorology and river hydraulics, of map making, lithography, and printing; and bureau of communication (telephones and telegraphs, etc.), **P-05, 124.**

Department of construction and engineering: Secretary of chief engineer; assistant chief engineer; manager of labor and quarters, **P-05, 151.**

Superintendent of motive power and machinery; architect; master builder, **P-05, 152.**

Principal assistant or assistant engineers; office engineer; division engineers; mechanical engineer, **P-05, 153.**

Executive department: Charles E. Magoon, member of Isthmian Canal Commission No. 3, governor, **P-05, 27, 107.**

Act 8, Laws of the Canal Zone, established the executive branch of the zone government, created the office of governor, and provided for the following departments: Executive, health, revenues, justice, police and prisons, treasurer of the zone, and auditor of the zone, **P-05, 29.**

Department of health: Col. W. C. Gorgas, chief sanitary officer, **P-05, 107.**

Judicial department (supreme court): F. Otis Duran, chief justice; Hezekiah A. Gudger, associate justice; Lorin C. Collins, associate justice, **P-05, 107.**

Duties of the head of the department of government and sanitation of the Isthmian Canal Commission No. 3, and governor of the Canal Zone: Defined by order of Apr. 1, 1905, of President. He shall administer and enforce the laws of the zone, supervise all measures of sanitation within the zone and the cities of Panama and Colon, act as custodian of supplies required for sanitary purposes, and perform such other duties as he may be charged with by Sec. of War. **P-05, 28.**

Treasury: Paymaster G. C. Schaefer, U. S. Navy, treasurer, **P-05, 107.**

Washington office: Organized Apr. 3, 1905. Chief of office appointed, Col. C. R. Edwards, U. S. Army. Sections or divisions: Central office, or office of administration proper; office of general auditor; general pur-

chasing officer; disbursing officer; committee on engineering, **P-05, 148.**

Col. Edwards resigned as chief of Washington office, Nov. 15, 1905, **P-05, 150.**

Duties of chief of Washington office assigned to assistant chief, **P-05, 150.**

1906. Reorganization: The President, Nov. 17, 1906, during a visit to Panama, amended Executive order of Apr. 1, 1905, to divide the work of the project among the following departments: Engineering and construction, law and government, sanitation, auditing, purchasing, disbursing, and labor, quarters, and subsistence. Head of each department made directly responsible for the work carried on under his direction. All appointed by and report directly to the chairman of the Isthmian Canal Commission No. 3, who, in turn, is responsible to the President through the Sec. of War. **P-06, 15.**

Executive committee abolished, legal and governmental departments consolidated, separation of sanitary department from governmental department. In the absence of the chairman, the chief engineer acts in matters requiring immediate attention. **P-06, 16.**

Executive order of Apr. 1, 1905, changed Nov. 17, 1906, to provide: Quarterly sessions of the Isthmian Canal Commission (4 members a quorum) on the Isthmus; with general charge of all operations incident to the building of an Isthmian Canal at Panama, including sanitation, local government, etc.; executive committee of Isthmian Canal Commission abolished.

General organization: Chairman, chief engineer, general counsel, chief sanitary officer, general purchasing officer, general auditor, disbursing officer, and manager of labor and quarters.

Besides being in general charge, the chairman shall appoint the heads of the various departments, subject to the approval of the Isthmian Canal Commission; the head of each department shall report to and receive instructions from the chairman; he shall have charge of the operations of the Panama R. R. and steamship lines.

The chief engineer shall have charge of all engineering work relating to the canal, etc.; all construction work on the Isthmus; operation of Panama R. R. so far as it relates to canal work; the custody of all the supplies and plant of the Isthmian Canal Commission on the Isthmus. He shall act, in absence, for the chairman.

The general counsel shall have charge of all legal matters pertaining to the Isthmian Canal Commission; the administration of civil government within the zone, exercising through a local administrator the authority heretofore vested in the governor of the zone. The chief sanitary officer shall have charge of all matters of sanitation within the zone,

and also in the cities of Panama and Colon, and the harbors, etc., between the U. S. and Panama; the custody of all medical supplies needed for sanitary purposes.

The general purchasing officer shall have charge of the purchase and delivery of all supplies, machinery, and necessary plant.

The general auditor shall have charge of the general bookkeeping, of property accounts, of statistics, of administrative audit of the Isthmian Canal Commission, and of the accounting, bookkeeping, and audit of the government of the zone.

The disbursing officer shall have charge of the timekeeping, of preparation of time rolls and vouchers, and payment of the same.

The manager of labor and quarters shall have charge of the employment of all necessary labor; of record of employees; quarters, assignment of same to employees or contractors; and operation of all Isthmian Canal Commission hotels and mess houses.

Appointments: All officers and employees shall be appointed and their salaries fixed by the respective heads of the departments, subject to the later approval of the Isthmian Canal Commission. Contracts for labor shall be negotiated by the chairman of the Isthmian Canal Commission, where the contract is made in the U. S. Employment of labor upon the Isthmus or outside the U. S. shall be conducted under the supervision of the chief engineer, subject to the approval of the chairman.

Contracts: Amounting to over \$10,000, by public advertising; award to lowest responsible bidder. More than \$1,000 and less than \$10,000, competitive bids by invitation or advertisement whenever practicable.

Reports: Head of departments to report to the Isthmian Canal Commission, as may be required; chairman to report to Sec. of War; Sec. of War to report to President. **P-06,** 151-153.

1907. (See No. 217, p. 236, this Index.)

1914. Effective Apr. 1, 1914, by Executive order and in conformity with Panama Canal act Aug. 24, 1912, "existing" organization abolished and one contemplated by act made effective. Under this there were created department of operation and maintenance, purchasing department, supply department, accounting department, health department, executive office, and Washington office.

Department of operation and maintenance placed in charge of governor, and in administration of affairs of department he is assisted by an engineer of maintenance and a superintendent of canal transportation. To provide for remaining construction work as well as maintenance and operation of canal, department organized with following divisions:

Division of terminal construction, which embraces charge of design, inspection, and construction of dry docks, shops, coaling and fuel-oil plants, floating cranes, docks, and

other terminal facilities; construction transportation by rail; road, street, and sewer work in new town of Balboa; and break-water construction at Atlantic terminal, reporting to governor.

Division of erection; electrical division; division of municipal engineering; division of light-houses (until June 16, 1914, when it was abolished); and office engineer with his forces, placed under engineer of maintenance.

Dredging division, fortification division, mechanical division, and remaining construction work, consisting of sluicing in vicinity of Gold Hill, completion of Naos Island Breakwater, excavation in dry to relieve side pressure in vicinity of Culebra, and grading and filling at locks and dams, combined in general construction division, report directly to governor.

Division of canal transportation, under supervision of superintendent of transportation reporting to governor is charged with safe conduct of vessels through canal. Port captains, board of local inspectors, pilots, and measurers of vessels, and, since June 16, 1914, care and operation of lights and beacons, directly in charge of superintendent of transportation.

Col. H. F. Hodges, U. S. Army, designated as engineer of maintenance; H. H. Rousseau, U. S. Navy, as engineer of terminal construction; and Capt. H. Rodman, U. S. Navy, as superintendent of transportation.

Quartermaster's department and subsistence department, consolidated to constitute supply department, placed in charge of Capt. R. E. Wood as chief quartermaster. Has charge of storing and distribution of all material and supplies for use of Panama Canal and its employees, and for other departments on Isthmus and their employees, and for vessels of U. S. and other vessels when required. Operates commissaries, hotels, and messes; has charge of maintenance of buildings, assignment of quarters, and care of grounds. Recruits and distributes unskilled labor and is in charge of necessary animal transportation.

Accounting department, as organized, consists of auditor's, paymaster's, and collector's offices. Consolidation made for administrative purposes only, to secure economy, auditor having supervision and direction of entire department; heads of subdivisions are independent in their own particular spheres. Department has charge of general bookkeeping, auditing, and accounting for both money and property, examination of pay rolls and vouchers, inspection of time books and of money and property accounts, administrative examination of accounts as required by law, and collection, custody, and disbursement of funds for Panama Canal and zone. Accounting department placed in charge of H. A. A. Smith as auditor for Panama Canal, with J. H. McLean as paymaster and T. L. Clear as collector.

Health department organized under supervision and direction of a chief health officer,

Lt. Col. C. F. Mason, U. S. Army. Department charged with all matters relating to maritime sanitation and quarantine in ports and waters of zone and in harbors of cities of Panama and Colon, and with land sanitation in zone and sanitary matters in terminal cities in conformity with canal treaty between U. S. and the Republic, together with all matters relating to hospitals and charities.

Civil functions of zone placed in charge of executive secretary who, under direction of governor, has supervision of all matters relating to keeping of time of employees, to post offices, customs, taxes and excises, excepting collection thereof, police and prisons, fire protection, land offices, schools, clubs, and law library, custody of files and records, and administration of estates of deceased and insane employees. He conducts all correspondence and communications between authorities of zone and Republic and diplomatic representatives from other countries. C. A. McIlvaine appointed executive secretary.

Scope of work of Washington office remained about the same as previously reported, Maj. F. C. Boggs, U. S. Army, being continued in charge as general purchasing officer and chief of office.

By Executive order May 20, 1914, committee of 6 members created to arrange and provide suitable ceremonies for formal and official opening of Panama Canal, as provided for in section 4 of Panama Canal act. Committee composed of persons who were members of Isthmian Canal Commission and is to be known and referred to as committee for formal and official opening of Panama Canal.

Outlets, Locks.

Study for, Gatun Lock, **P-11**, pls. 94, 95, 96, 97.

Output. (See Dredges.)

Overtime.

Shops, **P-11**, 221; **P-12**, 260; **P-13**, 257; **P-14**, 255.

Oxy-acetylene Plant.

Locomotive department, **P-11**, 236.

P.

Pacific Division. (See Nos. 242, 255, 256, pp. 2367, 2368 of this Index.)

Panoramic view, **P-09**, 134, pl. 68.

Pedro Miguel to Panama Bay, **P-10**, pl. 107.

Pacific Division, Operation. 1905. Canal work delayed by quarantine. Miscellaneous survey work done, etc. **P-05**, 13.

1906-1909. (See Nos. 125, 219, 220, 221, pp. 2364, 2366 of this Index.)

1909. Duties: Construction of locks and dam at Pedro Miguel, at Miraflores; Ancon quarry work; sand supply at Chame; dredging and excavating channel between the locks and below Miraflores Locks to deep water in the Pacific; and such municipal, building construction, and sanitary work as required by the district. District takes in the former La Boca dredging, and Pacific Locks and dams divisions.

In charge: S. B. Williamson, as division engineer. **P-09**, 15.

Pedro Miguel; foundations of locks: Durable rock of ample strength; no underlying water-bearing strata. Rock of such quality that portion will be left in place under the central culvert to form part of the separating wall between the lock chambers; this core will be faced with concrete.

Culverts: Later culverts will be built in trenches; lock floors connecting them will be 1' thick.

Excavation, locks: Continued during the year; total amount removed, 715,726 c. y. (167,061 c. y. used to construct rock toes of the dam).

Results of work to date: Completion of west lock chamber to grade; and of east lock chamber, excepting about 45,000 c. y. to be removed.

West dam: To be of earth, connecting the lock with the hill to the northwest; about 1,400' long; reference of top at 105; top width 50', and side slopes approximately 8 to 1. Maximum pressure that from head of 40'. Two rock piles are formed of spoil from lock excavation; puddled clay between. Maximum thickness at bottom of this clay core, 140'. Material underlying dam impervious generally.

Approach piers: Character undetermined.

East lock wall: To be turned toward hill on east and connected thereto, by concrete core wall resting on rock 550' long, 4' thick on top, and 10' thick at bottom.

Drainage: Dike made across south end of lock site to keep out tide water; pumping plant installed to take care of seepage, etc. **P-09**, 15, 16.

Miraflores; lock site excavation: Continued by steam shovels in the upper locks and by a suction dredge. Total removed, 1,147,527 c. y. (about half the total estimated quantity). Of this amount, 307,060 c. y. placed in toes of

the dam, and 239,400 c. y. for fills for construction purposes.

Plans for dams: Adopted and approved during the year. West dam to extend from head of the lock to Cocoli Hill; will dam the Cocoli River (discharge of which will be thrown into Lake Miraflores). Dam to be built of 2 rock piles, as at Pedro Miguel. Will rest upon impervious material; cored to lock walls and Cocoli Hill with concrete. Length, 2,300'; top width, 40' at reference 70; side slopes approximately 12 to 1. Average head to which dam will be subjected, 30'; maximum, 45'. Plan of east dam approved; details not completed. Of concrete on rock; 500' long; with regulating works as at Gatun; crest at elevation 39. Openings will permit of discharge of 75,000' per second. Approach piers of locks: Under study.

Locks: Of concrete. Quarry for stone opened on west side of Ancon Hill. Crushing plant being installed; capacity, 2,500 c. y. daily. Sand to be procured with suitable plant from Point Chame, 23 miles west of Balboa. Cement shed built on west side of Miraflores Locks, having a capacity of 75,000 barrels. Construction plant for locks under contract. Four berm cranes and four chamber cranes. **P-09, 16, 17.**

Channel excavation, Pedro Miguel to Pacific deep water: 1,279,600 c. y. to be removed (63,600 c. y. rock) between Pedro Miguel and Miraflores; between Miraflores and deep water in Pacific, 13,000,900 c. y. loam and 1,725,000 c. y. rock. Because of tidal oscillations, etc., decided to remove all rock between the locks and for 2 miles below Miraflores, in the dry. Temporary dam to be placed about 2 miles below Miraflores locks to permit dry excavation. This would leave below the temporary dam about 3,600,000 c. y. of loam and 123,000 c. y. rock, to be removed by dredging, etc.

Dredging: Fleet consisted of 1 seagoing suction, one 20" suction and pipe line, one 5-yard dipper, and 4 French ladder dredges. 8,475,931 c. y. dredged from the channel proper, completed for about 5 miles from deep water in the Pacific.

Marine shops: At Balboa, maintained. Repairs made to plant; new equipment erected. **Municipal, sanitary, and building work:** 1,000,000 capacity concrete reservoir built at Ancon Hill to replace smaller tank. Alterations made in Ancon pumping and filtration station. Considerable work done in changing the water main from the Rio Grande Reservoir to permit the excavation of the locks at Pedro Miguel; various pipe connections made.

Roads: Constructed under the direction of the department of civil government from Panama to Corozal, and from Paraiso station to Pedro Miguel.

Buildings: 23 begun in previous year finished; were entirely erected by day labor, and 4 under contract. Repairs, etc.

Sanitary work: Digging and cleaning ditches, laying concrete and tile drains, and filling swamp lands. **P-09, 15-18.**

1910. Work in division consists of construction of locks and dam at Pedro Miguel, locks and dams at Miraflores, Ancon quarry, dredging sand at Chame, excavating channel between locks and below Miraflores Locks to deep water in Pacific, such municipal work as may be required within territorial limits of division, and such sanitary engineering work as may be prescribed by sanitary department within same area. Work in charge of S. B. Williamson, as division engineer.

Pedro Miguel: Work continued excavating lock site and approaches thereto from south. When excavation nearly completed two slides on east side, delaying work and increasing amount to be removed by 75,299 c. y. Total excavation during year, 277,935 c. y. by steam shovels, and 65,513 c. y. by hand, of which 44,948 c. y. classed as preparing foundations.

Subsequent to completion of steam-shovel work preparation of foundations for reception of concrete undertaken by removing loose rock which remained and by excavating 42 trenches, 13' wide, 11' deep, and 137' long for lateral culverts, and an area of 2,500 sq. ft. to 5' below floor level at miter sills. Greater portion of material handled by pick and shovel into buckets or skips, which were unloaded into cars by locomotive cranes or derricks. Small portion handled directly into cars by Thew shovel. In preparation of foundations 64,084 c. y. removed.

Bids invited for lock construction plant Oct. 8, 1908. Largest amount of concrete in division to be laid at Miraflores, and while in the selection of plant economical handling of this material was guiding consideration, another factor was that plant should be capable of being adapted to work at Pedro Miguel. Cantilever cranes adopted, general description given in report for 1908. Contract entered into with Wellman-Seaver-Morgan Co., Cleveland, Ohio, May 8, 1909, for furnishing material and assistance in erection. One arm of berm cranes will transport material from storage piles to mixers on cranes. Product will be passed by boom arms to side walls or to chamber cranes in locks, which will place concrete in center walls. Both berm and chamber cranes will handle forms and steel or cast iron embedded in the concrete.

At Pedro Miguel banks adjacent to lock pit are such as to prevent berm cranes from functioning as at Miraflores, so they are arranged with two cantilever arms, placed in forebay of locks, and used solely for transporting material from stock piles to mixers and for mixing. Chamber cranes place the mixture in both side and center walls, as

well as handle all forms and steel or iron work. Concrete is carried from mixers by narrow-gauge construction locomotives hauling two flat cars, each carrying 2-yard bottom-dump bucket, which is taken by chamber crane and concrete deposited in the walls.

Contract required delivery of one berm and one chamber crane by Aug. 20, and one berm and two chamber cranes by Sept. 20, 1909. Due to causes beyond control of contractor deliveries delayed, and as cement deliveries were based on dates noted, when advised of delays, arrangements made to install mixers for building lower guide or approach wall and for laying concrete in floors in advance of receipt of construction plant. To this end three $\frac{3}{4}$ -yard mixers employed in approach walls, and two 2-yard mixers installed temporarily, one on east and one on west side of lock pit, for laying lateral culverts and floors.

First berm crane delivered Oct. 10, and first chamber crane Oct. 25, 1909, but erection interfered with by excessive rains, so that it was not until Apr. 4, 1910, that one-half of regular plant was installed and began laying concrete in west and center walls. Temporary mixer on west side then dismantled, but one on east side continued in service until close of year. Entire construction plant at Pedro Miguel began operations July 15.

Storage trestles in forebay of locks constructed on both sides of and parallel to canal axis, each having height of 28' and length of 880' available for storage. For this purpose 3,525 linear feet of trestle erected.

Crushed stone and sand delivered by trains made up of 12-yard dump cars; stone dumped on the inside, to minimize average haul to the mixers. Total storage capacity, about 45,000 and 50,000 c. y. of sand and stone, respectively, capable of supplying mixers for 17 working days of 8 hours each.

Necessary tracks for berm cranes required laying of two parallel 5' gauge tracks 50' apart in forebay.

Total of 11,000' of narrow-gauge track constructed from forebay to lock chambers, necessitating construction of 1,400 linear feet of trestles for these tracks, which are laid on incline of $2\frac{1}{2}$ per cent.

Total concrete laid, 166,869 c. y., of which 1,656 c. y. large stone placed in mass. Of this total, permanent plant laid 73,063 c. y. on basis of 8-hour day. Estimated concrete in locks, including approach and wing walls, 858,600 c. y., so there remain 691,732 c. y. to complete.

Steel collapsible forms used for main and lateral culverts, and wooden forms in built-up panels, 15' long and 8' high, are used for construction of walls. Panels are series of uprights, 14' long, held together by walling strips and lagging. Latter placed on upper 6', lower 8' acting as cantilevers on concrete

previously placed. Anchor bolts extend into masonry for 2', and are removed as work progresses, leaving anchor nut embedded. Each panel used at least 12 times.

Filling back of west wall begun about June 1. Material obtained from Ancon quarry site.

West dam at Pedro Miguel consists of two mounds or toes of all classes of waste material, large percentage being rock, with intervening space filled with selected material, forming impervious core. Selected material clay, excavated from canal prism south of locks, and deposited from dump cars in layers about 6' deep, each layer being thoroughly wetted down and compacted. Within the year 51,827 c. y. added to impervious portion and 41,964 c. y. to the toes.

Total of 99,703 c. y. removed below locks at Pedro Miguel. Bulk of this material placed in dam.

Miraflores: Excavation for upper locks of flight at Miraflores practically completed, work of preparing foundations, erecting concrete plant, and placing concrete begun. Total excavated, 234,731 c. y. by steam shovels, and 59,098 c. y. by hand, scrapers, and cranes. Of total excavated, 157,483 c. y. placed in toes of Miraflores west dam and 121,080 c. y. used as back fill.

Twenty-inch suction dredge worked in lower lock site until Dec. 20, 1909. Because of large number of bowlders and character of material, output small and performance of dredge unsatisfactory. As this dredge could be utilized to advantage in Atlantic division, it was transferred, arrangements being made for excavating remainder of material by hydraulic means. Dredge removed 141,759 c. y.

Preparing foundation of upper locks begun as soon as excavation completed sufficiently, and consisted of cleaning up loose material and excavating for lateral culverts and areas above miter sills. Work done by these steam shovel and by hand, total being 39,381 c. y. Excavation by steam shovels, classed as preparing foundations, 24,655 c. y.

Handling plant in these locks will consist of 4 berm cranes, 2 of which in operation in forebay at Pedro Miguel, and 4 chamber cranes, in use at Pedro Miguel. Tower and movable boom of one of berm cranes in place completely erected, and another on west side partly erected. Cantilever arms will be placed on these cranes when berm cranes at Pedro Miguel dismantled and transferred.

On east side of lock storage trestle 3,200' long under construction, and 1,400 linear feet of tracks for berm crane laid and balasted. Two concrete mixers will be installed in storage trestle on east side and will supply concrete to berm crane for placing until mixers can be permanently installed on crane after work at Pedro Miguel permits. On west side berm-crane tracks and erection of trestles for storage in progress; fourth crane being assembled.

On June 1 concreting in upper lock begun on floor and lateral culverts, mixture being furnished by two $\frac{1}{2}$ -yard mixers, as it is desired to complete the floors before permanent plant is transferred from Pedro Miguel. Total concrete laid, 1,630 c. y. Estimated concrete in locks, including approach and wing walls, 1,327,300 c. y.

Reinforced concrete power house at Miraflores finished and in operation. Building 157' 6" long, 76' 6" wide, and eaves 39' above generator-room floor, beneath which is basement. One end of building and portion of turbine-room floor of temporary construction, as depth and width of water turbines to be used have not yet been determined. Equipment similar to that at Gatun, described in last report. Furnishes power for operation of all cranes, for crusher plant at Ancon, and for sand-unloading cranes at Balboa.

West dam, from head of locks to Coccol Hill, consisting of two mounds or toes made up of waster material obtained from lock excavation, mostly rock, and of hydraulic fill between them, continued. 157,483 c. y. placed in toes and 120,910 c. y. impervious material added by dredge.

Stone and sand: Broken stone for concrete furnished by quarry opened on west side of Ancon Hill, as described in last report. Installation of plant continued during early part of year, and practically complete Oct., 1909, when bad slide occurred on face of hill between crushers and storage bins, which delayed operations until material which had been moved could be excavated and some provision made to guard against future slides.

Slide necessitated removal of 40,960 c. y. building large amount of rock-fill cribwork, and replacing conveyor connecting crusher and bins. In opening up quarry, 2,384 c. y. removed in preparing necessary grade, and 194,112 c. y. of stripping. Plant finally installed and operations begun Feb. 10, 1910, and 175,174 c. y. crushed stone secured. Quarry worked 8 hours per day, and during June furnished 32,232 c. y., or 155 c. y. per hour in service and 265 c. y. per actual working time. As large amount of screening required for road surfacing in connection with municipal improvements, small jaw crusher installed, fed directly from storage-bin pocket, which reduces size to $\frac{1}{2}$ " or less; produced from 30 to 40 c. y. of finishing material per day.

Prior to operation of Ancon quarry, stone for concrete obtained from Rio Grande quarry, which furnished broken stone for ballast and highway construction. This quarry operated until Feb. 10 and supplied 58,928 c. y. In addition, 3,750 c. y. obtained from Atlantic division.

Sand for concrete obtained from bay formed by Point Chame, about 20 miles up coast from Balboa. Sand secured by French self-propelling ladder dredge and loaded into barges of 500 c. y. capacity, which are towed

to Balboa, where it is removed from barges to storage bins by means of rapid unloading cranes. Dump cars loaded from bins by gravity and sand transferred to storage trestles at lock sites.

Under contract with Cleveland Crane & Engineering Co., 3 unloading cranes furnished, each having single cantilever 33' long projecting beyond face of dock, operated electrically. Delay, due to defects in machines. Structural weaknesses developed, which required modification. Brakes originally furnished not satisfactory, and air-controlled brakes substituted.

229,250 c. y. sand secured during year, of which 101,748 c. y. sent to Atlantic division for use in concreting.

Hydraulic machinery: Material to be removed in 2-mile stretch of channel below Miraflores Locks amounts to 9,650,000 c. y., of which over 1,500,000 c. y. rock. As time is an important element and it was impossible to assemble sufficiently large plant to complete this section within limit fixed, hydraulic excavating plant selected as being most expeditious method of handling loam overlying the rock, and cheapest.

Plant as designed contemplates washing of material overlying rock to sumps by water jet under high pressure, and dredging pumps elevating and conveying material from sumps through flumes. Consists of central pumping station, pipe lines, hydraulic monitors, and dredging pumps. Central station located on west bank of canal, and in center of area to be excavated. There are mounted 4 Worthington horizontal, direct-acting, triple-expansion pumping engines with 24" stroke, 24 $\frac{1}{2}$ " water cylinders, and 19, 30, and 50" steam cylinders. Each pump provided with surface condenser and direct acting single cylinder 12 by 20 by 24" vacuum pump. Pumps discharge into common delivery pipe equipped with necessary checking gate valves. Steam supplied by 4 Babcock & Wilcox standard water-tube boilers arranged in batteries of two. Oil will be used for fuel, for which purpose 2 steel tanks of 2,000-barrel capacity each erected on hill at rear of station to feed oil burners by gravity. Supply pipe from pumping station 3,600' long, of 2,000' of 40" and 800' of 32" lock-bar pipe, and 800' of 24" spiral riveted pipe. Main is provided with valves and tees suitably located for connecting branch lines leading to monitors. Branch lines 16" spiral riveted pipe laid in groups of 3, so that 2 giants may be continued at work while third is being changed. Monitors are fitted with special deflecting nozzels. Dredging pumps, 3, are 18" single suction centrifugal pumps, direct connected to 655-horsepower induction motor. Pumps, with motors, switchboard, and priming pump, all mounted on reinforced concrete barges specially designed by

division engineer and constructed for the purpose.

Rio Grande River, which originally occupied portion of area to be excavated, diverted and dike constructed across south end to prevent access of tidewater to area. After removal of loam overlying rock by hydraulic process, rock will be excavated by steam shovel in dry.

South of area to be excavated by hydraulic means, necessary depth and width of channel will be secured by ordinary dredging operations. During year there were employed at this work 20" seagoing suction dredge "Culebra," one 5-yard dipper dredge "Cardenas," and four French ladder dredges. Total output of dredges, 6,914,384 c. y., of which 57,161 c. y. classified as plant. Bids invited for delivery of ladder dredge having capacity of 1,200 c. y. per hour in sand and mud, for use in division and subsequently for maintenance work through canal.

Three methods employed in breaking up rock that it may be handled by dredges; rock lies in separate shoals of comparatively small area and volume. First method, by drilling and mining, in which case well drills operate through overlying earth to depth below required grade; holes are sprung, charged, and fired. By this means 274,339 c. y. rock broken up, of which 19,392 c. y. removed by dredges.

Second method, by subaqueous blasting, for which purpose drill barge constructed, consisting of steel hull 112' long by 36' 8" wide provided with timber spuds—one at each corner of the barge. Three drill frames 38' high located along one of gunnels, arranged to move lengthwise of barge on rails. Each frame carries slide to which is attached 5½' rock drill, and each slide operated by hydraulic ram and may be moved vertically through 10'. Drills operated over distance of 85' from one position of barge, and holes spaced 5' apart on 6' centers located by ranges on shore. Barge began Mar., 1910, and blasted over area of 49,600 sq. feet.

Third method, by rock breaking, and Lobnitz rock breaker placed in commission Aug., 1909. It consists of a ram or cutter of steel fitted with hardened steel conical point which is alternately hoisted and dropped. Device mounted on steel hull 100 by 28 by 8'. Tidal range requires three sizes of rams, 30, 40, and 56', weighing approximately 15, 16, and 19½ tons. General practice has been to attack surface of rock shoal which has been exposed by dredging with rock breaker at intervals of 4' each way, points of attack being located by ranges on shore and permanent marks on bay. Average limit of penetration has been 3.12'. After entire area of shoal is gone over, rock breaker is removed and broken rock dredged. Area covered, 266,230 sq. feet, from which 25,515 c. y. dredged.

Balboa shops and shipways operated in construction of some new pieces of plant, including drill barge, erection of dump scows, construction of floating repair shop and crane boat. In addition, dredges, tugs, and barges were kept in good condition.

Municipal and sanitary work: In addition to municipal improvements carried on in Panama under separate appropriation by Congress, principal municipal work was erection of Cocoli pumping and filtration station installed to augment water supply for domestic and construction purposes furnished by Rio Grande Reservoir, consumption from which had increased so as to materially reduce pressure and supply at south end. Necessary pumps, treating and settling tanks, and filters erected at total cost of \$34,324.39.

Reinforced concrete reservoirs of 10,000 and 100,000 gallons capacity constructed for Palo Seco Leper Asylum and Culebra Island quarantine station, respectively.

About 9,000 linear feet road connecting Corozal with Pedro Miguel completed, and portion of road connecting Corozal and Camp Diablo added. Extensive repairs made to Balboa and Sabanas roads.

Sanitary work consisted in cleaning 573,942 linear feet earth drains; construction of new earth drains requiring removal of 2,661 c. y.; filling swamps and holes at various points necessitating handling of 689 c. y., and construction of 9,700 linear feet of cement drains, and 3,338 linear feet of tile drains. **P-10, 21-29.**

1911. Pedro Miguel: Excavation of lock chamber, including slides, completed by removal of 16,423 c. y. In addition, 76,847 c. y. handled in preparing foundations. Greater portion removed with picks and shovels, loading into skips handled by locomotive cranes or derricks; steam shovels, however, used wherever practicable.

Construction plant in its entirety began operations July 15, 1910, and continued as a whole until Jan. 31, 1911, when dismantling plant was begun preparatory to moving it to Miraflores, under contract made for taking down cranes and erecting them at Miraflores. Total concrete laid during year at Pedro Miguel, 498,187 c. y. Of this, 376,657 c. y. laid by construction plant and remainder, 121,530 c. y., supplied by three 2 c.-y. auxiliary mixers and by two ½-yard portable mixers. One of these large mixers located at south end of east wall and other two in forebay; one at south end of east storage trestle and other at south end of west trestle; those in forebay subsequently combined at south end of west trestle to make way for drainage of central division through middle wall culvert. Total concrete laid in Pedro Miguel Locks at close of year, 665,056 c. y., and, as estimated amount

remaining July 1, 1911, was 172,345 c. y., lock 79.42 per cent completed.

Concrete supplied by construction plant mixed on berm cranes and transported by narrow-gauge railroad to chamber cranes which placed it in forms. Chamber cranes laid 401,725 c. y. concrete and 1,430 c. y. large rock during year.

Back filling behind side walls continued intermittently; total placed, 273,709 c. y., including 1,434 c. y. in center wall. Filling completed at north end of west wall to provide yard required by gate contractors.

West dam at Pedro Miguel can not be completed until drainage of central division diverted from site; will be done as soon as concreting in forebay of east lock completed, when water will pass through middle culvert. For this reason, no filling added to dam in past year. Trestle driven in continuation of west toe toward north; operations will be resumed during next dry season.

Miraflores: Excavation by steam shovels in upper lock completed except that removed in preparing foundations, aggregating 137,752 c. y.

Construction plant, two berm cranes partly erected at Miraflores consisting of towers and movable booms; one of east side completed Sept. 2 and placed concrete supplied by auxiliary mixers until erection of cantilever arm taken from berm crane used in forebay of Pedro Miguel began Feb. 15, 1911, when mixers placed in position. This machine finally completed and began operations Mar. 22, 1911. Second one assembled on west side of lock site; fixed cantilever arm in position, wiring completed, and put in commission Apr. 7, 1911. Third under erection on west side, and fourth being dismantled at Pedro Miguel. Before chamber cranes transferred to Miraflores, manner of using cranes changed; two to be reerected in east lock of upper pair with longer arms extending over center wall, and concrete to be supplied by portion of narrow-gauge equipment moved from Pedro Miguel from two auxiliary mixers erected in east wall. By this, two additional mixers added to plant, and chamber cranes can handle concrete to both sides of center wall. Moving of first berm crane begun Apr. 20, 1911, and second May 9; former had been assembled ready for wiring at close of year, latter in course of erection.

Prior to transfer of plant concrete laid by means of auxiliary plant consisting of two 2-yard mixers and four $\frac{1}{2}$ -yard mixers. Former installed in east storage trestle until removed to position on east wall for supplying concrete to chamber cranes. $\frac{1}{2}$ -yard mixers were portable and used for placing concrete in floors, lateral culverts, miter walls, and foundations for main walls. Total concrete placed in Miraflores

Locks during year, 272,933 c. y. The partly completed construction plant placed 67,678 c. y., and remaining 205,255 c. y. supplied by auxiliary plant. Total masonry (concrete and large rock) laid by this division in locks on Pacific side, 771,120 c. y. Storage trestles on both sides of locks completed and 156,571 c. y. crushed stone and 164,980 c. y. sand placed in storage. Various types of forms used, the same as described for Pedro Miguel in last report. Some transferred from Pedro Miguel to Miraflores after service at former place ceased.

East wall of upper lock partly back filled, 53,521 c. y. of material placed. Total concrete to complete Miraflores Locks, 1,424,563 c. y., so that locks at close of year 19.27 per cent completed.

Hydraulic excavating plant began operations in lower lock of Miraflores during latter part of Sept., 1910, and continued until Feb., 1911, by which time practically all overlying material had been removed; steam shovels then resorted to for removing rock. Hydraulic plant removed 332,703 c. y., greater part of which pumped into Miraflores Dam. At close of year steam shovels had excavated 247,700 c. y., material being used in Miraflores Dam and back fill for locks at Pedro Miguel.

Stone and sand: Broken stone for concrete furnished by quarry on west side of Ancon Hill, operated throughout year, with exception of 6 days lost by breakdowns and to replace main shaft on No. 16 crusher. Formation of rock is seamy, and seams filled with clay. To exclude this from product, screen added. Total produced, 855,824 c. y. Quarry operated on 9-hour day basis, except from Dec. 1 to Apr. 4, when 12-hour day in force. Of total crushed, 808,767 c. y. for locks; 35,382 c. y. for work in division other than locks, of which 16,505 c. y. for municipal work and 11,675 c. y. supplied to other divisions and departments. Quarry also furnished 76,411 c. y. large rock for back filling lock walls and other purposes.

Sand obtained from bay formed behind Chame Point, 20 miles west from Balboa. Dredged by ladder dredge into barges of 500 c. y. capacity and towed to Balboa, where transferred by rapid unloading cranes to bins. Total produced, 494,841 c. y. Of this, 465,426 c. y. used by Pacific division, 19,814 c. y. delivered to Atlantic division, and 9,601 c. y. sold to other departments. Sand unloaded from barges to bins by 3 electric cranes, 2 being operated 8 hours per day and 1 in reserve; 494,841 c. y. unloaded during year.

Hydraulic excavating plant began work in Sept., 1910, and deposited 444,145 c. y. of impervious material from prism to form hydraulic fill of west dam at Miraflores. In addition, 295,598 c. y. dry fill, obtained from excavation of locks, added to dam. On May

24, 1911, temporary spillway used for draining water from hydraulic fill gave way, through undercutting of outer toe, and about 96,000 c. y. escaped. Large portion of material moved around into Miraflores Lock pit and seriously interfered with prosecution of work. Dam 83 per cent completed.

Channel between locks and the Pacific Ocean: During last 5 months of fiscal year, 197,880 c. y. excavated in dry by steam shovels between Pedro Miguel and Miraflores Locks. Material used as back fill for Pedro Miguel Locks.

In area between Miraflores Locks and Pacific Ocean, excavation done by hydraulic excavating plant and by dredges. After completing work in lower lock chambers Feb., 1911, dredging units of hydraulic plant moved into sea-level section of canal, where they have since been operated. Numerous large boulders and sunken logs encountered in process of sinking barges on which dredging pumps installed, and existence of rock requiring blasting at higher level than borings indicated prevented barges from settling to grades desired, and in some instances injured bottoms. For this reason barges abandoned and dredging pumps placed at intervals along axis of channel with their suction in sumps extending slightly below final grade. Two pumps installed in this manner and third was still operated from barge. Amount removed from channel by this process outside of lock chamber, 197,677 c. y. Cost greater than anticipated, but since the dredging pumps can handle rock after it is blasted, which was not contemplated, resulting cost is less than combined cost of dredging equivalent amounts of earth and rock. Of amount so removed, 111,421 c. y. placed in dam at Miraflores and 86,253 c. y. used in reclaiming swamps east of canal channel.

Dredges operating in channel during year were 20" seagoing suction dredge "Culebra," one 5-yard dipper dredge, and 3 French ladder dredges. Suction dredge operated over 7.5 miles of canal, measured from sea end, and others between point reached by "Culebra" and area inclosed for operation of hydraulic plant. They removed from channel 5,549,642 c. y. At close of year there remained total of 4,693,211 c. y. to be removed from channel south of Miraflores, including estimate for siltage.

Below point 7 miles from Pacific entrance to canal rock in prism lies in separate shoals of small area and volume, which are removed by subaqueous methods, heretofore described. Rock breaker "Vulcan" operated by two 10-hour shifts until Mar., 1911, after which one shift only used, as shoal had been removed to depth that made it impossible to work economically greater length of time, due to range of tides. Area covered by rock breaker aggregated 648,033 sq. feet, and

material removed after breaking 49,266 c. y. Drill barge operated with two 10-hour shifts per day, and drilled and blasted area of 247,560 sq. feet, from which dredges removed 1,300 c. y.; this removed in May; should not be taken as indication of capacity of drill barge, as all rock broken by its operations during year not taken out on account of lack of available dredges, above-mentioned amount having been removed to determine whether or not sufficient amount of explosives used to properly shatter rock. Work continued until Apr. 4, 1911, with well drills operating through overlying earth by means of pipe casing. Estimated rock broken up by this method, 251,812 c. y.; 251,819 c. y. dredged.

Miscellaneous dredging consisted in excavating channel to lumber dock under construction, 705,465 c. y.; deepening berths in front of sand dock, 17,200 c. y.; Panama R. R. Co.'s commercial and coaling docks, 15,633 c. y.; shipways, 19,400 c. y.; and at hydraulic pumping plant, 18,000 c. y.

All necessary running repairs made to plant and floating equipment by Balboa shops and shipways. Equipment in addition to dredges already enumerated consists of 4 tugs, 7 scows, and 12 barges.

Municipal and sanitary works: In addition to municipal improvements carried on in Panama under separate appropriation by Congress, plant described in last report as installed at Coccol Lake increased by installation of 8" motor-driven centrifugal pump to lift water from lake to mixing tanks, which enables use of both 10" pumps to force filtered water through mains. This addition made necessary because of demands for increased pressure in city of Panama. To permit of excavation of drainage channel from central division to Pedro Miguel Locks and to admit raising Balboa dumps, water mains moved.

Reinforced concrete reservoir at Palo Seco Leper Asylum completed July, 1910, and distributing system constructed. Aside from completing sewer system at Palo Seco, work performed during year consisted in making repairs, extensions, and house connections.

Of main highway practically parallel to canal and extending from Panama to Gorgona 3.14 miles constructed by Pacific division between Pedro Miguel and Corozal.

Sanitary work consisted in cleaning 511,010 linear feet of new earth drains, requiring removal of 3,257 c. y.; filling swamps and holes at various points, necessitating handling of 1,063 c. y.; construction of 6,136 linear feet cement drains; and laying 2,509 linear feet tile drains. P-11, 21-27.

1912. Excavation necessary to prepare for work on terminals, including coaling station, dry dock, and machine shops, placed under this division.

Excavation for Pedro Miguel Locks extended to include 95,156 c. y. removed during last year from French dump east of site, making total excavation done by this division for Pedro Miguel Lock 1,130,236 c. y., exclusive of material removed preparing foundations. In preparing lock foundations, which consisted of removing material below floor level to secure footings for walls, foundations for lateral culverts, sills, and sumps, 38,826 c. y. handled. Large portion removed with picks and shovels and loaded into skips handled by locomotive cranes or derricks into cars. Steam shovels employed wherever practicable.

At beginning of fiscal year construction plant moved to Miraflores, with exception of two chamber cranes. Dismantling of these began Dec. 12 and Feb. 7, respectively. Total concrete laid during year at Pedro Miguel, 182,870 c. y., mixed entirely by auxiliary plant, which consisted of one 2-yard mixer located at south end of east wall until Sept. 25, two 2-yard mixers installed at south end of west storage trestle in forebay, one of which moved on Mar. 15, and an average of 3.16 $\frac{1}{2}$ -yard mixers, moved about as considered most advantageous. Prior to dismantling, chamber cranes handled 28,450 c. y. of concrete supplied by auxiliary plant and were also engaged in setting ironwork and filling the center wall. Remaining 154,420 c. y. handled either by locomotive cranes and derricks or poured into forms from $\frac{1}{2}$ -yard mixers. Yardage for year, 134,193 c. y. plain concrete and 48,677 c. y. reinforced concrete. Revised estimates July 1, 1912, showed increase of 61,761 c. y. in total concrete previously estimated for these locks. Amount placed to June 30, 1912, 847,926 c. y. and estimated amount remaining 51,150 c. y. Back filling behind side walls continued and total of 371,212 c. y. placed, of which 186,518 c. y. back of east wall, 162,757 c. y. back of west wall, and 21,937 c. y. in center wall.

Drainage from central division turned through culvert in center wall at Pedro Miguel Aug. 15, which permitted resumption of building west dam, and 321,589 c. y. added. Dam 87 per cent completed. Excavation for concrete core wall, to connect dam with wing wall of lock, begun and 95 per cent completed; material removed, 3,937 c. y.

At Miraflores excavation of lock pit continued; resulted in removal of 624,747 c. y., exclusive of that for preparing foundations. Of amount excavated, 120,351 c. y. earth and 504,396 c. y. rock. Of this, 364,767 c. y. used for back filling and 259,980 c. y. placed in toes of west dam. Surface of rock on which Miraflores Locks founded dips rapidly at north end of site. Walls originally located with their northern extremities on rock which was only few feet above desired grade. After excavation for locks had been begun, changes in design necessitated extending

walls 98' farther north, thereby not only increasing amount and depth of excavation required to secure suitable foundations, but adding materially to difficulties and cost, in that additional work had to be done in confined space below surface-water level; necessary to remove number of construction tracks located according to original plan. In this work and preparing lower lock foundations 165,145 c. y. removed, of which 26,832 c. y. earth and remainder rock.

On June 30, 1911, there were 2 berm cranes in operation at Miraflores, and the other 2 put in commission July 25 and Oct. 28, respectively. They handled concrete for side walls, forms, and irons, and worked on basis of 8-hour day, except from Dec. 21 to May 11, and from May 15 to June 8, when 2 cranes operated on basis of 12-hour day. The 8 mixers connected with them produced 409,651 c. y. concrete.

Four chamber cranes assembled and began placing concrete, handling forms, and steel July 13, Aug. 3, Feb. 15, and Mar. 26, respectively. Cranes handled 234,520 c. y. concrete and 7,342 c. y. filling for center wall. Operated on basis of 8-hour day, with some exceptions.

Two auxiliary 2-yard mixers installed in east wall of upper locks supplied concrete until June 15, 1912, and from May 8 two 2-yard mixers installed on east wall of lower locks operated, making average of 2.09 mixers of this size for year; produced 253,450 c. y. concrete.

In addition to regular plant, average of 4.24 $\frac{1}{2}$ -yard portable mixers used, mainly constructing walls of forebay and upper reinforced-concrete approach pier.

Total concrete placed in Miraflores Locks, 751,540 c. y., made up of 729,096 c. y. plain and 22,444 c. y. reinforced concrete. Construction and auxiliary plants placed 401,079 c. y. and 350,461 c. y., respectively. Total masonry laid in locks on Pacific side, 934,410 c. y. and 174 c. y. in wing walls.

Total concrete laid in Pacific division locks to July 1, 1912, aggregated 1,874,029 c. y. There remained to complete locks 51,150 c. y. at Pedro Miguel, as already noted, and 386,729 c. y. at Miraflores; in addition, there will be required to complete cut-off walls at Pedro Miguel 3,000 c. y. and dam at Miraflores 75,000 c. y.

Back filling lock walls continued with material from locks and prism below locks, and 450,686 c. y. placed, of which 315,487 c. y. placed back of east wall, 127,287 c. y. back of west wall, and 7,912 c. y. in center wall.

Crushed stone for concrete in Pacific Locks obtained from Ancon quarry which, with crusher plant, operated throughout year. For most part, operation was on basis of 9-hour day, but for few months was necessary to put on night shift for week or two at a time. Total produced by plant, 839,279 c. y. Of total crushed, 782,818 c. y. placed in stor-

age piles for use at locks, 31,467 c. y. used in other work under charge of division, 21,642 c. y. sold to other departments and divisions, and 3,352 c. y. used in municipal work.

Sand for lock masonry and other concrete construction obtained from Chame Bay, located about 20 miles west of Balboa. Secured by dredging, thence loaded into barges, towed to Balboa, and transferred to bins by rapid unloading cranes. Of 3 electric cranes 2 operated 8 hours per day and 1 held in reserve. During year 564,837 c. y. unloaded. From bins it is loaded by gravity into cars and transported to storage piles at lock sites or to such other points as may be desired. Total produced during year, 564,837 c. y. Of this, 509,587 c. y. placed in storage piles for use in concrete, 34,394 c. y. delivered to Atlantic division, and 20,856 c. y. delivered to other divisions.

Hydraulic fill in west dam at Miraflores completed Dec. 4, 1911, and contains 625,048 c. y., of which 78,316 c. y. pumped into dam during year. Dry filling continued; 425,125 c. y. placed. Dam 87 per cent completed; remaining work consists in connecting north end of "present" work and lock wall over space occupied by west storage trestle and train tracks.

Excavation of channel by steam shovels between Pedro Miguel and Miraflores and south of latter continued; 864,475 c. y. removed during year, of which 411,987 c. y. earth and remainder rock.

Hydraulic excavation plant in operation throughout year in sea-level section of canal south of Miraflores and excavated 900,596 c. y. Of this, 78,316 c. y. dumped into west dam at Miraflores and 822,280 c. y. deposited in swamps east of prism. Material deposited on adjacent swamps reclaimed 76 acres of tidal swamp land east of prism.

Dredges operating in canal below Miraflores were 20" seagoing suction dredge, "Culebra," 5-yard dipper dredge "Cardenas," 3 French ladder dredges, and, for a period of 3 months at close of year, new ladder dredge "Corozal." Operating in prism dredges worked between stations 2100 and 2236, or for 13,600', lower end of which is 1,855' north of French dock. During year dredges removed 4,683,902 c. y. Of this, 3,884,287 c. y. removed from channel, including about 1,044,203 c. y. in maintaining channel, and 799,615 c. y. outside of prism in vicinity of terminals at Balboa, in maintaining berth at sand dock, and in excavating channel to Flamenco Island. Of latter, 370,607 c. y. removed from area of basin in connection with terminals on Pacific side. Ladder dredges could not dredge economically on account of depth of water at high tide, and rather than tie them up they worked in this area pending action by Congress on recommendations relative to terminals. There remained at close of fiscal year to complete excavation in channel 4,194,059 c. y., including 700,000 c. y. estimated allowance for silting.

South of station 2142 rock that must be removed in order to secure required depth lies in separate shoals of relatively small area and volume, and rock is broken up for dredging by drilling under water with drill scow and breaking below water with Lobnitz rock breaker. Three drills operated on drill barge, on two 10-hour shifts, and covered area of 236,082 sq. feet, through which 153,819 linear feet of holes drilled. Of amount broken up, 160,903 c. y. removed by dredging. By rock-breaker method area covered approximately 563,617 sq. feet and depth of penetration averaged 3.69'. Amount dredged from area thus broken aggregated 77,156 c. y.

Dredge "Corozal" is self-propelling center ladder dredge designed to excavate mud or sand at rate of 1,200 c. y. per hour from depth of 50' and to discharge spoil directly into hoppers of 1,020 c. y. capacity or into barges alongside. Two sets of 39 buckets provided, one set with capacity of 54 cubic feet per bucket for use in soft material and other set with capacity of 34 cubic feet per bucket to be used when digging rock. Dredge delivered by contractors Balboa Mar. 27, 1912. No equipment assembled or erected during year at Balboa shops and shipways. All necessary running repairs made to plant and floating equipment at these shops. Equipment, in addition to dredges already enumerated, consisted of 5 tugs, 6 clapnets, 7 dump scows, and 6 sand and 4 service barges.

In addition to municipal improvements carried on in Panama under separate appropriation made by Congress, municipal improvements consisted in replacing 16" main from Rio Grande Reservoir by 20" main at cost of \$158,562.87. 16" pipe from reservoir to Pedro Miguel Locks left in position, where, together with 20" main, connected to 24" pipe embedded in emergency dam sills. Both mains again connected on east side of locks and double line extended to within 2,490' of Ancon pumping supply. This done not only to insure supply and pressure at south end of system, but to avoid changing large number of temporary connections already made for construction work with 16" line. Second 10" line from Cocoli pumping station to main at Miraflores also added. Cocoli pumping and filtration plant, installed for pumping from Cocoli Reservoir to make up deficiency in Rio Grande supply, increased by addition of two pumps; 3-stage, motor-driven centrifugal, with capacity of 1,500 gallons per minute each against a head of 300', and are direct-connected with 200-horsepower, 3-phase, 25-cycle motors.

Reinforced concrete dock constructed for Panama R. R. by Pacific division and described in last report completed, including back filling. Dredging in front of wharf, aggregating 1,005,983 c. y., not completed, but advanced sufficiently to permit docking vessels for 575'. 45 caissons sunk to rock, greatest depth found

being 64.08' below mean tide and least depth 52' below mean tide. Total cost of dock, \$351,741.39.

Borings made over area to be occupied by dry docks, coaling station, terminal docks, and machine shops, and, based on these, permanent locations selected.

Sanitary work consisted in cleaning 654,531 linear feet of earth drains; excavation of new earth drains, requiring removal of 3,274 c. y. earth; sweeping 627,009 linear feet of cement drains; filling swamps and holes at various points, necessitating handling of 975 c. y. material; laying 270 linear feet of tile drains; constructing 5,164 linear feet of cement drains; and clearing 112½ acres of vegetation. **P-12**, 31-38.

1914. S. B. Williamson, division engineer, concluding that the work of his division had advanced to such a state that the I. C. C., not warranted in continuing his position, tendered his resignation, effective Dec. 11, 1912; reluctantly accepted. This action necessitated a reorganization of work on Pacific side. That relating to terminals, which during the previous year had been assigned to Pacific division, transferred to second division, which had charge of preparing designs for shops, dry docks, and coaling stations. Locks, dams, spillway, dry excavation between and below locks, the quarry, and municipal engineering work organized into fifth division of O. C. E. and placed in charge of H. O. Cole as resident engineer. Dredging and operations for procurement of sand constituted sixth division of O. C. E., under W. G. Comber as resident engineer. **P-13**, 1.

Pacific Side of Canal.

Conditions on, map, **P-13**, pl. 102.

Pacific Slope.

Change of position of locks and dams, **P-08**, 63.
New project, **P-08**, 64.

Paints, Economical.

Formula, **P-09**, 180.

Panama Canal. (See No. 248, p. 2367 of this Index.)

Division of work, natural, **P-07**, 17, 21.

U. S. representative at transfer of Panama Canal properties: Lt. Mark Brooke, Corps of Engineers, U. S. Army, **P-04**, 36.

Transfer: Republic of Panama desired appropriate ceremonies at transfer; action taken to delimit the probable boundaries of the zone. Officials told to proceed with their duties according to laws in force. U. S. officials willing to have ceremonies, but none of any special character conducted. **P-04**, 78.

Panama Canal Act. (See Acts; Laws.)

Panama Canal Act. Approved Aug. 24, 1912.

Act providing for the opening, maintenance, protection, and operation of The Panama Can-

nal, and the sanitation and government of the Canal Zone. **P-12**, 599-605

Zone to extend 5 miles on each side of center line of canal, from 3 mile limit in Caribbean to 3-mile limit in Pacific, excluding cities of Colon and Panama and their adjacent harbors within the zone, but including certain islands, and any necessary lands and waters necessary from time to time. Sec. 1.

Existing laws, orders, regulations, etc., ratified. Sec. 2.

Claims and titles of occupants of land wanted for U. S. purposes to be extinguished. Sec. 3. Providing for discontinuance of I. C. C., and for government, etc., through a governor, and such other persons as the President may deem competent. Sec. 4.

Governor to be appointed for 4 years by the President and Senate and until his successor shall be appointed and qualified. Salary, \$10,000 a year. Sec. 4.

The Panama Canal, upon completion, to be officially and formally opened. Sec. 4.

Commission of Arts to report to the President recommendation regarding artistic character of the structures of the canal, the report to be transmitted to Congress. Sec. 4.

The President authorized to prescribe or change tolls. Changes to be after 6 months' notice. Sec. 5.

No tolls to be levied upon vessels engaged in the coastwise trade of the U. S. Sec. 5.

Tolls may be based upon gross or net registered tonnage, displacement tonnage, or otherwise; there may be one form of tonnage for warships and another for other ships. Sec. 5.

When based upon net registered tonnage tolls shall not exceed \$1.25 per ton. Modifications relating to U. S. ships, treaty with Panama, etc. Sec. 5.

Toll for each passenger shall not be more than \$1.50. Sec. 5.

The President authorized to amend regulations governing operation of the canal, etc. Sec. 5. Regulations to provide for prompt adjustment of claims, etc., relating to passage of commerce. Sec. 5.

The President to provide a method for the determination and adjustment of all personal-injury claims of employees, etc. Sec. 5.

Wireless installations authorized. Sec. 6.

The President authorized to establish, maintain, and operate dry docks, repair shops, yards, docks, wharves, warehouses, etc., for U. S. craft and, incidentally, passing craft at reasonable prices. Money thus obtained to be expended or reinvested, but monthly reports of receipts and expenditures required. Annual report to be made to Congress. Sec. 6.

Civil government of the zone shall be under official control and jurisdiction of the Governor of the Panama Canal. Sec. 7.

The President to determine what towns shall exist in the zone. Provision for courts, etc. Magistrates, etc., to be appointed by the governor for 4 years, etc. Rules governing courts, etc., to be established by order of the Presi-

dent. Notaries to be appointed by the governor. Sec. 7.

One district court with two divisions to be established in the zone. Rules of practice to be prescribed or amended by the President. Scope of the authority of the court. There shall be a district attorney and a marshal. The judge, attorney, and marshal to be appointed by the President, in conjunction with the Senate, for 4 years. Sec. 8.

New courts shall take over and carry forward pending proceedings at time of formation of the new court with its divisions. Sec. 9.

All existing laws in the zone governing practice and procedure shall be applicable and adapted to new courts. Sec. 9.

The Circuit Court of Appeals of the Fifth Circuit of the U. S. to have jurisdiction, etc., over zone court, final appeal or review to be to the Supreme Court of the U. S. Sec. 9.

The governor to make rules and regulations governing trespass, injury of works, etc. Penalties. Sec. 10.

From July 1, 1914, unlawful for railroad company to conduct, etc., directly or indirectly, common carriage by water through the Panama Canal or elsewhere, etc. Penalty. Sec. 11.

Jurisdiction conferred on Interstate Commerce Commission to determine questions of fact concerning alleged competition of railways through water carriage. Order of I. C. C. to be final. Sec. 11.

If I. C. C. of opinion that existing water service controlled by railways other than through the Panama Canal beneficial to the public, extension of it may be arranged. Sec. 11.

No vessel engaged in coastwise or foreign trade of the U. S. shall be permitted to use the Panama Canal, if owned, etc., by monopolies, etc.; provision for determining fact. Sec. 11.

The I. C. C. to have jurisdiction over interstate commerce in certain particulars relating to connection with the Panama Canal. Sec. 11.

Extradition for crime to be governed subject to treaties; otherwise the zone shall be considered and treated as an organized territory of the U. S. Sec. 12.

In time of war or imminent war an officer of the Army designated by the President shall assume and have exclusive authority and jurisdiction over the Panama Canal and zone, and the Governor of the Panama Canal shall be subject to his order, etc. Sec. 13.

The act to be known as the Panama Canal act. Sec. 14. P-12, 599-605.

Repeal, June 15, 1914, of provision that no tolls shall be levied upon vessels engaged in the coastwise trade of the United States, P-14, 557.

Third sentence of third paragraph of the Panama Canal act amended June 15, 1914, to read: "When based upon net registered tonnage for ships of commerce the tolls shall not exceed \$1.25 per net registered ton, nor be less than 75 cents per net registered ton" subject to convention between U. S.

and Panama of Nov. 18, 1903: *Provided*, the passage of "this act" not to be construed, etc., as waiver, etc., of any right U. S. may have under treaty with Great Britain of Feb. 21, 1902, or with Panama, of Feb. 26, 1904, to discriminate in favor of its vessels by exempting the vessels of the United States or its citizens from the payment of tolls for passage through said canal, or as in any way waiving, impairing, or affecting any right of the United States under said treaties, or otherwise, with respect to the sovereignty over or the ownership, control, and management of said canal and the regulation of the conditions or charges of traffic through the same. P-14, 557, 558.

Panama Canal Co. (See Nos. 14, 15, p. 2361 of this Index.)

Panama, City of. (See Nos. 39, 155, pp. 2362, 2364 of this Index.)

Panama R. R. (See Nos. 44, 73, 140, 189, 234, pp. 2362, 2363, 2365, 2366 of this Index.)

Ballast, P-10, 202; P-11, 198.

Bond furnished by railroad for furnishing supplies to canal, act relating to, P-11, 581.

Bonds, purchase of, P-11, 563.

Borrow pits, P-11, 193.

Brazos bottom, P-10, 204, pl. 55; P-12, 292, pl. 63.

Bridge, Monte Lirio, P-13, 269.

Bridge, relocating, P-11, 194.

Caimito section, P-09, 139.

Colon to Bas Obispo, P-09, 142, pl. 69; P-10, pl. 120.

Completed line, P-11, 198; P-12, 283.

Concrete piers for Bascule bridge over Gatun River, P-11, 200, pl. 67.

Consolidation with the Isthmian Canal Commission, P-11, 501.

Construction, P-08, 207; P-09, 135.

Court cases, P-13, 520, 523.

Crossings, P-09, 138; P-10, 198.

Culvert, arch, reinforced concrete, Frijolito River, P-10, 204.

Culvert, Cardenas River, P-10, pl. 123.

Culvert, concrete box, Agua Salud River, P-10, 204, pl. 60.

Culvert, permanent, P-10, 200.

Culvert, Quebrada Anocha, P-10, pl. 122.

Directors, list of, P-04, 65.

Docks, Balboa, initial work, P-11, 192, pls. 61, 62.

Embankments, across Gatun River, P-10, 204, pl. 58.

Embankments, Gold Hill line, looking up the Pedro Miguel Valley, showing heavy pan car work, P-11, 200, pl. 70.

Embankments, large, Gatun Valley, P-11, 193.

Embankments, method of making, Quebrancha, P-10, pl. 121.

Embankments, typical cross section, Quebrada, P-11, pl. 118.

Embankments, toe widened to prevent settlement, Quebrada Baja, P-11, 200.

Estimates, relocation, **P-09**, 345.

Fill, first deck of, Brazos bottom, **P-11**, 200, pl. 64.

Frijoles to Gamboa Bridge, **P-10**, 200.

Gamboa Bridge to Juan Grande, **P-08**, 209, 213.

Gamboa to Pedro Miguel, **P-12**, 283.

Gatun ridge, **P-09**, 138; **P-10**, 198.

Gatun River, **P-09**, 138.

Gatun, south of, **P-08**, 216, pl. 175.

Gatun to Frijoles, **P-10**, 199.

Gold Hill line, **P-11**, 195, 200, pls. 68, 71;

P-12, 292, pls. 64, 65.

Legal cases, department of law, **P-11**, 495;

P-12, 525; **P-13**, 520, 523; **P-14**, 521.

Loans, estimates, **P-09**, 348.

Mindi to Gamboa, **P-12**, 281.

Mindi to Tiger Hill, **P-08**, 208.

Mount Hope line, **P-10**, 203.

New Gold Hill line, **P-12**, 283.

New town, Monte Lirio, looking north, **P-12**, 292, pl. 66.

Old girder span across Gatun, Mount Lirio, **P-10**, 204, pl. 59.

Paraiso to Corozal, **P-10**, 200.

Pedro Miguel to Corozal, **P-08**, 213.

Purchase of, by U. S., act, **P-11**, 550.

Quebrada Baja, **P-11**, 200, pl. 66.

Quebrancha bottom, **P-10**, 204, pls. 54, 56, 57;

P-11, 200, pl. 63; **P-12**, 292, pl. 62.

Reequipment by U. S., remission of payments to U. S., act, **P-11**, 580.

Relocation, **P-11**, pl. 143.

Relocation, progress photographs, **P-12**, 234.

Station and water station, **P-12**, 284.

Structures, **P-08**, 202.

Trestle, temporary, 40' high, along bank of Pedro Miguel River, Gold Hill line, **P-11**, 200, pl. 69.

Work done, summary of, **P-10**, 202.

Panama Railroad. Operation.

1904. Suggestions of Sec. of War Taft looking to complete control of the railroad by Isthmian Canal Commission No. 2. Directors of the road ordered to end agreement with Pacific Mail S. S. Co. for issuance of exclusive through bills of lading. Agrees with Gen. Davis that it might be better for the railroad to get out of the steamship business by leasing or selling its three steamers. Best course for Isthmian Canal Commission No. 2 to pursue to limit commercial business as a common carrier to the railroad on the Isthmus, and to offer to all American lines at least reasonable rates, with through bills of lading, without discrimination in favor of any line. **P-04**, 13-16.

The French canal company sold to the U. S. 68,887 shares of stock in the Panama R. R. Total shares, 70,000; hence, U. S. acquired 98½ per cent. History of railroad. First concession acquired 1848; in 1849 New York incorporated the company by a special act; road continuously existed under that act, and one amendatory passed in 1855. Road completed in 1855. Road, instead of receiving subsidy for its construction, has

had to pay Colombia \$250,000 annually, and to transport free of charge the troops, chiefs, and officers, and their equipage, ammunition, armament, clothing, etc., and new settlers to the number of 2,000 annually. When turned over to the U. S. road consisted of 47.65 miles of single track, with 26.07 miles of sidings and yards. 24 locomotives, 11 switching engines, over 20 passenger cars, about 1,000 freight cars, etc. Equipment in poor condition. Three steamships owned by the company, with total tonnage of over 8,000; American built, on the Delaware. Description of property and right of way owned by the company. Table showing gross receipts, operating expenses, fixed charges, dividends, etc., 1895-1904. Bond issues. During the year Isthmian Canal Commission purchased 100 additional shares of the company, leaving but 1,013 shares outstanding in hands of private individuals. Offer made publicly to buy the remaining shares at par; considered liberal in view of the past returns on the shares. In view of the large amount of transportation which has been free under its concession, the railroad has had to charge high rates; steps taken to reduce this traffic. In 1903, 4,633 first-class paying passengers were carried and, also, 11,098 passengers and 6,601 troops carried free. New and additional steamers planned. Management of road vested in 13 directors; 7 resigned, and their places filled by members of the Isthmian Canal Commission. **P-04**, 57-65.

1905. Entire stock owned by the U. S. Bonds largely in hands of public. Essentially a part of the canal construction plant. Road neglected by French. New wharves begun, terminal yards, machine shops, etc. Complete rehabilitation under way. Personnel reorganized. Double-tracking at places, paid for by Isthmian Canal Commission No. 3. **P-05**, 18.

Before coming of the Americans no enterprise exhibited. Plant antiquated. Lack of equipment, terminal, and line facilities. Freight tied up for months on the road. 500 flat cars added; 200 of them in commission. Dock facilities increased. Terminal yards improved. Double-tracking in progress. Personnel improved. Methods for reducing cost of handling freight installed. 56-pound rail being replaced with 70-pound rail. Haulage congested through an unlooked-for quarantine placed on shipments by South American ports. Nature of traffic such that low cost of handling freight not in sight. Commissary opened by road for benefit of employees. **P-05**, 121.

1906. Great progress made in enlarging and improving the road; new organization completed; shipping at terminals promptly discharged; Nov. 6, 1906, new schedule of sailing cut off one day from the lay-over at each end of the route; no congestion of freight

since Dec., 1905; across-Isthmus freight rates, etc., settled with steamship lines; reconstruction of old tracks; double-tracking going on and almost finished; probability that sections of the road will require more than 2 tracks. **P-06**, 10.

1907. Surveys for new line, made necessary by canal line, begun latter part of July; completed Nov. Location practically determined in Mar., 1907. Involves excavation of 1,600,000 c. y., and placing of 12,000,000 c. y. in embankments. Work on new location vicinity of Gatun and Mindi begun in May. Diversion tracks opened, to fills for Culebra and Chagres stuff. 30 branches started at various places; trestle built at Gatun and at Pedro Miguel; culverts begun. 36,661 c. y. excavated. 92,180 c. y. hauled and placed in embankments, permitting laying of 6,852 linear feet permanent track. 4 steam shovels, 1 pile driver, and an aggregate of 1,100 laborers. **P-07**, 14, 15.

Rebuilding of old line completed; building of new double-track, save 4 miles from Gatun to Lion Hill, completed. Sidings, storage tracks, and block systems installed. 15 miles of track washed out between Mindi and Bas Obispo, during an unusual flood in Dec., 1906, in Chagres River. 90-pound rails being installed; 70-pound rails too light for traffic. Coal-handling plants, yards, etc., installed. Lay-over time of steamships lengthened by one day to former lay-over; only because of time needed to repair steamship machinery. Equipment increased; 100 Rogers ballast cars, 273 box cars, 10 stock cars, 12 caboose cars; 2 Rogers ballast-sand plows; 9 first-class coaches, 10 second-class coaches, and 4 baggage and mail coaches. **P-07**, 33.

1908. Relocation: Made necessary by overflow of the existing roadbed by water storage for lock canal. Atlantic terminal to Mindi (5 miles), and from Corozal to Panama and La Boca, the old line to be used. Between Mindi and Corozal road will be carried to the east, and at a general elevation of 95, or 100' above the normal surface of the lake.

Progress of relocation: Connecting tracks made last year. Preparatory work continued; work shut down due to lack of funds. Portion on Gatun site moved.

Embankments: A number of valleys north of the Chagres require heavy revetments, material being obtained best from Culebra division. Bridge built across Chagres near Gamboa to make connection.

Tunnel work: Miraflores Tunnel continued; material treacherous; work advanced to permit laying of concrete for lining.

Culverts: Two constructed; one for flow of Pedro Miguel River and the other for the Caimitillo River.

Double-tracking and viaduct work: Isthmian Canal Commission paid for some advantageous work of these classes.

New lines: Changing locks from La Boca to Miraflores saved the construction of a new line from the Cardenas River to La Boca, as well as the erection of new wharves. **P-08**, 20, 21.

1909. New Panama R. R. between Gatun and San Pablo: 20 miles; final location not yet determined; decided to abandon originally selected crossing of the Gatun Valley, to gain unobstructed passage to the anchorage basin; surveys along the Bohio, Agua Salud, and Baldo Espino ridges developed shorter line of much less curvature.

Plans: Entire relocated line to be 46.2 miles long; maximum grade, 1.25 per cent Mindi to Gatun, and 0.45 per cent between Gatun and Panama; maximum curvature, 6°.

Value of road: Opinions differ as to value of road after completion of canal.

Construction: Fill south of Gatun station brought up to grade. Main work has been confined to construction along the ridge bordering the Gatun Valley, grading in the vicinity of Gatun River crossing, opening up and grading the line from the crossing to the connection at Caimito, and building the Miraflores Tunnel and grading in that vicinity. Trestle work and filling; branch tracks built to old line; culverts under construction.

Work prosecuted with a view of having the line advanced for its operation between Gatun and Bas Obispo when the lake level is raised sufficiently to permit the operation of dredges in the lake sections of the central division.

Construction work done by the Panama R. R. under an agreement with the Isthmian Canal Commission.

In charge: R. Budd, chief engineer of the Panama R. R., and Lt. F. Mears, First Cavalry, U. S. Army, as assistant. **P-09**, 18, 19.

1910. Construction of new line for Panama R. R. being done by Panama R. R. Co. under agreement with Isthmian Canal Commission. In charge of R. Budd, chief engineer of Panama R. R., until he resigned, Sept. 21, 1909, since which date Lt. F. Mears, First Cavalry, U. S. Army, has continued in charge.

At beginning of year work in progress upon entire stretch, Gatun to Gamboa, with exception of 8 miles through valley of Gatun River. As canal construction contemplated closing of west diversion and discharging Chagres River through spillway, elevation of which was placed 10' above sea level, work on relocation had to be arranged to give continuous communication at such times as main line of Panama R. R. is flooded. Work therefore pushed to have through route available, and temporary line on 60' level completed Apr. 23. Trestles driven over bottoms of Quebrancha, Brazos, Baja, and Gatun, and while

outside center line, they are so arranged that these fills will form parts of completed embankments. Filling in of these trestles under way; no special difficulty met except across Baja bottom, where material overlying rock very soft and treacherous. In embankment across Gatun River arrangements will be made for bridge of three spans at 95' level to allow for floods; one span will be converted into lift span for navigation of eastern arm of Gatun Lake. Temporary provision made for floods by use of two girders formerly spanning Chagres at Barbacoas.

Trestles along line from Caimito to Gamboa Bridge turned over to central division for filling and used as waste dumps for material from cut; this portion practically complete. When floods necessitate use of relocated line during construction, connection between Gamboa and "present" line of railroad will be at Matachin over construction track of central division laid on the barrier which separates cut from the Chagres.

Permanent culverts of reinforced concrete constructed to take care of various streams crossed by embankments.

In addition to 2,350,000 c. y. dumped by central division along new line, 2,500,000 c. y. excavated and disposed of in embankments, 17,000 c. y. concrete laid, 25,000 linear feet of temporary trestle constructed, and 15,000 linear feet of bridge piling driven..

Completed track for most part ballasted by gravel secured during dry season from gravel pit opened on the Chagres about 1 mile above Gamboa Bridge, and from Gorgona gravel pit operated by maintenance of way department of Panama R. R. In all, about 42,000 c. y. secured, 18,000 c. y. of which placed on line and balance stored.

Present plan contemplates use of 95' berm on east side of Culebra Cut as location of new railroad, and will be finished by central division in connection with excavation.

During early part of year decided to push work on section from Paraiso to Corozal that "present" line of railroad might be turned over to Isthmian Canal Commission for moving spoil trains. Section 4 miles long; consists largely of embankments made from spoil from Culebra. Practically complete, and laid with new 90-pound steel rails. To secure better alignment for high line, part of operated line diverted. Two temporary stations built to replace those of old line abandoned at Pedro Miguel and at Miraflores. P-10, 30, 31.

1911. All grading from Gatun to Gamboa practically completed at beginning of fiscal year, except for 3 miles where line crosses valleys of Quebrancha, Brazos, Baja, and Gatun Rivers. Ground level of Quebrancha bottom at average elevation of 20' above sea level, while soundings indicate rock is from 150' to 180' below this elevation and overlaid with soft, sandy clay, with harder

stratum of clay and pure sand near surface. As height of embankment across bottom averages 71', necessary to spread out base of fill so weight would not disturb upper stratum sufficiently to squeeze out softer material below. First fill carried to elevation 50 and out to 2:1 slope stakes. After this fill made, trestle to elevation 70 driven across it and filling from this level started. Small settlement occurred along trestle with corresponding upheaval beyond slope stakes and additional counterweight added on both sides well beyond stakes, after which raising of center line to permanent grade continued. By June 30, 653,505 c. y. placed.

Across Brazos bottom original elevation 30' above mean tide, necessitating construction of embankment averaging 60' in height. Filling across bottom has given no trouble and 1,112,036 c. y. placed.

Baja bottom has given trouble from time filling began. Elevation of natural ground 25' and depth to rock 60'; overlying material softest kind of clay intermixed with decomposed wood and vegetation. As embankment settled additional weight put along toes and in this way fill gradually raised until at close of year it was about 10' below grade. Average fill over valley, 67', and at close of fiscal year 495,925 c. y. placed in fill.

Gatun River bottom at crossing of railroad line requires fill averaging 62' in height. Permanent bridge to be located at this point and embankment at bridge to be raised to plus 97. Small settlement occurred on south end of Gatun River Valley, which rolled and pushed up natural ground for two or three hundred feet. This well filled over and counterweighted. Total material placed in this fill to close of fiscal year, 932,238 c. y. As but few main line cuts remained to be excavated at close of last fiscal year, greater part of material for fills across these valleys secured from borrow pits.

Reinforced concrete piers for permanent bridge across Gatun River built during dry season. Designed to carry three plate girders which now form north span of Barbacoas Bridge in operated line. Creosoted pile bridge driven to west of these piers, to be available for operation during dismantling of Barbacoas Bridge, and for erection of girders. To give access to upper Gatun Valley, one span of bridge will be of bascule type.

Under original plans for relocation of Panama R. R., operating track to be carried through Culebra Cut on berm at elevation 95. Because of slides along east side of Culebra Cut, and necessity of maintaining through communication when line is flooded, permanent location on berm line through Culebra Cut had to be abandoned, and high line around Gold Hill adopted; will be used until condition of banks through Culebra Cut permit return to original location. Surveys for location of

high line begun July, 1910; construction commenced Jan. 1, 1911. Location necessitates $1\frac{1}{2}$ per cent grade and maximum curvature of 7". Cuts and fills about balance at 1,250,000 c. y. Length of line, $9\frac{1}{2}$ miles from Gamboa to Paraiso. New culverts will require placing of 9,000 c. y. concrete, and new fills will necessitate driving 2 $\frac{1}{2}$ miles of temporary trestle.

During year 896,742 c. y. excavation completed; 7,035 c. y. concrete placed; 11,446 linear feet trestle driven; 53,639 linear feet temporary track laid; and 257 acres of clearing done.

Construction of permanent telegraph and telephone line undertaken, and built of 56-pound steel rails for poles, with 4 cross arms, 10 pins to arm, making 40-wire line. On June 30 line Gatun to Gamboa Bridge 50 per cent completed.

On completed section, near Gatun and south of Monte Lirio, 6 miles of 90-pound steel rails laid, in large part on hardwood ties. Ballasting continued along permanent track, Chagres River gravel being used. Relocated line from Paraiso Junction to Corozal Junction formally turned over to Panama R. R. Co. Sept. 4, 1910.

To complete excavation of central division through Chagres section at Tavernilla and San Pablo during next dry season, necessary to interrupt operation of old line; to this end every effort being made to complete new line Gatun to Gamboa by Jan. 1, 1912. P-11, 31-33.

1912. At beginning of year construction work confined to stretch from Gatun to Gamboa—Gatun Valley section—and consisted in completing embankments across Quebrancha, Brazos, and Baja bottoms, under construction since 1910. Material reported as necessary at beginning of fiscal year for their completion, 850,000 c. y., exceeded and, though practically completed Jan. 1, 1912, two steam shovels at work during following month and a half furnishing material for riprapping slopes. Largest embankment on this section 4,800' long, across Brazos bottom. Rock in this valley from 150 to 200' below surface, which is of fairly good clay, 20 to 30' thick, but between this and rock the material very soft. Embankment, 60.70' high, given side slopes of 1 on 2 with hope that this would spread foundation sufficiently to enable layer of clay to support it without disturbing soft strata. Just before full height reached, however, pressure became too great and soft material moved out, upheaving natural ground beyond toes of slopes. When this occurred base was widened to secure slope of about 1 on 3 before any weight was added to upper level, after which embankment completed to grade. Trouble with settlements encountered in fills over Quebrancha and Baja bottoms, where it was necessary to spread base to secure slope of 1 on 4; these fills

72.70' and 68.70', respectively, above natural surface of ground. In the 3 miles covered by these bottoms, 4,736,072 c. y. placed, or an average of 1,578,690 c. y. per mile, all necessary to secure permanent roadbed above proposed lake level.

Laying remainder of permanent track undertaken Dec., 1911, and completed far as practicable by Feb. 15, 1912. Track of 90-pound open-hearth steel, 100 per cent splice bars, and either creosoted or hardwood crossties fitted with "Economy" tie-plates and screw spikes. Track ballasted with gravel obtained from deposits in Chagres River. This section formally turned over to Panama R. R. Co. Feb. 15, 1912, on which date operation of the road transferred from old to new line. Trains now operate east of canal as far as north end of Culebra Cut, where they switch back across canal on construction dike to old main line, following it north to Gorgona, thence south over old route to Panama. Operation over new roadbed attended with no difficulties, except small slides along slopes. Riprapping submerged embankments continued and weight of rock has sometimes caused sides of fill to slide.

Slides on east side of Culebra Cut, and necessity of maintaining through communication caused construction of high line around Gold Hill and abandonment of original plan of carrying railroad on 95' berm through Culebra Cut. Hoped that eventually high line might be abandoned in favor of 95' berm, but this given up on account of excessive cost of rebuilding berm throughout cut. Gold Hill line joins Gamboa Bridge on north with Pedro Miguel on south, and is $9\frac{1}{2}$ miles long. Summit is near La Pita divide at elevation 271' above mean sea level, and Continental Divide is crossed opposite Culebra at elevation of 241' above mean sea level. This section of road well under construction at beginning of fiscal year, and work progressed to completion in early part of 1912. Some difficulty encountered along Pedro Miguel River on account of slides. Laying of permanent track begun in May and line completed and formally turned over to Panama R. R. Co. May 25, 1912.

Construction of telephone and telegraph line continued and completed June 30, 1912. New frame station building and section house erected at town site of Monte Lirio, on Gatun River, and reinforced concrete water station constructed at Frijoles. Dismantling old bridge at Barbacoas—3 girder spans—undertaken as soon as original Panama R. R. abandoned, Feb. 15, 1912. Bridge transferred to Monte Lirio, to be used for carrying relocated line over Gatun River. The two shore spans set in place at new site and center span to be converted into balanced lift span, so that steamers can have access to upper arm of Gatun Lake.

During year 3,209,021 c. y. grading completed and 123,463 lineal feet permanent track laid;

1,820.2 c. y. concrete were placed in bridge culverts. **P-12**, 45-47.

1913. Work during year consisted of rapping slopes of embankments through Gatun Lake section, building lift span of bascule type in bridge spanning Gatun River at Monte Lirio, and installing automatic signals throughout line.

Material from Culebra Cut utilized during year in strengthening embankments near mileposts 20, 21, and 24, and also embankment in Brazos Valley. Total used, 257,831 c. y.

Bridge across Gatun River at Monte Lirio consists of 3 plate-girder spans formerly used on old line of railroad for crossing Chagres River at Barbacoas. Center span, a 103' plate girder, converted into lift span by addition of lifting trusses, lifting mechanism, and counterweight; will provide channel 80' wide in clear, with depth of 45', thus giving ships access to large area of lake which lies east of railroad. Necessary materials purchased under contract for \$24,390, and bridge erected by forces of Panama R. R. at a cost of \$59,611.20, including combined operator's house, block office, and interlocking cabin.

Automatic signals installed Mindi to Corozal, with exception of about 4 miles between Caimito and Gamboa cabin, where main tracks are not on permanent grade and alignment. Signals placed between Pedro Miguel and Corozal removed when it became necessary to use new line for passage of dirt trains to enable cutting of old line for construction of Miraflores spillway. **P-13**, 48-49.

Panama R. R. Co. (See Nos. 44, 73, 140, 189, 234, pp. 2362, 2363, 2364, 2365, 2367 of this Index.)

Subsidy abolished, **P-11**, 577.

Panama, Republic of. (See Nos. 29, 78, pp. 2362, 2363 of this Index.)

Governor of zone urged fair, impartial, and peaceful election, **P-06**, 19.

Joint commission (U. S. and Panama), **P-07**, 146.

Payments to, **P-11**, 553, 573, 575.

Relations, **P-07**, 146; **P-08**, 255; **P-09**, 257; **P-10**, 364; **P-11**, 414; **P-12**, 456; **P-13**, 461; **P-14**, 419.

Rights granted to U. S., **P-11**, 555, 573, 575.

Panama Route. (See Projects; see Nos. 5, 166, pp. 2361, 2365 of this Index.)

Physical characteristics. General details. **P-06***, 15.

Panama Street Ry., **P-07**, 149.

Panels, Control. (See Valves; Locks.)

Valves, Miraflores Locks, **P-13**, 110, pl. 14.

Panorama.

View of Pacific division, **P-09**, 134, pl. 68.

Pardons.

Executive order, **P-14**, 599.

Parsons, W. B. (See Nos. 26, 164, pp. 2362, 2365 of this Index.)

Pasco, S. (See No. 1, pp. 2361 of this Index.)

Patients. (See Hospitals.)

Outside patients treated in hospitals, and amounts collected for their treatment, **P-12**, 547.

Patterns.

Foundry and pattern shop, **P-11**, 237.

Pattern storage, new shops, Balboa, **P-13**, 254, pl. 57.

Storage, **P-12**, 271.

Paving. (See Nos. 89, 131, p. 2363 of this Index.)

Balboa, **P-14**, 224.

Cities, **P-07**, pls. 47-73.

Colon, **P-07**, 62, 64, pls. 55-60, 62-69; **P-08**, 120, pls. 49, 50, 51, 52; **P-11**, 130.

Cristobal, **P-07**, 64, pls. 73, 74.

Isthmian Canal Commission No. 3 authorized paving of Panama as a sanitary measure, **P-05**, 42.

Panama and Colon, **P-07**, 150.

Preparatory work at Panama, **P-05**, 112.

Slope, Gatun Dam, **P-13**, 138, pl. 28.

Paving, Brick.

Terminals, Balboa, **P-14**, 14, pl. 23.

Pay.

Computation in cases of administration of estates or in case of injury, **P-13**, 622.

Deductions from pay for transportation, **P-08**, 249.

Deductions from pay for supplies, **P-11**, 564.

Pay Car.

View of paying off, Gatun Dam, **P-07**, 58, pl. 46.

Payments. (See Disbursements.)

Annual payments to Republic of Panama, act relating to, **P-11**, 573, 575, 577.

Special, employees, **P-08**, 235.

Pay Rolls, P-04, 71; **P-05**, 76; **P-06**, 118; **P-07**, 214; **P-08**, 324; **P-09**, 230, 253; **P-10**, 337, 361; **P-11**, 385, 411; **P-12**, 407, 453; **P-13**, 411, 457; **P-14**, 332. (See Appropriation: Employees.)

Including those laborers who work but transiently, 25,000 men under direction supervision of Isthmian Canal Commission and Panama R. R. Of the 17,000 continuous employees, 12,612 in department of construction and engineering, 1,129 in division of material and supplies, 2,291 in department of government and sanitation, 137 in the auditing and disbursing offices and 3,700 on gold rolls, all being virtually white Americans. **P-06**, 5.

Peat.

Deposits, zone, **P-13**, 579.

Penitentiary, P-07, pl. 128; **P-11**, 432.

Culebra, **P-07**, 96, pl. 128; **P-08**, 280, pl. 187.

Personnel, P-14, 5. (See Nos. 254, 275, p. 2368 of this Index; see also each annual report, detailed reports, and charts of organization.) Gold force, **P-08**, 252.

Tables of salaries, etc., **P-12**, 565; **P-13**, 583-604; **P-14**, 531-551.

Persons Entering U. S. from Zone.

Status of acts relating to, **P-11**, 558.

Physical Characteristics. (See Canal, Isthmian.)

Physicians.

Quarters for, **P-10**, 434, pl. 68.

Pier, Old French.

Relocation of main tracks to, Pacific terminal, **P-13**, 195.

Piers.

Approach piers, concrete, **P-13**, 14.

Atlantic terminals, **P-13**, 205.

Caisson sinking, Pacific division, **P-11**, 174.

Caissons, concrete, Balboa, **P-13**, 254, pls. 60, 61.

Concrete, laying, **P-13**, 14, 15.

Construction of, Pacific division, **P-11**, 171.

Construction, Pacific terminals, **P-14**, 204, 205.

Floor reinforcement, Balboa terminals, **P-14**, pl. 28.

Foundation, dredging, **P-13**, 14.

Pier No. 1, **P-13**, 198, 219.

Pier and wharf construction, Pacific terminals, **P-14**, 195.

Plant for manufacturing pier shells, Balboa docks, **P-13**, 107.

Plan section, Panama R. R. bridge, **P-08**, 212.

Reinforced concrete piers for bascule bridge, Panama R. R., **P-11**, 200, pl. 67.

Runway piers, coal cranes, Balboa, **P-14**, pl. 27.

Section, Stoney gate valves, **P-09**, 42, pl. 3.

Sinking, Pacific division, **P-11**, 172.

Superstructure, Balboa terminals, **P-14**, 28.

Terminals and wharves, **P-12**, 217.

Piles and Piling. (See Trestles.)

Concrete, costs, **P-11**, 298.

Concrete, of, Gatun Locks, **P-11**, 117.

Dam with and without piling, mechanical analysis of material, Gatun Dam study, **P-08**, 159, 160.

Foundations for, costs, **P-12**, 304.

Gatun Locks, **P-13**, 117.

Number driven, foundations of shops, Pacific terminals, **P-13**, 200.

Number driven, Pacific terminals, **P-14**, 212.

Pilots. (See Order, Executive.)

Pin.

Driving pin for eyebar of top chord of emergency dam, Pedro Miguel, **P-13**, 110, pl. 10.

Pipe and Tin Shop.

Locomotive department, **P-11**, 235.

Pipe Line. (See Oil; see No. 84, p. 2363 of this Index.)

Pipe Lines and Monitors.

Handling plant, Gatun, **P-09**, 61.

Hydraulic excavation, Pacific division, **P-10**, 177.

Pipes.

Tunnel for operating pipes and cables, Balboa shop, **P-13**, 254, pl. 58.

Pipe, Vitrified.

Culverts, Panama R. R., **P-09**, 142, pl. 71.

Piping.

Mechanical division and shops, **P-14**, 172.

Piping laid, Folks River, **P-10**, 131.

Pits.

Chain fenders, locks, **P-13**, pls. 79, 80.

Pits, Borrow.

Panama R. R. relocation work, **P-11**, 193.

Pits, Emergency Dam.

Seepage, Miraflores, **P-14**, 158.

Pits, Gravel.

Zone, **P-13**, 575.

Pits, Machinery.

Locks, Pedro Miguel, **P-11**, 192, pls. 49, 50.

Planes, Joint.

Foundations, Gatun Dam, **P-08**, 196, pl. 85.

Planing Mills. **P-08**, 105; **P-10**, 267; **P-11**, 236; **P-12**, 272. (See Mills.)

Plans. (See Profiles; Projects; see Nos. 180, 182, p. 2365 of this Index.)

Balboa dump, **P-13**, pl. 96.

Balboa terminals, **P-12**, pl. 97.

Building division, **P-07**, 90.

Culebra slides, **P-12**, 170, pls. 40, 84, 87.

Dumps, Juan Grande River, **P-11**, 106.

Gatun Dam, **P-09**, 66, pl. 19; **P-13**, pl. 90.

Gatun Locks, **P-09**, 42, pl. 1; **P-13**, pl. 90.

Gatun spillway, **P-11**, pl. 85.

High service reservoir, Ancon, **P-09**, 134, pl. 59.

Hydraulic excavating plant, Miraflores, **P-10**, pl. 114.

Leaf of mitering lock gate, **P-09**, 42, pl. 8.

Light and fog signals, west breakwater, **P-12**, pl. 76.

Lock construction, Gatun, **P-13**, pl. 89.

Locks, **P-10**, pl. 95.

Miraflores spillway, **P-11**, pl. 87.

Pedro Miguel Locks, **P-09**, 42, pl. 2.

Permanent town sites, central division, **P-13**, pl. 96.

Waterworks, Agua Clara, **P-10**, pl. 101.

Plant. (See No. 70, p. 2363 of this Index.)

References to plant are made under the specific title of a part of the work, as, under Dredging, Excavation, Quarries, Shops, and the like. See also Expenditures, Cost Keeping, Pacific Div., Central Div., and Atlantic Div.

Plants, Botanical.

Propagation, Balboa, **P-14**, 225.

Plates.

A large number of views or photographs are given in each report indexed. These are indexed according to the subject.

Playgrounds, Bureau of. **P-14**, 60, 405. (See Recreation; Civil Administration.)

Plowing.

Plowing off flats, Tabernilla, **P-07**, 48, pl. 32.

Poe Locks. (See Board of Consulting Engineers; Locks; Projects.)

Poles, Lighting.

Hollow poles of cement, **P-13**, 10.

Police. (See Civil Administration; see No. 119, p. 2363 of this Index.)

Department of, **P-07**, 161.

Organization, **P-05**, 107.

1905. Sept. 12, 1905; 3 officers, 176 men, and 6 clerks. Total arrests, 2,373, in a population of 25,000. Convictions, 1,573. No public gambling in the zone. Jails and police stations established. Site for a penitentiary selected. Cooperation of zone police and those of the Republic. Colored police officers admirable in dealing with West Indians, etc. Chief of police marshal of the supreme and circuit courts. Acts also as coroner. **P-05**, 71.

1906. Force had increased to 300 officers and 7 clerks by Sept. 30, 1906. Arrests, an average of about 355 a month in a population of about 22,137. Average getting lower. Violations of sanitary measures most frequent cause of arrest. Three jails completed, 4 under way; others authorized. Convicts used on road systems, etc. **P-06**, 43.

Police Stations, P-11, 432.

Ancon, **P-08**, 280, pl. 193.

Empire, **P-08**, 280, pl. 190.

View of, Empire, **P-05**, 69.

Pontoon, P-14, 191. (See Bridges.)

Pontoon bridge, **P-14**, 18.

Pontoon bridges, Paraiso, **P-14**, pl. 136.

Population of Zone.

And death rates, **P-07**, 189.

Porosity.

Diking material, Gatun Dam studies, **P-08**, 169.

Ports. (See Harbors; Quarantine.)

Laws relating to ports of entry, **P-05**, 198.

Proclamation opening Ancon and Cristobal to world, **P-05**, 63.

Ports, Captains of the, P-14, 261.

Postal Savings System.

Executive order establishing, on Isthmus, **P-12**, 609.

Postal Service. (See Civil Administration; see each annual report; see Nos. 55, 112, pp. 2362, 2363 of this Index.)

Extended. Panama stamps, bought at 40 per cent by U. S., used. Most mail franked, but sales of stamps \$1,775.79, 1905, opposed to 655.54, 1904. **P-05**, 64.

Receipts increasing, with increase in personnel. Money-order system begun June 1, 1906. Mail being handled promptly; system becoming almost self-sustaining. 75 per cent mail franked. **P-06**, 32.

Post Office.

Ancon, **P-08**, 280, pl. 192.

Las Cascadas, **P-08**, 280, pl. 185.

Posts, Snubbing, P-14, 124.

Power. (See Electricity.)

Balboa, **P-14**, 225.

Coal chute, Las Cascadas, **P-07**, 80, pl. 91.

Generating stations established, **P-10**, 57.

Graphic wattmeter curve, Gatun Locks, **P-14**, pl. 86.

Hydroelectric plant, **P-14**, 314.

Locks, **P-11**, 81.

Motors, shops, **P-13**, 207.

Plant, **P-07**, pl. 91.

Plant, costs, **P-11**, 298; **P-12**, 305; **P-13**, 282.

Plant, Gatun Dam and spillway, **P-12**, 132; **P-13**, 130.

Plant, Gatun Locks, **P-11**, 116; **P-12**, 127; **P-13**, 122.

Power house, Miraflores, **P-09**, 97; **P-10**, 171, 196, pl. 47.

Terminal construction, **P-14**, 168.

Transmission or power line, operating locks, **P-12**, 93.

Power and Machinery, Division of Motive.

1907. Embraced the erection and preparation for service of machinery necessary in canal construction, and its maintenance in good repair; the installation and operation of air-compressor plants; work in connection with electrical installation; manufacture and repair work for other divisions.

Employees: 2,479 during year; expenditures, \$6,360,496.56. 63 steam shovels, 284 locomotives, 2,706 dump cars, 18 unloaders, 13 bank spreaders, 33 unloading plows, 3 track shifters, and 7 pile drivers erected and made ready for service. Done mainly at old plants at Cristobal, Gorgona, Empire, and Paraiso. New plants at Empire and Paraiso begun. Some facilities provided at Pedro Miguel, Rio Grande, and Tabernilla. Engine houses built at various points, as well as auxiliary devices. Air-compressor plants located at Empire and Rio Grande, and piping laid to various points. Boiler-inspection service begun. Jurisdiction of mechanical engineer, master car builder, and electrical engineer extended to cover Panama R. R.

Electrical subdivision: Construction of electric lighting plants at Empire and Gorgona. **P-07**, 11, 12.

1908. Duties: Erection, preparation for service, and maintenance in good repair of machinery necessary in canal construction; erection and operation of air-compressor plants; electric installations; manufacture and repair work for other divisions.

Employees: 2,206 men.

Expenditures: \$5,645,622.18.

Shops: Three (Gorgona, Empire, and Paraiso) handle all work except electrical installations; each charged with the maintenance and operation of engine houses, coal chutes, and air-compressor plant in its territory. Gorgona shops to embrace 307,000 sq. feet floor space; Empire shops, 198,000 sq. feet; and Paraiso shops, 41,090 sq. feet.

Gorgona shops: One-third of output manufactured material, including 4,279,237 pounds gray iron castings, 50,000 pounds semisteel castings, and 216,947 pounds brass and bronze castings. **P-08, 14.**

Empire shops: 55 of the 101 shovels in use, 55 given general shop repairs, costing \$145,479.41 for direct material and labor charges. Cost of general shop repairs to steam shovels per cubic yard, \$0.00833. 275,000,000 cubic feet air compressed, at cost of \$0.0344 per 1,000 cubic foot.

Paraiso shops: Light repairs handled.

Equipment erected and made ready: "At the end of the year" there had been erected and made ready for service the following equipment: 101 steam shovels, 300 American and French locomotives, 3,451 American and 659 French cars, 20 cranes, 30 unloaders, 9 track shifters (manufactured on the Isthmus), 18 pile drivers (16 made on the Isthmus), 23 bank or earth spreaders, and 46 unloading plows.

Maintenance and repairs: Including operation of air compressors, cost \$1,951,618.79.

Equipment costs: Including erection, \$2,590,536.94.

Inspections: 77 tests of machinery, etc., including the installation of oil-burning apparatus at various boiler plants. Boiler-inspection service inspected and tested 3,580 boilers. **P-08, 15.**

Electricity: 13,365 16-candlepower lights installed, which would supply all Isthmian Canal Commission settlements. Fire-alarm systems installed. **P-08, 15.**

Power, Motive. (See No. 221, p. 2366 of this Index.)

Department of, report, **P-07, 59-102.**

Department, organization, chart, **P-07, pl. 139.**

Division of, **P-07, 79; P-08, 74.**

Precipitation. (See Meteorology.)

President, The. (See Nos. 31, 64, 164, 217, pp. 2362, 2363, 2365, 3366 of this Index.)

Costs to be reported annually, **P-11, 559.**

Pressure, Water. (See Gates.)

Gatun Dam, **P-08, 151.**

Prices. (See Nos. 3, 214, pp. 2861, 2365 of this Index.)

Materials to be purchased from lowest responsible bidder, act relating to, **P-11, 560.**

Printing Plant, P-07, 105; P-08, 246.

Prism. (See Costs; Dredging; Excavation; Plans; Profiles.)

Cucaracha, **P-14, pls. 129, 130, 131.**

Pedro Miguel to Miraflores, **P-11, 166.**

Prisms of lift, intermediate lock gate study, **P-10, 87.**

Profile and plan, Pedro Miguel to Balboa, **P-09, 134, pl. 51.**

South of Miraflores Locks, showing dipper dredge, **P-11, 192, pl. 60.**

Work hitherto experimental, **P-05, 108.**

Prisoners.

Transportation through zone, **P-07, 149.**

Proceedings. (See Nos. 165, 193, p. 2365 of this Index.)

Profiles. (See Plans; Yardage.)

Axis of Gatun Dam, showing borings, **P-08, 196, pls. 155, 156, 157.**

Borings, Gatun, **P-06*, 7, pls. 11, 12, 13.**

Borings, vicinity of La Boca, **P-06*, 7, pl. 7.**

Canal and yardage estimated, **P-10, pl. 106; P-11, pl. 109; P-12, pl. 88.**

Chagres River, **P-13, pl. 121.**

Chagres Valley, **P-08, 196, pl. 166.**

Culebra division, **P-08, pl. 26.**

Excavation, central division, **P-13, pl. 95.**

Foundations, Gatun Locks, **P-08, 126, pl. 55.**

General plans and profile of locks, **P-10, pl. 95.**

Lock canal, cross section, **P-06*, 7, list of plates.**

Lock canal, 60' summit level, **P-06*, 7, pl. IV.**

Pedro Miguel to Balboa, canal prism, **P-08, 134, pl. 51.**

Ranges, **P-12, pl. 75.**

Sea-level canal, proposed, **P-06*, 7.**

Progress and Costs.

Culebra division, disadvantages of Culebra division in a comparison with U. S. work, **P-08, 42.**

Projects. (See Nos. 2, 3, 5, 6, 8, 14, 15, 17, 18, 170, 171, 172, 173, 183, 185, pp. 2361, 2365 of this Index.) (See Acts; Treaties.)

Lock canal, Jan. 1, 1909, **P-09, 352.**

Pacific slope, **P-08, 64.**

Sixty-foot summit level, Board of Consulting Engineers, **P-06*, 7, pl. IV.**

Projects, summaries of Isthmian Canal

These summaries are arranged under the following heads:

(a) Projects, 1486-1899—Historical surveys, etc.

(b) Projects (Nicaragua v. Panama), 1899-1901.

(c) Projects, Panama route, 1905-1908.

(Embracing consideration of the plans of Isthmian Commission Nos. 1, 2, 3, and of plans proposed by Board of Consulting Engineers of 1906, for lock level or sea level canal.)

(d) Projects, adopted or official project of 1909.

(a) **Projects, 1486-1899.**

1486-87. Portuguese explorations for a route to India. Discovery of the Cape of Good Hope accidentally. **P-99, 18.**

1487-1499. First voyage around Africa to India. Great stimulus of trade by new route, placing Portugal among the foremost nations of Europe. Voyages of Columbus and discovery of America. **P-99, 19.**

1513. Balboa discovers the Pacific.

1515. Balboa transports material for exploration ships across the Isthmus, **P-99, 20.**

1519-20. Magellan discovers Straits of Magellan as an entrance to the Pacific. * * *

- For the first time a continuous voyage had been made around the world. * * * "But this western passage did not reduce the distance nor satisfy the wishes of those who sought a direct way thither (to the far eastern countries) by the discovery of a connecting strait along the coast line of the new continent." * * * "Efforts to discover it (the supposed isthmian strait) were still prosecuted, but they were mainly confined to the isthmian section, from Mexico to Darien, where it had been developed that the two oceans were least widely separated." **P-99, 21.**
- 1516-1523.** Charles V of Spain charged the governors of his American provinces to have the entire coast line thoroughly examined, etc., in search of a passage which would connect the eastern and western shores of the New World and shorten by two-thirds "the route from Cadiz to Cathay." Lake Nicaragua found.
- 1517-1521.** City of Panama founded. Road built across the Isthmus, crossing the Chagres. **P-99, 23.**
- 1519.** Line of posts established across Isthmus, Nombre de Dios being founded as the Atlantic port, old Panama as the Pacific port. **P-99, 22, 23.**
- 1520-1527.** Cortes after conquering Mexico explored adjacent coasts. Constructed vessels on coast near Tehuantepec. Discovered Gulf of California. Course he followed across divide became an important route of communication between Atlantic and Pacific. **P-99, 23, 24.**
- 1529.** Capt. Machuca undertook exploration of Lake Nicaragua and its eastern outlet, and finally reached the Atlantic. At a later period sea vessels passed regularly up and down the San Juan. This commerce maintained as late as 1637. **P-99, 22, 23.**
- 1520-1534.** Royal decree that space between the Chagres and Pacific be examined, with a view to effecting communication between the navigable waters of the river and the ocean. The governor, Pascual Andagoya, reported that such a work was impracticable, and that "no king, however powerful he might be, was capable of forming a junction of the two seas or of furnishing the means of carrying out such an undertaking." Under Philip II of Spain the policy with regard to the isthmian transit changed. Why seek an unobstructed strait? Trade was good enough. Opening a canal would be flying in the face of the Almighty who had thought it wise to make none. Besides, an opening might afford access to enemies of Spain. This policy ruled for two centuries, though the connection between the two oceans was often discussed, and many explorations made. **P-99, 24.**
- 1534.** About this time a route by water for boats and light-draft vessels established from Nombre de Dios along the coast and up the Chagres to Cruces. **P-99, 23.**
- 1597.** Porto Bello made the eastern port of entry instead of Nombre de Dios, latter being so unhealthy as to be termed the "sepulcher of the Spaniards." **P-99, 23.**
- 1585.** Commerce of the Isthmus increased amazingly, and reached its height, 1585, when Panama was called the tollgate between western Europe and eastern Asia. Spain greatly enriched through her establishment of this isthmian route. **P-99, 23.**
- 1695.** Scotch Parliament authorized the formation of a company to trade from Scotland to Africa and the Indies. Known as the Darien Co. In 1698 sent out 1,200 men. Scheme originated with William Paterson. Vessel anchored in Caledonia Bay, yet known by that name. Paterson's plan contemplated establishment of settlements and ports on both oceans. The new colony declared freedom of trade and freedom of conscience in matters of religion. Colonists became discouraged. Climate unhealthy. Only a small remnant returned alive. Several attempts made to revive the colony (Port Escoces). Spain protested that her territory was invaded. Force used; 2,000 lives lost. Project abandoned. **P-99, 25.**
- 1771.** Bronzecannon accidentally discovered, in Mexico, to have been cast in the Philippines, suggested ascertaining if they had not been imported through an isthmian route. Investigation showed they had come in through old Tehuantepec route. Viceroy of Mexico had 2 engineers, Augustin Cramer and Miguel del Corral, survey the Isthmus, hoping to discover water communication. They reported that in one place the mountains formed a group rather than a continuous chain, that a valley existed through which a canal of small dimensions was practicable, connecting two rivers on opposite slopes, which would form a continuous communication across the Isthmus. **P-99, 26.**
- 1774.** Determined effort made to bring Indians under subjection because of their interference with traffic over the various isthmian routes. Military posts were again established on both sides of the Isthmus. Trail cut which was afterwards known as Ariza's Road. But in 1790, posts abandoned. **P-99, 26.**
- 1779-1781.** Under orders of Charles III of Spain, investigation undertaken by Manuel Galisteo to determine practicability of connecting Nicaragua lakes with Pacific. Report discouraging. Lake Nicaragua 134' higher than Pacific, and high mountains between lakes and the ocean. In spite of

this, company formed, but project never commenced. **P-99, 26.**

1780-1786. Galisteo's party was accompanied in a private capacity by British agents; territory claimed in name of Mosquito Indians. Country invaded by British after Spain had declared war against British. Admiral Nelson (then captain) was in charge of naval operations. In his dispatches he spoke of his intention to "possess the Lake of Nicaragua, which for the present may be looked upon as the inland Gibraltar of Spanish America." Invading force was successful, but it was depleted through sickness due to constant rains, fevers, etc. Nelson's life was saved only by careful nursing. Treaty of 1783 terminated the war; Great Britain relinquished whatever territorial rights she claimed in that region, retaining only some rights of woodcutting for dyeing purposes. In 1786 the Spanish sovereignty was again confirmed by the British, but treaties disregarded later after Spanish colonies acquired their independence. (Mosquito tribes, 1894, agreed their territory should become a department of Nicaragua.) **P-99, 27, 28.**

1814-1823. Spanish Cortes, aroused by remarks of Baron Humboldt deploring lamentable lack of knowledge concerning isthmian regions, decreed, 1814, for the construction of a canal through the peninsula for vessels of the largest size, and authorized the formation of a company therefor. No results. Spain's opportunity of making an isthmian passageway terminated 1823, when the last of her central American Provinces seceded. **P-99, 28.**

1819. Republic of Colombia formed from New Granada, Venezuela, and Ecuador. **P-99, 28.**

1823. Guatemala, San Salvador, Honduras, Nicaragua, and Costa Rica established Republic of the United Provinces of Central America, **P-99, 28.**

1824. Mexico had reconnaissance made of Tehuantepec route by Juan de Orbegoso and Tadeo Ortiz. Examination showed the great difficulties of making a navigable canal. Carriage road recommended. (See H. R. 322, 25th Cong., 3d sess.) **P-99, 31.**

1825. Republic of Central America proposes to U. S. cooperation in the building of a canal through Nicaragua. Mr. Clay, then Sec. of State, made favorable response. U. S. representative asked by U. S. for information for guiding the U. S. in the matter. No definite action appears to have been taken. A private concern, headed by A. H. Palmer, New York, had previously made proposals to the Republic looking toward a canal. **P-99, 29.**

1826. President Adams instructed commissioners to a proposed congress of nations at Panama, that subject of canal might be well considered; that the benefits of it ought not to be exclusively appropriated to any one nation, but should be extended to all parts of the globe upon the payment of just compensation or reasonable tolls, **P-99, 29.**

The Republic of Central America, not waiting for action by U. S., accepted terms of Palmer, and made contract. (See Report 145, H. R., 30th Cong., 2d sess., pp. 362-367). Palmer sought to capitalize a company at \$5,000,000; sought English money; was unsuccessful. **P-99, 29, 30.**

Survey of Nicaragua route made by John Bailly, who had been sent out by an English company wanting a concession. Local authorities employed him to make the survey. He favored a route from Greytown to Lake Nicaragua, across the lake to the Lajas, thence to the Pacific. He proposed canal for ships of 1200 tons burthen, depth of 18'. Recognized difficulties of the work. Alternative plan embraced a tunnel. Suggested also route through the Tipitapa and Lake Managua. **P-99, 31.**

1827. J. A. Lloyd explored the Isthmus of Panama under authority of President Bolivar. Recommended new line instead of those in use from Porto Bello and Chagres by Cruces to Panama, beginning at Bay of Limon via Chagres River and Trinidad River. Made no definite recommendation in favor of a canal. **P-99, 32.**

1830. Central American Republic negotiated with Netherlands company for canal. U. S. announced that it would consider itself entitled to all advantages accorded other nations over such a canal through Nicaragua. Project abandoned. **P-99, 30.**

1835. Central America again turned to the U. S. on subject of Isthmian Canal. President Jackson sent Mr. Biddle to examine Nicaragua and Panama routes. In 1837 Senate informed that it was not expedient to take up subject of Isthmian Canal. **P-99, 30.**

1838. Aaron Clark, with citizens, memorialized Congress on the value of an Isthmian Canal, and asked that engineers examine for routes. Interesting and valuable report rendered by C. F. Mercer, 1839 (25th Cong., 3d sess., H. R. No. 322). No notable action. President Van Buren sent John L. Stephens to the Isthmus. Nicaragua route recommended by him; estimate for canal there, \$25,000,000. Times not favorable because of unsettled and revolutionary character of the country. **P-99, 30, 31.**

New Granada, formerly a part of Colombia, in control of the Panama route, granted concession for roads, canals, etc., to French

company; latter made explorations for about 2 years; represented to French Government there was a depression of about 37' above sea vicinity of Panama. French Government sent out Napoleon Garella; latter approved some portions of Lloyd's project; low depression not findable; tunnel proposed, 34 locks with some guard locks; estimate, \$25,000,000 or \$28,000,000, for boats of 1,200 tons, 198½' long, 45½' wide, requiring channel depth of 23' (H. R. 322, 25th Cong, 3d sess.); this report disappointing; no steps taken; concession forfeited. **P-99, 32, 33.**

1846-1848. Extension of Pacific boundaries of the U. S. and discovery of gold in that quarter produced important travel across Isthmus of Panama. U. S. treated with New Granada for right of transit across Isthmus. **P-99, 33, 445.**

1847. New Granada granted to Panama Co. (association of French represented by Mateo Kline) the exclusive privilege of building a railroad between the two oceans, across the Isthmus, for 99 years. Company failed; contract forfeited. **P-99, 37.**

1848-1855. New Granada transferred Kline contract to Aspinwall, Stephens, and Chauncey, who organized the Panama R. R. Co. Road opened to public use 1855, from Aspinwall, or Colon, to Panama, 47½ miles. **P-99, 37.**

1849. U. S. Congress authorized surveys of certain routes for canal and railroads across Isthmus. Importance of canal recognized, but railroads favored meantime. Further surveys recommended. (H. R. 145, 30th Cong. 2d.) **P-99, 33.**

Aspinwall, Stephens, and Chauncey memorialized U. S. Congress for subsidy; only \$250,000 annually to aid in building the road recommended; no action; annual appropriation made for carrying mails across Isthmus. **P-99, 34.**

Treaty with Nicaragua by E. Hise, U. S. chargé d' affaires, for transit routes in favor of U. S.; latter to defend Nicaragua especially against pretensions of British to control of lower waters of San Juan; treaty not ratified by U. S.; Hise succeeded by E. G. Squier; latter negotiated treaty in behalf of American company composed of Cornelius Vanderbilt and others; not ratified. Both treaties, however, subjects of Clayton-Bulwer treaty 1850. **P-99, 34.**

1850. Clayton-Bulwer treaty, July 5, 1850, agreed, among other things, that the two contracting parties (England and U. S.) would support or encourage such persons or companies as might first commence adequately a ship canal through Nicaragua, which terms embraced any contract pending, this latter provision in the interest of

the company Squier had negotiated for. This latter company, the American, Atlantic & Pacific Ship Canal Co., incorporated in Nicaragua. **P-99, 34, 35.**

Col. O. W. Childs, Philadelphia, appointed the chief engineer of the canal project of the A. A. & P. Co., to make a careful instrumental survey from ocean to ocean for a line of location. **P-99, 35, 71.**

1851. The A., A. & P. Ship Canal Co. acquired a separation of its contract; getting a charter for an additional company which would establish a transit route across the Isthmus separate from the canal project. This accessory company maintained a line from Greytown, up the San Juan, across Lake Nicaragua to Virgin Bay, thence by stage coaches 13 miles over a good road to San Juan del Sur. Route much traveled for years, in connection with the influx of settlers to the Pacific coast. **P-99, 34, 35.**

1852. Col. J. J. Abert and Lt. Col. W. Turnbull, U. S. topographical engineers, at the desire of President Fillmore, inspected the Childs report of the surveys made across the Isthmus; reported plan practicable; recommended some changes. Representatives of the British Government were selected by the latter; commended the nature of the information obtained by Col. Childs; recommended channel 20' by 50', and locks of 800'. Nothing further in this connection done by the A., A. & P. Ship Canal Co. **P-99, 36.**

1855. The Panama R. R. was increasing the desire for waterway transit across the Isthmus, the U. S., Great Britain, and France being among the most active in exploring probable routes and in searching out traditional lines of passage. Three lines received major attention: The San Blas, Caledonia Bay, and the Atrato. Exploring parties sometimes aided by the respective Governments. No easy routes found. (Report, Isthmus of Darien, made to Sec. of Navy, by Lt. I. G. Strain, 1854; Sen. Ex. Doc. 1, 33d Cong., 2d sess.; and report, Lt. John T. Sullivan, U. S. Navy, 47th Cong., 2d sess., H. Ex. Doc. 107.) **P-99, 37, 38.**

1856. The President of Nicaragua claims that the project of the A., A. & P. Ship Canal Co. had been abandoned, and decree was issued revoking and annulling contracts made with the company; protest made by the company unavailing. **P-99, 36.**

1858. Nicaragua and Costa Rica united to grant a concession similar to the Squier concession, to Felix Belly, of France, to construct a canal from the mouth of the San Juan, by way of the river and Lake Nicaragua, to the Pacific, to be executed by a company to be formed, the French

Government to have the right to keep two war vessels on Lake Nicaragua. U. S. declared the latter provision obnoxious. Company failed; concession annulled. **P-99, 36.**

1866-67. In response to Senate resolution, Sec. Wells transmitted report of Rear Admiral C. H. Davis (S. Ex. Doc. 62, 39th Cong., 1st sess.), on results of isthmian examinations. Accompanied by general maps of the Isthmus routes. 19 canal and 7 road projects enumerated. Excluded from further consideration the Tehuantepec route and the Honduras as possessing little merit. With reference to 8 routes in Nicaragua, stress was laid on the obstacles connected therewith; suggestion made that easier routes might be found elsewhere. Further examination in detail much needed before it would be reasonable to determine the most practicable route across the Isthmus. Belief expressed that the Isthmus of Darien should be looked to first for a solution of the problem. **P-99, 38.**

1868. Nicaragua and Costa Rica contracted with Michel Chevalier, of France, for the same object as in 1858. Company failed; contract annulled. **P-99, 37, 115, 425.**

1869-1872. President Grant's first message to Congress commended an American canal on American soil. Congress promptly responded by providing for further explorations. In 1872, Congress authorized the appointment of a commission (Interoceanic Canal Commission). Members: Gen. A. A. Humphreys, Chief of Engineers, U. S. Army; C. P. Patterson, Superintendent Coast Survey; Commodore Daniel Ammen, Chief of the Bureau of Navigation, U. S. Navy. Commission studied examinations which had been made, those in progress, and assumed authority over others to be made. In 1870 Capt. R. W. Shufeldt recommended canal line beginning at the head of navigation in the Coatzacoalcas, to dividing ridge at Tarifa, thence to harbors of Salina Cruz, the Pacific terminus. Proposed canal to be 144 miles long, with 140 locks. (S. Ex. Doc. 6, 42d Cong., 2d sess.) **P-99, 39.**

1870-1873. Commander T. O. Selfridge, U. S. Navy, was directed to make a survey of the Isthmus of Darien; large force, assisted by 3 vessels. (H. Misc. Doc. 113, 42d Cong., 3d sess.) **P-99, 40.**

1872. Nicaragua route examined by Commanders Hatfield and Lull, U. S. Navy. A. G. Menocal served as chief civilian engineer. The survey followed the Childs route principally. (S. Ex. Doc. 57, 43d Cong., 1st sess.) **P-99, 39.**

1874. Interoceanic Canal Commission also studied report on Nicaragua route made by

Maj. W. McFarland, Corps of Engineers, U. S. Army, who went over the country; report favorable; rough estimate of 26' canal, \$140,000,000. (S. Ex. Doc. 46, 52d Cong., 2d sess.) **P-99, 39.**

1875. Capt. E. P. Lull and Mr. Menocal made careful instrumental examination of Isthmus of Panama, along the line of the railroad. Reported in favor of line 41.7 miles long, from the Bay of Limon to the Chagres, to the divide, thence to the Bay of Panama. (S. Ex. Doc. 75, 55th Cong., 3d sess.) **P-99, 40.**

1876. The Interoceanic Canal Commission unanimously reported in favor of the Nicaragua route—beginning at Greytown, thence to San Juan River, thence to Lake Nicaragua, through the valleys of the Rio del Medio, and the Rio Grande, to Brito, on the Pacific coast. (S. Ex. Doc. 15, 46th Cong., 1st sess.) **P-99, 40.**

1876-1877. Provisional company organized France for waterways across the Isthmus. Contract made through Lt. L. N. B. Wyse, with Republic of Colombia, giving promoters privilege for 99 years, without any restriction of an important character; general route to be determined by an international congress of engineers and others about 1881. **P-99, 40, 41.**

1879-1881. International Scientific Congress assembled Paris, 1879. Decision reached that the best line for a maritime canal across the Isthmus was from the Gulf of Limon to the Bay of Panama. Concession transferred to the La Compagnie Universelle du Canal Interocéanique de Panama (Panama Canal Co.), organized 1881. In later years this company failed, and went into liquidation. The new Panama Canal Co. undertook its work. **P-99, 41.**

1881. J. B. Eads proposed a ship railway, by way of Tehuantepec. Charter obtained from Mexico. Belief of many that this scheme most practical and more practicable than canal by any route known. **P-99, 41.**

1884. Treaty had been negotiated between U. S. and Nicaragua, authorizing construction of a canal by the former, to be owned by the two contracting parties, **P-99, 41, 359.**

1885. Foregoing treaty withdrawn in the Senate of the U. S. by the President, in the belief that the perpetual alliance it proposed with Nicaragua was against the declared policy of the U. S., **P-99, 41.**

Nicaragua route again surveyed under authority of Sec. of Navy, by A. G. Menocal, who prepared a special plan. (S. Ex. Doc. 99, 49th Cong., 1st sess.) **P-99, 41.**

1887-1889. Nicaragua granted concession to A. G. Menocal and others, authorizing ship canal from Greytown to Brito; like con-

cession secured from Costa Rica. Name of company, "The Maritime Canal Co. of Nicaragua." Incorporated by Congress, Feb., 1889. Failure of construction company; Nicaragua declared contract forfeited; several proposals before Congress for years to aid company. P-99, 41, 42, 389, 431.

1895. Bill pending for several years for a board of engineers to ascertain feasibility, permanence, cost, etc., of canal through Nicaragua, passed and approved Mar. 2. Board composed of Lt. Col. Wm. Ludlow, Corps of Engineers, U. S. Army; Civilian Engineer M. T. Endicott, U. S. Navy; Alfred Noble, civil engineer. Designated as "Nicaragua Canal Board." Reported Nov. 1, 1895. (H. D. 279, 54th, 1st) Reported it was impracticable in the short time allowed to make satisfactory examination; recommended further explorations, etc.; tentative estimate, \$133,000,000. P-99, 42, 82.

1897-1899. Congress authorized continuation of surveys and examinations in Nicaragua, as recommended by Ludlow Board. New board formed—Rear Admiral J. P. Walker, U. S. Navy; Col. P. C. Hains, Corps of Engineers, U. S. Army; Prof. L. M. Haupt, civil engineer. Designation, "Nicaragua Canal Commission." Board reported to the President, May 9, 1899. Route favored practically that of Childs in 1852. Project, however, calls for canal 30' by 150', with locks 665' by 80'. Provision was made also for regulation of lake level, never before adequately dealt with.

At this point in the history of isthmian investigations, the examinations and surveys made under the authority of the U. S. had dispelled all fictions and fanciful views concerning an isthmian waterway passage.

The central American Republics were beginning to realize that the isthmian waterway could be built only through the aid of some powerful nation, instead of by individuals and corporations. There was evidence that these Republics were willing to enter into negotiations toward such an end, provided proper assurances were given that the sovereignties involved would not be disturbed. P-99, 42, 43, 82.

(b) Projects (Nicaragua v. Panama), 1899-1901. (See p. 2549 of this Index.)

The subjects embraced by the above title are as follows:

- Choice to be between Nicaragua and Panama.
- Consideration of the respective rights, privileges, and franchises.
- History of the French Panama companies, including consideration of what they had accomplished.
- Canal dimensions, and unit prices for construction, by either route.
- Panama route. Details, sea level, and lock canals.
- Nicaragua route. Details, lock level canal.
- Conclusions favorable to Nicaragua route after comparing the features of both routes.
- Later conclusions favorable to Panama.

Factors considered by Isthmian Canal Commission No. 1:

"The passages to the Orient around the Cape of Good Hope, through the Strait of Magellan and around Cape Horn, have not satisfied the desire for a direct line of communication eastward or westward. The passage north of the American Continent, discovered (by McClure) in 1851, and that north of Asia, first made in 1879, were valuable only as contributions to geographic knowledge, for they are through arctic regions, where the ice seldom permits a continuous voyage. Lines of transcontinental railroad connecting Atlantic and Pacific ports have facilitated travel and commercial intercourse, but they have not filled the place of a ship canal. The reopening of the ancient communication, mainly upon a new line, between the Mediterranean Sea and the Indian Ocean by the completion of the Suez Canal in 1869 has made the inter-oceanic connection westward of less importance to the people of Europe, but it has had little effect on the American Continent. The demand that the American Isthmus be opened to navigation from sea to sea is each year becoming more imperative. The extension of our territory to include the Hawaiian Islands and afterwards the Philippines has made this connection most desirable for the proper exercise of governmental functions wherever they are to be discharged." P-99, 43.

Probable choice of routes to be made between Nicaragua and Panamá. (See Physical Characteristics; Routes.)

RIGHTS, PRIVILEGES, AND FRANCHISES. (Chap. VIII.) P-99, 115-160.

Contents: Requirements of law as to investigation; proposition before Congress was that U. S. should construct, maintain, and operate a navigable waterway through territory of foreign States; can not be done, "under law of nations," without "their" consent. Sovereignty of U. S. over canal route not requisite. P-99, 115.

Strip or zone 5 miles wide from center thereof on each side recommended; U. S. "should have power to protect the entire line from intrusion by evil-disposed persons, prevent smuggling, regulate the kinds of business that ordinarily require control, and enforce police, sanitary, and other appropriate rules and regulations, as well as contracts relating to the construction and operation of the canal," P-99, 116.

If rights, privileges, and franchises exist, they should be removed. Treaties to be examined. P-99, 116.

Treaties relating to Nicaragua route (see Treaties): Costa Rica also interested. Treaty between U. S. and Nicaragua, 1867. P-99, 116.

Frelinghuysen-Zavala treaty, 1884, P-99, 117.

Two treaties between Nicaragua and Great Britain, 1860, **P-99**, 118.

Between Nicaragua and France, 1859. Other treaties by Nicaragua with other countries. **P-99**, 119.

Relation of Clayton-Bulwer treaty (1850) to Nicaragua; "entered into for the purpose of setting forth and fixing the views and intentions of the two contracting parties (U. S. and England) with reference to any means of communication between the Atlantic and Pacific Oceans, by the way of the River San Juan and either or both of the lakes of Nicaragua and Managua to the Pacific Ocean," **P-99**, 119.

Through Clayton-Bulwer treaty of 1850 Great Britain and the United States declared that neither would ever obtain or maintain for itself any exclusive control over the proposed communication by canal—

That neither would ever erect or maintain any fortifications commanding the same or in the vicinity of, or occupy, fortify, or exercise any dominion over Nicaragua, Costa Rica, or any part of Central America—

That neither would use any alliance or influence that it might possess with any State or Government through whose territory the said canal might pass for the purpose of acquiring for the citizens or subjects of the one any rights or advantages in regard to commerce or navigation through the said canal which should not be offered on the same terms to the citizens or subjects of the other.

In case of war between the contracting parties, it was agreed that the vessels of each country should be exempt from blockade or capture by either of the belligerents while traversing the canal or near either of its ends.

They further agreed to protect the canal when completed and guarantee its neutrality, so that it might be forever open and free and the capital invested in it secure.

They agreed to invite every State to enter into similar stipulations, so that all might share in the honor and advantage of having contributed to a work of such general interest and importance.

The agreement to establish a general principle; agreed that they would, by further treaty stipulations, extend their protection to any other practicable communications across the Isthmus, whether by canal or railway, particularly to the interoceanic communications by the way of Tehuantepec or Panama. **P-99**, 119, 120.

Amendment of Clayton-Bulwer treaty proposed by U. S., 1900, not accepted by Great Britain, **P-99**, 120.

Tabulation of policy with reference to interoceanic canal, **P-99**, 120.

Concession to Nicaragua Canal Association, 1887. (See Treaties.) **P-99**, 120.

Maritime Canal Co. of Nicaragua incorporated, act of Congress (U. S.), Feb. 20, 1889. (See Treaties.) Concession of Maritime Canal Co. forfeited, 1898 and 1899. **P-99**, 121.

Concession to Interoceanic Canal Co., 1898. Company failed to make second payment as guaranteed, due 1900. Concession declared forfeited, 1900. **P-99**, 122.

Various concessions, embracing rights of navigation of Lake Nicaragua and San Juan River by steam, by Nicaragua Mail Steam Navigation & Trading Co., Atlas Steamship Co., Caribbean & Pacific Transit Co., etc., **P-99**, 123, 124.

Boundary between Nicaragua and Costa Rica. Treaty between U. S. and Costa Rica, 1852. Treaty between Costa Rica and Spain, 1850. **P-99**, 124.

Between Costa Rica and Nicaragua, 1869. Other treaties. Policy of Costa Rica, etc., relating to interoceanic canal. **P-99**, 125.

Concession by Costa Rica to Nicaragua Canal Association, 1888. (See Treaties.) **P-99**, 125.

Isthmian Canal Commission No. 1 report "on obligations now in force to prevent an agreement with the U. S. relative to a canal" (via Nicaragua and Costa Rica). Former unwillingness of Nicaragua and Costa Rica to have their territories "occupied by another nationality even for the purpose of promoting the commercial and industrial development of the State" passing. Opinion growing that canal can only be constructed with the large resources "and abundant means of a willing Government." Protocols with Nicaragua and Costa Rica, 1900, expressing willingness that U. S. should make canal. **P-99**, 126, 127.

Treaties relating to Panama route (see Treaties): Treaties with Colombia, or "New Granada," as it was designated prior to 1862. **P-99**, 127. Though waters of the two oceans only 30 miles apart, no action taken by U. S. to secure privileges until 1846. Treaty of 1846 securing transit rights, ratified 1848. In return for the advantages and favors acquired, and in order to secure their tranquil enjoyment, the United States guaranteed to New Granada the perfect neutrality of the Isthmus, so that the free transit from the one to the other sea might not be interrupted during the existence of the treaty; the United States further guaranteed the rights of sovereignty and property which New Granada had and possessed over the said territory. **P-99**, 127.

Treaty of Colombia with France, 1856; with Spain, 1881; various other treaties, **P-99**, 128. Contract with Panama Co. (French) for railroad, 1847. Privileges of French company lapsed, 1848. Grant revived, 1848, in favor of Panama R. R. Co. (American). Road completed, 1855. Rights of Panama R. R. Co. **P-99**, 128, 129.

Contract with Wyse, 1876, for canal. Modification, in behalf of International Inter-

oceanic Canal Association of France. New contract, 1878. Canal route to be determined by international commission of experts. Outline of rights of Colombia and the concession holders, etc. **P-99, 129.**

Expert commission (135 delegates, 11 from U. S.) after session of 2 weeks decided best location was from Gulf of Limon to Bay of Panama; sea-level canal plan. **P-99, 130.**

Panama Canal Co. organized to work on Wyse grant, 1881. Failed, 1888. New agreement, 1890, on behalf of receivers. Contract extended to 1904; again, to 1910. (See Treaties.) **P-99, 130.**

1894 a new company organized, "New Panama Canal Co.," acquiring rights of old company, **P-99, 130, 131.**

"No treaties exist giving U. S. the right to occupy Nicaragua, Costa Rica, or Colombia for canal purposes," **P-99, 131.**

Terms must be arranged by diplomatic negotiations. Concessions from Nicaragua and Costa Rica declared forfeited.

Cost to U. S. of acquiring the privilege of entering and occupying the territory of the States through which the different routes extend, **P-99, 131.**

Nature of title required. Unlimited control by U. S. desirable. Compensation therefore should be definite in amount. Probable bases in determining compensation; Isthmian Canal Commission No. 1 had no power to negotiate. Hise treaty (see Treaties), 1849, with Nicaragua. Contract of Nicaragua, 1849, with American, Atlantic & Pacific Ship Canal Co. **P-99, 132.**

Frelinghuysen-Zavala treaty, 1884 (U. S. and Nicaragua). Contract between Nicaragua and Maritime Canal Co., 1887. Contract between Nicaragua and Interoceanic Canal Co., 1898. (See Treaties.) **P-99, 133.**

Contract between Costa Rica and Maritime Canal Co. Way open for direct negotiations with Nicaragua and Costa Rica. **P-99, 134.**

Way not open for direct negotiations at Panama. Privileges of Panama R. R. Co. continue to 1966; of canal company to 2009. **P-99, 134.**

Both companies prohibited from ceding privileges to foreign Government. These privileges subject to conditions, etc., which would not give U. S. the control, etc., desired. **P-99, 135.**

New arrangements necessary if U. S. shall build canal. "Relinquishment by canal company, with consent of Colombia," of its privileges to U. S. "would leave the way open for treaty negotiations between the two Governments to ascertain whether Colombia will consent to the occupation of its territory by the U. S. for the construction of a canal to be under Government control, management, and ownership, etc." **P-99, 135.**

"The U. S. can obtain from Colombia no concession that does not have the approval of the company, and its concessions do not

permit the company to transfer or attempt to transfer its rights to a foreign Government," **P-99, 136.**

Negotiation with New Panama Canal Co., through President Hutin. Queries propounded by Isthmian Canal Commission No. 1 to company. Delays. Suggestion of company that it reincorporate in New York, and the U. S. become majority stockholder; minority to be New Panama Canal Co., and income to latter protected in opposition to any policy of U. S. to lower tolls. Reference to S. Doc. 188, 56th Cong., 1st sess., pp. 41, 42, relating to sale of its rights. Colombian Government "would give" its consent to company making a sale and transfer "if satisfactory arrangements and conditions could be agreed upon." **P-99, 136, 137.**

Table representing the intrinsic, or real and absolute, value of the work already done and the other property owned by new Panama Canal Co. up to Oct. 4, 1901, on Isthmus, \$109,141,500. In addition, compensation was proposed for the possible profits which might result from operation of canal, ranging from 0.5 franc per ton for a traffic of 7,000,000 tons annually, to 3 francs per ton for traffic of 20,000,000 tons annually. **P-99, 138.**

Company requested a new examination of its schedules; rejected by Isthmian Canal Commission No. 1, as latter felt sufficient examination had been made, and time of final report was approaching rapidly. Isthmian Canal Commission No. 1 named Nov. 5, 1901, as last date for decision of New Panama Canal Co. **P-99, 139.**

Before the time set, President Hutin named price given above, but withdrew claim to compensation on future traffic basis "as an act of conciliation." Correspondence with the company. **P-99, 140-160.**

Documents furnished Isthmian Canal Commission No. 1 by New Panama Canal Co., **P-99, 215.**

HISTORICAL NOTES RELATIVE TO THE UNIVERSAL INTEROCEANIC CANAL CO. (1880-1894) until the organization of the new company. Preliminary remarks: "Now, the real cause of the downfall of the old Panama Co. was the lack of the serious studies which should have preceded its organization."

CHAPTER 1, 1880-1889: Brief sketch of the discoveries, explorations, and plans for maritime canals on the American Isthmus until 1879. **P-99, 197.**

The International Congress of Surveys for an interoceanic canal, 1879, **P-99, 199.**

The first issue of shares, **P-99, 201.**

The International Survey Commission, **P-99, 201.**

The Cuvveux and Hersent contract; success of the second issue of shares, **P-99, 202.**

The superior advisory commission for the work, **P-99, 203.**

Purchase of the shares of the Panama R. R. Co. from the American owners, **P-99**, 204.

The small contracts, 1883-1885. Numerous work yards opened. The highest peaks attacked. Examination by Engineer in Chief of Bridges and Roads Dingler of the entire plan for a sea-level canal. "His report is the only full statement of the question that has been made." Outline of his plan. **P-99**, 204, 205.

The large contracts (1885-1887-1889). Canal work divided into 5 sections. Expert engineers after personal examination did not hesitate to declare that the hopes (engineering plans and methods relating to sea-level canal) entertained by De Lesseps were without foundation. **P-99**, 206.

The temporary canal with locks (1887-88); plan hurriedly made, **P-99**, 207.

Receiver appointed, 1889, **P-99**, 209.

CHAP. II: Receipts to Mar. 8, 1890, 1,329,693,-078.74 francs, and expenditures 1,313,418,-840.28 francs. Cube of excavations done, 50,641,079,861 cubic meters; metallic parts of locks, over 20,000 tons; plant, especially housed plant, in good order, and probably sufficient for completion of work; dwellings for accommodation of 26,000 to 27,000 workmen. The commission (receivers) estimated value of useful work done, and of machinery at 450,000,000 francs. **P-99**, 209, 210, 211.

CHAP. III: The liquidation (1889-1894). Receiver thought new company might be organized. **P-99**, 211.

Receiver's commission of survey reported it was possible to complete canal in 8 years, with a system of locks having a lift of from 8 to 11 meters, united in groups on each slope; that plant was ample; and that 580,000,000 francs needed to complete work. 1890, L. N. B. Wyse gained from Colombia extension of 10 years. New contract signed Apr. 14, 1893, granting extension until Oct. 31, 1894, to organize new company which should have 10 years to complete canal. By-laws of New Panama Canal Co. filed June 26, 1894; capital, 650,000 shares of 100 francs each—50,000 shares to go to Colombia: **P-99**, 212, 213.

DIMENSIONS AND UNIT PRICES: Greater part of world sea commerce carried on by ships of moderate size. In view of increasing draft of ships, 35' of water fixed as minimum. **P-99**, 44.

Width of locks fixed at 84'; length, 740', **P-99**, 44, 45.

Prism of various canals; bottom width of 150' fixed. Side slopes variable; 1 on 3 in soft earth, and 1 on 2 above water; in firm earth, 2 on 3, and 1 on 1 above a berm 10' by 6' under water. In rock, the sides to be vertical from the bottom to a berm 5' above water, with slopes of 4 on 1 in hard rock and 2 on 1 in soft rock above such berm. **P-99**, 45.

Slope of 1 on 1 in Culebra Cut, and retaining walls where required, **P-99**, 45, 46.

Width of channels, 200', 250', 260', 300', 320', 500', 800'. Locks 788' to 793' long from quoin to quoin to give 740' clear. Twin locks and guard gates provided. Intermediate gates proposed, to lock smaller ships. **P-99**, 46.

All locks to have rock foundations; floors to be protected by concrete inverts. Walls of locks to be concrete mainly; climate favorable to concrete. Culvert linings to be protected by 1" iron. Gates of steel, based on actual designs made by U. S. Board of Engineers on Deep Waterways (1900) (from Great Lakes to Atlantic Ocean).

Unit prices: Hard rock, \$1.15 c. y.; soft, 80 cents. Earth removed, 45 cents c. y.; by dredge, 20 cents. Rock removed, under water, \$4.75 c. y. Embankments and back fill; 60 cents c. y. Rock in jetty construction, \$2.50 c. y. Stone pitching, \$2 sq. y. Clearing and grubbing, Nicaragua, \$200 per acre; other routes, \$100 per acre. Concrete, in place, \$8 c. y. Finished granite, \$60 c. y. Culvert lining, brick, \$15 c. y.; metal lining, 0.04 cent pound. Metal in locks and sluices, 0.075 cent pound. Allowance for each lock chamber for operating machinery, \$50,000. Power plant, each group of locks, \$100,000. Timber in locks, \$100 M b. m. Sheet piling, spillways, \$75 M b. m. Bearing piles, spillways, 50 cents linear foot. Pneumatic work, Bohio Dam, \$29.50 c. y. Caisson work, Conchudo Dam, \$20 c. y. Railroad, complete, \$75,000 per mile. 20 per cent additional for contingencies. **P-99**, 47, 48.

PANAMA ROUTE: (See Projects, 1486-1899, above.) Route surveyed, 1875, by Commander E. P. Lull, U. S. Navy. Recommended canal with locks, 26' deep, and bottom width of 60' to 72'. Locks to be 450' long and 65' wide. Summit level fixed at 124' above tide level. 12 locks proposed, on each side. Dam across Chagres River to dam up water supply. Estimate, \$94,511,360. **P-99**, 56.

In 1876, the Société Civile Internationale du Canal Interocéanique sent an expedition under Lt. L. N. B. Wyse, of the French Navy to make surveys. He obtained a concession. In 1879 an international congress of experts (majority French), under auspices of F. de Lesseps, recommended canal at Panama location, at sea level, without locks. The Panama Canal Co. immediately organized. Purchased Wyse concession. Two years devoted to surveys and examinations. Operations on large scale began 1883, for sea-level canal 29.5' deep, and bottom width of 72', involving excavation estimated at 157,000,000 c. y. Line laid about 47 miles long to obtain curvature. Maximum height on center line of Culebra Cut, about 333' above sea. Among various schemes to control floods of Chagres,

dam proposed at Gamboa; decided later to be impracticable; problem never solved (by Panama Canal Co.). Cost estimated by De Lesseps at \$127,600,000 time, 8 years. Works continued on this plan until 1887. Then evident that sea-level canal not completable within estimates. Temporary plan of lock canal adopted; summit level to be supplied from Chagres River with pumps. Company bankrupt, 1889. (See Historical notes relating to Panama Canal Co., above.) Receiver's commission, after study, estimated canal could be completed in 8 years; cost of completion, \$112,500,000 or \$174,600,000. **P-99, 56, 57.**

Legal difficulties, but New Panama Canal Co. formed. Work continued; by 1899 had removed about 5,000,000 c. y. In 1898 a special commission of 14 engineers (European and American) submitted a report (reproduced in S. Doc. 188, 56th Cong., 1st sess., pp. 43-83); reported canal could be built according to the current project. The engineering problems considered solved, but the continuous financial problem made more difficult by the appearance in the field of the U. S. as a probable competitor in the forming of an Isthmian Canal. **P-99, 59.**

Plan of the new company involved 2 levels above the sea level—one an artificial lake to be made with a dam at Bohio, to be reached with 2 locks; and a summit level to be reached with 2 locks from the lake. The summit level to have its bottom 68' above the sea, to be supplied with water by a feeder leading from an artificial reservoir to be made at Alhajuela, in the upper Chagres Valley, the ascent on the Pacific side to be likewise by 4 locks. The canal to have a depth of 29.5' and a bottom width of 98'. General location, the same as that adopted by the old company. Lock chambers, 32'10" x 82' x 738'. Lifts, 26' to 33'. Cost, \$101,850,000, not including administration and finance.

A second plan worked out, apparently preferable, but taking more time. Upper level omitted, the cut through the Continental Divide being deepened until its bottom was 32' above the sea; Lake Bohio made summit level, fed directly by Chagres; one flight of locks on Atlantic side and one lock on Pacific side omitted; feeder from Alhajuela omitted, but dam there retained. Estimate, \$105,500,000. **P-99, 59, 60.**

Old Panama Canal Co. began its work without adequate knowledge of the physical condition at the Isthmus.

Much physical data gathered by the two companies. Made available for uses of Isthmian Canal Commission No. 1. Found essentially correct. **P-99, 60.**

Study of plan for canal by Panama route to be built by U. S. Made on a different basis than would be adopted for a commercial corporation. Time of less vital importance; funds problem much diminished. Canal

should permit passage of craft of largest size for years to come. **P-99, 60, 61.**

A great natural difficulty the control of the Chagres River. Excessive rainfall, and precipitous slopes of the valley give river a torrential character. Rose 23', 1890, in 16 hours. **P-99, 61.**

Sea-level plan rejected by Isthmian Canal Commission No. 1. Excavation required, about 266,228,000 c. y. Cost of plan, \$240,000,000. Time, 20 years. **P-99, 61.**

Canal with locks simplifies problem of flood control, but introduces the problem of supplying the summit level with water. Total amount required to operate canal for a traffic of 10,000,000 tons per annum, 1,063 cubic feet per second. Study of the flood discharge of the Chagres, and for location of impounding dam. Height of spillway fixed at 85' above mean tide; spillway to be a fixed weir 2,000' long. Crest of dam placed at 100', and top of lock walls and gates at 94', to make them entirely safe from severest floods. **P-99, 62, 63.**

Annual flow of the Chagres and the topography of the country favorable to a very large increase in the water supply. Reservoir can be constructed at Alhajuela with a capacity for storing an additional volume 4 times that "now" provided. Overflow disposed of through natural and artificial channels to the Chagres River, thence to sea. **P-99, 62, 63.**

Canal as projected by the Isthmian Canal Commission No. 1 may be described as follows: Beginning at the 6-fathom line in Limon Bay, a channel 500' wide at bottom, with side slopes 1 on 3 excavated, curving gently to the left upon a radius of 6,560', until it reaches a point just inside the jetty of the old Panama Canal Co. Here it changes direction to the right upon a curve of 3,280' radius, then conducted on a straight line for 2,000' to a point 2.39 miles from deep water in the bay. For about a mile this wide channel is inside the shore line, forming a narrow but well protected harbor. Near the apex of the second curve the bottom width is increased to 800' for 800', for a turning basin. Estimate, for this entrance and harbor, \$8,057,707, of which \$1,936,991 for work outside the jetty. Annual cost of maintenance, \$30,000. **P-99, 63 and pls. 21, 22, 23.**

Colon to Bohio: Bottom width 150', side slopes 1 on 3 for 1.86 miles through swamp, reduced to standard used in firm earth, for 12.56 miles to Bohio Locks. Length of level, 14.42 miles. Estimate, \$11,099,939, including \$151,347 for levees to exclude flood waters and \$299,000 for the lower approach, 1,200' long to the lock. **P-99, 63.**

Bohio Locks: Double flight of locks; total lift varying from 82' to 90' at the maximum; 41 to 45 to each lock; normal lift, 85'. Location that of French company. Estimate, \$11,567,275. **P-99, 63 and pl. 24.**

Lake Bohio: Above locks canal enters artificial lake, known as Lake Bohio. Broad, deep water for first 7 miles. Length of channel, 12.68 miles from the locks to the point where the canal leaves the Chagres. Section extends 0.93 mile farther, to where it enters the cut through the divide. Estimate, \$2,952,154, including \$434,400 for the upper approach to the Bohio Locks.

Obispo guard gates: Near entrance to summit will be placed a pair of gates 100' wide, so that if it should become necessary to draw off the water from the summit cut the level of Lake Bohio would not be affected. Estimate, \$295,434. **P-99, 64.**

Culebra Cut: The summit cut, 7.91 miles long from the Obispo gates to the Pedro Miguel Locks. The highest point about 5 miles from the Obispo gates, where the bottom of the canal at the axis is 286' below the natural surface of the ground, this is the famous Culebra Cut. This cut estimated on a basis of a bottom width of 150', with side slopes of 1 on 1 (cut would probably not be finished with this uniform slope, "this furnishes as correct a basis of estimate as can now be arrived at"). Entire cut to be lined with masonry walls. Broad benches on each side to arrest slides and for P. R. R. "Much has been said about the instability of the Culebra Cut; in point of fact, there is a clay in the upper portion of the deep cut which flows readily when saturated, but which will give little trouble if thoroughly drained; probably nine-tenths of the material would naturally be classed as hard clay of stable character; it would weather somewhat, and the surface might require some repairing with concrete in bad places, a practice common in deep cuttings in Europe. This clay disintegrates rapidly in water, and for this reason the canal prism should be confined between masonry walls. With the provision made for broad benches on each side, on which any slight slides would be arrested, it is believed that no trouble will be experienced. * * * It would probably take 8 years to excavate this section of the canal." Estimate of the 6.02 miles of heavy work, \$41,940,480; of the entire 7.91 miles between Obispo gates and the Pedro Miguel Locks, \$44,414,460, including the upper approach. Time, 8 years. Excavation, 43,237,200 c. y. Hugeness suggests thorough organization and tools. "Ample ground for deposit of spoil." Cost estimated at 80 cents c. y.; bad management might make it \$1 c. y.; good management might make it 60 cents c. y. **P-99, 64.**

Pedro Miguel Locks: Similar to Bohio Locks. Aggregate lift, 54' to 62'. Estimate, including an adjacent dam, \$9,081,321. **P-99, 65.**

Pedro Miguel level: From Pedro Miguel Locks to last lock, at Miraflores, 1.33 miles. Estimate, \$1,192,286, including \$388,880 for lock approaches at each end. **P-99, 65, pl. 25.**

Miraflores Lock: Lift varying from 18' to 38' m. l. w. Spillway required. Estimate, lock and spillway, \$5,781,401. **P-99, 65, pl. 25.**

Pacific maritime section: For 4.12 miles beyond the Miraflores Lock canal extends through a low, swampy country, through which the Rio Grande runs. Brings canal to point La Boca, where the Panama R. R. has constructed a large and substantial wharf. Dredged channel 200' wide, with slopes of 1 on 3, will extend from this point 4.41 miles to the 6-fathom line in Panama Bay. Estimate, \$12,427,971, of which \$1,464,513 is for work outside of La Boca. **P-99, 65.**

Bohio Dam: Most important structure on the line. 107 borings made; reached rock. Masonry dam held to be safer than earthen dam. **P-99, 65.**

Width, 20' at top; length, 2,546'. Total height above lowest part of foundation, 228'. Masonry core, 30' thick at and below elevation -30. From that level it tapers to a thickness of 8' at top. Estimate, \$6,369,640. "Before actual construction a better location may be found," and the cost reduced.

Gigante Spillway: Dam of concrete. Crest at elevation 85, terminating in an apron at elevation 65. Estimate, \$1,209,419. **P-99, 66.**

Pena Blanca swamp: Water from spillway will flow across country to this swamp, thence into the Agua Clara swamp by an artificial channel. Estimate, \$2,448,076. **P-99, 67.**

Chagres diversion: In neighborhood of Gatun valley contracts; diversion of Chagres needful. Channel made by the Panama Canal Co. not ample. New one necessary. Estimate, \$1,929,982.

Leaves: Low region above and below Gatun must be protected from overflow. **P-99, 67.**

Gatun diversion: Estimate, \$100,000. **P-99, 67.**

Panama R. R. diversion: Estimate, \$1,267,500. **P-99, 68.**

Total estimate: Including engineering, sanitation, police, etc., \$144,233,358. Total excavation, 94,863,703 c. y., exclusive of excavation for the Bohio Dam and the Gigante Spillway. **P-99, 68.**

Total length, from 36' depth in Atlantic to 36' depth in Pacific, 49.09 miles. Alignment good. Sharpest curve having radius of 6,232', except one at entrance to Colon Harbor, which has a radius of 3,280'. **P-99, 68.**

Alternative line: Shortening distance 1.25 miles. No material saving. Details. **P-99, 253.**

Time of transit: Computed for average ship, one 400' long, 50' beam, and 24.5' draft, 11 hours and 14 minutes. **P-99, 69.**

Advantages of Isthmian Canal Commission No. 1 plan: Simplicity. Control of Chagres. One weir at Bohio instead of two. Reduction of cost.

Value of work done at report of Isthmian Canal Commission No. 1: Considering excavation, plant, etc.—excavation (72,000,000 c. y. excavated by old company, and 5,000,000 by new company), \$27,474,033; Panama R. R. stock at par, \$6,850,000; maps, drawings, etc., \$2,000,000. Total, including 10 per cent for contingencies, \$40,000,000. (No special allowance made for plant though cared for. Probably of small value in American methods of building canal.) **P-99**, 69, 70.

Plates: Locks, Pedro Miguel and Miraflores **P-99**, pl. 25.

Bohio Locks, **P-99**, pl. 24.

Gigante Spillway, **P-99**, pl. 27.

Bohio Dam, **P-99**, pl. 26.

Special studies: Waste weir dimensions and discharges for Lake Bohio, **P-99**, 247.

Lock systems, **P-99**, 179.

Gates, side walls, drawings, middle walls, miter sills, approach walls, culverts and valves, lock floors, time of filling and emptying locks, use of water for lockage of vessels, leakage at locks, single and double locks, **P-99**, 179-196.

NICARAGUA CANAL PROJECT: Childs's projects, 1852. Routes examined by Col. Childs. Water in canal was to be 17' deep and 50' wide on bottom. Dimensions and slopes. Length and cost of canal. Total length of route—western division, 18,588 miles; eastern division, 119,305 miles; summit level, 103.430 miles; across Lake Nicaragua, 56,500 miles (now known to be 70.51 miles). Total cost estimated at \$31,538,319.55, which included 15 per cent for contingencies, and the work was to be completed within 6 years from the time of breaking ground. His reasons for limiting the depth to 17' were that the ratio of increase of the expense of a deeper canal would be very great, and that a canal of the dimensions required for vessels of the largest size would be an injudicious application of means that the company, which had a contract with Nicaragua for a canal big enough to accommodate vessels of all sizes, would scarcely favor or the interests of commerce require. No vessels plying between Atlantic States and eastern coast of Pacific with a draft as great as 17', and that of 261 steam vessels, mostly English, only 15 drew over 17', 21 drew 17', and 225 less than 17' each at the load line. Childs's project submitted by President Fillmore to Corps of Topographical Engineers, U. S. Army; Childs's plan reported practicable, but some modifications to reduce cost suggested. Col. Childs subsequently proposed a project for a canal 12' deep with a smaller prism and smaller locks. **P-99**, 75-77.

Lull's project, 1873: Started out under command of Commander A. F. Crozman, U. S. Navy, who was drowned at landing. Commander Hatfield assumed command; inves-

tigations showed that Col. Childs's survey of the western portion of his line was correct. In Nov. of the same year Commander E. P. Lull, U. S. Navy, had charge of an expedition to continue work of the Hatfield party. Number of routes examined between the lake and the Pacific; one adopted known as the Medio route. Canal depth, 26'; locks to be 75' by 400'; bottom width, 50', 60', and 72'. Waters of the San Juan to be discharged by the Colorado branch. Total estimate, allowing 25 per cent for contingencies, \$65,722,137.

New project submitted, 1885, by a former assistant of Commander Lull, a Mr. A. G. Menocal, civil engineer, U. S. Navy, under the Frelinghuysen-Zavala treaty. Survey had been ordered, to determine advisability of any changes in the route for shortening the canal and diminishing the cost. Radical changes proposed. Instead of following the Medio line, Las Lajas route adopted, the one originally surveyed by Col. Childs, necessitating change of plans for taking care of the waters of the Rio Grande, etc. Dam proposed. Instead of a succession of comparatively low dams, single dam at Ochoa proposed, this dam to create slack water navigation in the river, raising the lake to 110. Ochoa Dam to be of masonry (concrete). Entire surplus water of San Juan to be discharged over crest of the dam. Embankments south of the San Juan, for summit level, not deemed required (later investigations determined them necessary). The divide cut an important feature of this project; almost 3 miles long, nearly all curvature. Elevation between eastern and western flowing waters 280'; impossible to locate canal so as to follow turns of the valley, hence line would cut several spurs. Maximum cutting would have been about 350'. Saving in distance from the Pacific to Atlantic over the Lull route 10.96 miles. Project contemplated depth of 28'; increased in places to 30'. Summit level to be reached by 3 locks on the east side and 4 on the west. Locks, 65' by 650'. Locks 1, 2, 3 on east side had lifts of 26', 27', and 53', respectively. Locks on the west side had lifts of 26.4', 29.7' (for second and third), and 24.2' to 33.18' for a tidal lock. 53' lock to be of rock (cut out of solid rock), the others to be of concrete, etc. Narrow-gauge railroad to be built from Greytown to the dam across the San Juan River, and another between the lake and Brito. Total estimated cost, \$64,036,197. This includes 25 per cent for contingencies, but nothing for surveys, hospitals, shops, management, and other necessary expenses. **P-99**, 79, 80.

In 1889 the Maritime Canal Co. of Nicaragua was granted a congressional charter. Project essentially the same as that of Menocal, 1885, modified in respect to the summit level. This was to be extended on the west side to within 3½ miles of Brito by the construe-

tion of a dam across the Rio Grande at La Flor. Surveys revealed that "continuous" ridges did not exist along the route; necessitating embankments, the construction of which made a somewhat difficult engineering problem, on account of the foundation soils. San Francisco, San Carlos, and other embankments. The Ochoa Dam, originally to be of masonry, modified to be a rock fill backed with earth. Crest of dam fixed at 105' above mean sea level; its width across top 25'. As the water of the San Juan was to be held at 106 in the vicinity of the dam, a constant discharge due to a head of 1' over the dam was expected. "This, however, would not have been the case, for the lake would have fallen to 106 or lower in the dry season and the level at the dam could not have been maintained." Maximum discharge of San Juan at Ochoa might sometimes reach over the dam crest 42,500 cubic feet per second, and the combined discharges with the lake at 111 over the dams, weirs, and through sluices were estimated at a maximum of 147,800 cubic feet per second. P-99, 81.

On the west side of the lake the summit level was to be continued through the west divide and down the valley of the Rio Grande to a point called La Flor, about $3\frac{1}{2}$ miles from the Pacific, where the valley narrowed to about 1,600 feet. At this place the valley was to be closed and the summit level maintained by a large dam. The latter would produce a large, deep basin into which the floods of the Rio Grande, Tola, and other streams would flow. This large pool would render unnecessary the proposed diversion of the upper Rio Grande into Lake Nicaragua, and thus save about \$1,500,000. Locks were to be fixed near western end of dam at La Flor, the combined lift of two being 85'. A third, as a tide lock, was to be located near harbor, lifting from 21' to 29'. Total cost of canal estimated at \$65,000,000, inclusive of 25 per cent for contingencies, but exclusive of interest, commissions, and other charges not coming under the cognizance of engineers.

The project was submitted, 1899, to a board of consulting engineers; considered "unquestionably feasible." Some hazard from San Francisco and other basins, due to probable leakage. Board's estimate, \$87,799,570, including 20 per cent for contingencies. P-99, 82.

A board of engineers was authorized by Congress Mar. 2, 1895, to make a survey and examination for the purpose of ascertaining the feasibility, permanence, and cost of the construction and completion of the Nicaragua canal by the route contemplated and provided for by an act passed in the Senate Jan. 28, 1895, entitled "An act to incorporate the Maritime Canal Co. of Nicaragua," approved Feb. 20, 1899." Report of this board published in H. Doc. 279, 54th Cong., 1st

sess. Report to effect that more specific information, etc., necessary; additional examination and surveys recommended; tentative estimate made of \$133,000,000. P-99, 82.

Appointment of Nicaragua Canal Commission was authorized by Congress June 4, 1897, to carry out recommendations of former or preceding board. Reported to the President May 9, 1899. Route that of Childs's practically, but project modified somewhat. Canal to be 30' by 150' bottom, with locks 80' by 665'. A single high dam across the San Juan, above the mouth of the San Carlos River, provided for; canal carried thence on the left bank of the San Juan River to the Caribbean Sea. Provision made for regulation of lake level; no prior project had adequately dealt with this. Safety as a principle placed before cost. Found that the discharge of San Juan had been greatly underestimated. New dam site at Boca San Carlos. Future duplicate locks kept in view at La Flor. P-99, 83.

The project of the Isthmian Canal Commission No. 1 follows the general route of that of the Nicaragua Canal Commission. Depth of water increased. Locks duplicated and enlarged. New and better site found for dam in the San Juan. P-99, 84.

Cross sections, P-99, pl. 60.

Beginning at the 6-fathom curve, the entrance to the canal will lie between 2 jetties running nearly north and south, about $1\frac{1}{2}$ miles northeast of Greytown and passing close to the most westerly bend of the lower San Juan. Entrance to harbor to be 500' wide and not less than 35' deep. The width gradually narrows to 150', after passing a turning basin, the regular width of the canal at the bottom. The head of the east jetty to extend to 6-fathom curve in Caribbean, and is the zero point to which distances along the canal are referred. Estimated cost of entrance and harbor, \$2,198,860, covering 2.15 miles. Summing up the various items of the project, as follows, the total estimated cost is \$189,864,062, which includes 20 per cent for engineering, police, sanitation, and general contingencies:

| Item. | Miles. | Cost. |
|--|--------|-------------|
| Greytown Harbor and entrance..... | 2.15 | \$2,198,860 |
| Greytown Harbor to Lock 1, including approach wall to lock..... | 7.44 | 4,899,887 |
| Diversion of lower San Juan..... | | 40,100 |
| Diversion of San Juanillo..... | | 116,760 |
| Lock 1, including excavation..... | .20 | 5,719,686 |
| Lock 1 to Lock 2, including approach walls, embankments, and wasteway..... | 10.96 | 6,296,632 |
| Lock 2, including excavation..... | .20 | 4,050,270 |

| Item. | Miles. | Cost. |
|--|--------|--------------|
| Lock 2 to Lock 3, including approach walls, embankments, and wasteway..... | 16.75 | \$19,330,654 |
| Lock 3, including excavation..... | .20 | 3,832,745 |
| Lock 3 to Lock 4, including approach walls, embankments, and wasteway..... | 2.77 | 4,310,580 |
| Lock 4, including excavation..... | .20 | 5,655,871 |
| Lock 4 to San Juan River, including approach walls and embankments..... | 5.30 | 8,579,431 |
| Conchuda Dam, including sluices and machinery..... | | 4,017,650 |
| Auxiliary wasteway, including sluices, machinery, and approach channels..... | | 2,045,322 |
| San Juan section..... | 49.64 | 23,155,670 |
| Lake Nicaragua section..... | 70.51 | 7,877,611 |
| Lake Nicaragua to Lock 5, including approach wall to lock and receiving basins for the Rio Grande and Chocolate..... | 9.09 | 19,566,575 |
| Diversion of the Las Lajas..... | | 199,382 |
| Lock 5, including excavation..... | .20 | 4,913,512 |
| Dam near Buen Retiro. Section from Lock 5 to Lock 6, including approach walls and wasteway..... | 2.04 | 3,259,283 |
| Lock 6, including excavation..... | .20 | 4,368,667 |
| Section from Lock 6 to Lock 7, including approach walls, embankments, and wasteway..... | 1.83 | 2,309,710 |
| Diversion of Rio Grande..... | | 176,180 |
| Lock 7, including excavation..... | .20 | 4,709,502 |
| Section from Lock 7 to Lock 8, including approach walls, embankments, and wasteway..... | 2.43 | 1,787,496 |
| Diversion of Rio Grande..... | | 117,580 |
| Lock 8, including excavation..... | .20 | 4,920,899 |
| Section from Lock 8 to Brito Harbor, including approach wall..... | .23 | 553,476 |
| Brito Harbor and entrance, including jetty..... | .92 | 1,509,470 |
| Railroad, including branch line to Conchuda Dam site, at \$75,000 per mile..... | | 7,575,000 |
| Total..... | 183.66 | 158,220,052 |
| Engineering, police, sanitation, and general contingencies, 20 per cent..... | | 31,644,010 |
| Grand total..... | | 189,864,062 |

P-99, 84, 109.

Table showing amount and length of curvature for the entire line. 56 curves. 49.29 miles. Total degrees of curvature, 2,339° 50' 30". P-99, 91.

As there are no natural harbors at either end of the canal line, artificial harbors to be constructed. Fine harbor once at Greytown—destroyed by moving sands. Jetties needed to gain and hold 35' depth. Dredging also required for maintenance. Jetty needed also at Brito, on the Pacific side. P-99, 91-96.

Regulation of level of Lake Nicaragua: Dam at Conchuda, 52.9 miles from the lake, would extend the waters of the lake to that point. Regulation to be accomplished with dams across the Rio Grande west of the lake and across the San Juan on the east side, having waste ways, etc., for discharge into the San Juan. Details of the problem. Maximum and minimum elevations not precisely determinable. Discharging capacity of the San Juan. Discharge of lake at any given stage. Slopes of canalized river corresponding to various discharges. Conditions governing the regulation of the gates. Precipitation in wet season. Effect of rainfall not felt immediately. October rainfalls heaviest. Satisfactory control gainable, but more data required. Concurrent rainfall and lake stage records not sufficiently extended. Maximum rainfall anticipated. Rise due to maximum rainfall. Results based on assumption that rainfall in basin is proportioned to that at Granada. Salient features of a contemplated control of the greatest lake elevations in seasons of maximum precipitations. Method of discussion of the regulation data, etc., not free from error. Computations show that the net available storage in the lake must be 6.2', if the requirements for evaporation and navigation for two dry seasons and an intermediate dry-wet season are to be met. Storage. Not possible to predict elevation of lake. Certain general principles of control procedure set forth in view of the results of the preceding computation. Oct. the month of heaviest rainfall. The general principle of operation of the sluiceways, etc., about as follows: (1) A full lake with surface probably a little above 110 on Dec. 1; (2) wasteway sluices closed at least from about Dec. 1 to some date in the early portion of the succeeding rainy season, or throughout that season if it be one of unusually low precipitation; (3) a variable opening of wasteway sluices, if necessary, during the intermediate portion of the rainy season, so as to maintain the lake surface elevation but little if any below 110 at the beginning of Oct.; (4) the operation of wasteway sluices during Oct. and Nov. so as to reach the first of Dec. with a full lake, or lake elevation probably a little above 110. P-99, 96-104.

Velocities in the minimum sections of the canalized river San Juan. Effect of tributaries of San Juan. P-99, 104.

Regulation of the lake to be effected with wasteways at the east end of the summit level. Movable dam essential. Vertically moving gates of the Stoney types selected.

Designed to discharge 100,000 cubic feet per second, through 21 sluice gates, with the water in the pool at 104. Depth of water on crest limited to 7'. **P-99, 104, 105.**

Conchuda Dam for regulation of Lake Nicaragua. Details. Most important structure on route. Length, 1,271 feet. Foundation on hard rock. One end in Costa Rica. **P-99, 105, pl. 69.**

Conchuda wasteways. **P-99, 105, pl. 68.**

Locks, Nicaragua. **P-99, pls. 64, 65, 66.**

Locks: Lock No. 1, vicinity of Misterioso; lift, $36\frac{1}{2}$ ' above mean low tide; in duplicate, as well as all others. Lock No. 2, near Negro Hills; lift, $18\frac{1}{2}$ '. Lock No. 3, beyond the Danta; lift, $18\frac{1}{2}$ '. Lock No. 4, beyond the Machado; variable lift, 31 to 37'. Lock No. 5, near Buen Retiro; variable lift, 23 $\frac{1}{2}$ to 28 $\frac{1}{2}$ '. Lock No. 6, near mouth of Rio Tola; lift, 28 $\frac{1}{2}$ '. Lock No. 7, at site once proposed for La Flor Dam, south abutment; lift, 28 $\frac{1}{2}$ '. Lock No. 8 connects with tidewater; lift, 20 $\frac{1}{2}$ to 28 $\frac{1}{2}$ '. **P-99, 84-90.**

Wasteways provided for disposal of floods in the various pools in the form of overfall weirs. Embankments in eastern division given a freeboard of 5' above level to which the assumed floods would rise. **P-99, 106.**

Wasteways provided in each of the levels between the summit level and the Pacific, **P-99, 106.**

Wasteways, **P-99, pls. 67, 68.**

Retaining walls planned for cuts where the rock has disintegrated, etc., **P-99, 106.**

The foregoing project based upon a careful and detailed examination of the route. Examinations and borings have been as complete as possible. Special explorations made also to clear up rumors about possible better lines of location in interior and near terminals. **P-99, 107, 108.**

Observations made which determined that the mean level of the two oceans would be about the same, with respect to terminals, **P-99, 108, 109.**

Sand and stone for construction are in large quantities. Concrete work stands the climate well. **P-99, 109.**

Railroad for construction purposes necessary; provision made for one from Greytown to the mouth of the Sabalos River, and from the west shore of the lake to Brito. The intervening space can be traversed by boats. **P-99, 109.**

Time of passing through the canal 30 hours for ship of average size, 24.5' by 50' by 400', and 37.6 hours for a ship 32' by 70' by 650'; these dimensions corresponding closely with "the largest ships afloat." **P-99, 110.**

None of the property of the Maritime Canal Co. of Nicaragua would have any value in the construction of the canal, except possibly the canal excavation from Greytown lagoon inland, and this only of value as a part of a channel for the diversion of the San Juanillo River; on account of forfeiture of concession, probable that all work and property of the

company owned by Nicaragua. Company had built telegraph and telephone lines; some railroad built, as were some buildings, shops, quarters, hospitals, storehouses, etc.; jetty at Greytown. **P-99, 110, 111.**

COMPARISON OF PANAMA AND NICARAGUAN ROUTES. Conclusions of the Isthmian Canal Commission No. 1 favorable to Nicaragua route.

Selection of an isthmian route must be made between Nicaragua and Panama. Panama route alone is feasible for a sea-level route. Canal with locks preferred. Both routes cross the Continental Divide less than 10 miles from the Pacific Ocean, the Panama summit being about double the height of that in Nicaragua. For more than half its length the location of each route on the Atlantic side is governed by the course of a river, the flow from whose drainage basin is the only source of water supply for a proposed canal. The summit levels, differing but about 20' in elevation (Panama the lower), are formed by lakes—natural at Nicaragua—requiring costly dams and wasteways for their regulation, etc. Water supply features on both lines satisfactory. In constructing the dams, the problem less at Conchuda on the Nicaragua line than at Bohio on the Panama route. Cost of Bohio Dam one-half more. Advantages in the design and construction of dams in favor of the Nicaragua route. Regulation of Lake Bohio automatic; that at Nicaragua dependent on human judgment. Well equipped railroad in existence at Panama; railroad would have to be provided at Nicaragua. Harbors would have to be created at terminals of Nicaragua route; existing harbors at Colon and Panama would have to be modernized. Construction can begin at Panama within one year; at Nicaragua in two years; because of better facilities for handling material, etc., at the former place. Excavation on the Nicaragua route distributed; heaviest on the Panama route at Culebra, etc. Eight years to complete Nicaraguan line; probably 10 years for Panama. Length of Nicaragua route, 183.66 miles; Panama, 49.09 miles. Cost of building, \$45,630,704 more on the Nicaragua line, omitting the cost of acquiring the Panama property. Annual maintenance and operation of Nicaragua Canal \$1,300,000 greater. Panama route would be 134.57 miles shorter from sea to sea, would have less summit elevation, fewer locks, 1,568' and 26.44 miles less curvature. Passage of a deep-draft vessel at Panama, 12 hours; 33 hours for Nicaragua. Risks and delays greater in canal than in open sea. Nicaragua route the most advantageous for all transisthmian commerce except that originating or ending on the west coast of South America. For the commerce in which the U. S. is most interested, that between Pacific and Atlantic ports,

European and American, Nicaragua route shorter by a day. The same advantage exists between Atlantic ports of U. S. and the Orient. For U. S. Gulf ports advantage of Nicaragua route nearly two days. For commerce between North Atlantic ports and the west coast of South America the Panama route is shorter by about two days. Between Gulf ports and the west coast of South America the saving is about one day. For sailing ships, not a large factor in the problem, Nicaragua route more favorable. Opening the Panama route could have no large effect on the adjacent country; large trade development of Nicaragua and Costa Rica would be expected were the Nicaragua line constructed. Nicaragua route has slight advantage hygienically. Cost of Nicaragua line, \$189,864,062; Panama, \$144,233,358. This does not include cost of acquiring concessions from the different Governments, nor the cost of the rights of the Panama Canal Co. (new). Latter estimated by the Isthmian Canal Commission No. 1 as valued at \$40,000,000. U. S. should acquire control of a strip of territory from sea to sea sufficient in area for the convenient and efficient accomplishment of the canal, etc. Strip should be not less than 5 miles wide on each side of the center line of the canal, or 10 miles total width. No treaties existing with any of the States within whose territory the two routes lie authorizing the U. S. to occupy its territory for the construction and operation of a canal. Republics of Nicaragua and Costa Rica untrammelled by any existing concessions or treaty obligations; free to grant rights to U. S.; their willingness demonstrated by a protocol. Colombia has granted concessions to New Panama Canal Co.; Colombia hence not free to treat with U. S. An agreement with the Panama Canal Co. to surrender or transfer its possessions must include a sale of its canal property and unfinished work. Negotiations with the company. Price, \$109,141,500. This would make cost of Panama route \$253,374,858, or \$63,510,796 more than Nicaragua route. Compensation which might be asked by the Republics concerned for the rights and privileges required unknown. Some physical advantages by Panama route, and lower cost of maintenance, etc., "but the price fixed by the Panama Canal Co. for a sale of its property and franchises is so unreasonable that its acceptance can not be recommended by this Commission." "After considering all the facts * * * this commission is of the opinion that 'the most practicable and feasible route' for an Isthmian Canal, to be 'under the control, management, and ownership of the U. S.,' is that known as the Nicaragua route." P-99, 171-175.

Later conclusions of the Isthmian Canal Commission No. 1 favorable to Panama route. The stockholders of the New Panama Canal

Co., Dec. 21, 1901, gave full power to its board of directors to negotiate for the transfer of its property, concessions, and unfinished work to the U. S. Cablegram sent by Marius Bo, president of the company, Jan. 4, 1902: "Admiral Walker, etc. The New Panama Canal Co. declares that it is ready to accept for the totality, without exception, of its property and rights on the Isthmus the amount of \$40,000,000, the above offer to remain in force up to Mar. 4, 1903." This was determined to include maps, plans, archives, and records in Paris. 56 parcels of land, amounting to about 300,000 acres, which, with the lands belonging to the railroad company, covered nearly all the ground needed for canal route. Canal company possessed right to about 625,000 acres of land under a Colombian law, of a land grant in the original Wyse concession. Never delimited. U. S. could relinquish this right as factor in any negotiations with Colombia. 2,431 buildings, used for offices, quarters, storehouses, hospitals, shops, stables, etc. Immense amount of machinery, tugs, launches, dredges, spare parts, rolling plant, stationary plant, etc. (No value attached to this by Isthmian Canal Commission No. 1, as any plant used by the U. S. would be more modern; plant of value to the extent it might be used by the U. S.) Work on canal line of value estimated to be excavation of 36,689,965 c. y.; in Chagres diversion, 210,873 c. y.; in Gatun diversion, 2,685,494 c. y.; monetary value, \$27,474,033. New Panama Canal Co. transfers 70,000 shares in the Panama R. R., except 1,100 shares, held by a few individuals. Estimated value of shares transferred, at par, \$6,886,300. Mortgage bonds to amount of \$3,439,000, issued by Panama R. R. at 4½ per cent; \$871,000 of these bonds owned by the railroad, but pledged as collateral to the Panama Canal Co.; \$1,064,000 in treasury subject to sale or cancellation, leaving outstanding bonds to value of \$1,504,000. Railroad had outstanding also \$996,000 6 per cent sinking fund subsidy bonds, as an amortization of the annual payment of \$225,000 due the Colombian Government under its concession for the period ending Nov. 1, 1910. Railroad owes \$986,918 to the Panama Canal Co., mainly on account of the construction of a pier at La Boca. Total liabilities of the railroad estimated at \$2,490,918, not counting the sinking-fund subsidy bonds, for which the Colombian Government has received the benefit, and for which it should make allowance to the U. S. in the negotiations for treaty rights. Its cash assets Jan. 15, 1902, were \$438,569.33. Railroad owns 3 passenger and freight steamers, about 2,000 tons each. Railroad owns undivided half interest in islands of Naos, Culebra, Perico, and Flamenco, in the Bay of Panama, the Pacific Mail Steamship Co. being the joint owner. Besides its right of way, terminals and

wharves, and considerable areas of land, the railroad owns nearly the whole of the town of Colon. The business from constructing the canal will enable the railroad to pay off its indebtedness; its value will decrease with the completion of the canal. Value of the maps, drawings, records, etc., of the Canal Company placed at \$2,000,000. Purchase of the rights, etc., of the new Panama Canal Co. for \$40,000,000 would make the comparative cost of the two probable routes as follows: Nicaragua, \$189,864,062; Panama, \$184,222,358. Originally the canal company prohibited absolutely from ceding its rights to any nation or foreign Government; applicable also to railroad company; Colombia waived the restrictions, and authorized the Panama Canal Co. to treat directly with the U. S. Liquidator of the old Panama Canal Co. agreeable to negotiations of the New Panama Canal Co. Agreement between the New Panama Canal Co. and the U. S. would require the approval of Colombia in view of the prohibitory clause named above, and also because Colombia owns 50,000 shares of 100 francs of the stock of the company, of which it could not be deprived without its consent. Following this should come negotiations with the Governments concerned for the necessary territory to be under the control of the U. S.

"The question whether the new Panama Canal Co. can make to a purchaser a valid title to the property formerly belonging to the old company, its predecessor, has been considered and answered in the former reports of the Commission, but in view of its importance in connection with the present offer the results of the investigation made will be again presented."

"The old company, in addition to its canal property acquired under its concession from the Colombian Government, owned nearly all of the shares of the Panama Railroad Co. By purchasing these it obtained the control of the concession under which the road had been built. The latter concession will continue in force until 1966; the canal concession is to run for 99 years from the day on which the canal shall be opened to public service, and the date fixed for this in the concession, according to its latest extension, is October 31, 1910. When these periods expire, the different properties are to belong absolutely to Colombia, without compensation, and the Government is under no obligation to extend either concession."

Isthmian Canal Commission No. 1 possessed of no power to make these latter negotiations, as it belongs to the treaty-making power of the U. S. " * * * There has been no change in the views of the commission with reference to any of these conclusions then reached (referring to a former summing up of the respective advantages, etc., of routes in Nicaragua and Panama). * * * There is, however, one important matter which can not enter into its determination, but

which may in the end control the action of the U. S. Reference is made to the disposition of the Government whose territory is necessary for the construction and operation of an Isthmian Canal. It must be assumed by the commission that Colombia will exercise the same fairness and liberality if the Panama route is determined upon that have been expected of Nicaragua and Costa Rica should the Nicaragua route be preferred." "After considering the changed conditions * * * the commission is of the opinion that 'the most practicable and feasible route' for an Isthmian Canal, to be 'under the control, management, and ownership of the U. S.,' is that known as the Panama route." P-99, 675-681.

(c) Projects (Panama Route), 1905-1909.

(See p. 2549 of this Index.)

The matter under this head is arranged as follows:

- Assumption that plan of Isthmian Commission No. 1 the plan approved by Congress.
- Doubt as to following of sea-level or lock plan.
- Board of Consulting Engineers formed.
- Plans proposed to Board of Consulting Engineers.
- Plan of Bunau-Varilla (see below).
- Plan of Bates.
- Plan of Gillette.
- Plan of Isthmian Commission No. 1.
- Lock-level projects.
- Comparison of lock and sea level plans.
- Sea-level plan of Bunau-Varilla. (See above.)
- Efficiency of lock and sea level plans.
- Recommendation by Board of Consulting Engineers of sea-level plan (majority report).
- Recommendation of lock-level plan, Board of Consulting Engineers (minority report).
- Isthmian Canal Commission No. 3, after reviewing foregoing matter, recommended lock-level plan (one member, Endicott, dissenting in favor of sea-level canal).
- Lock-level plan chosen by President Roosevelt, subject to wish of Congress.
- In 1907 project accepted by Congress.

1905. Assumed by Isthmian Canal Commission No. 3 that project adopted by Congress the one submitted by Isthmian Canal Commission No. 1, and "all construction work done thus far has been under and in accordance with that project." Isthmian Canal Commission No. 2 had under consideration a sea-level project. Difference of opinion concerning advisability of sea-level plan. Board of Consulting Engineers appointed by the President to consider type of canal to be adopted. Isthmian Canal Commission No. 3 obtaining data for this board. P-05, 14.

Physical data: "Few engineering works have ever been undertaken with more complete physical data available," P-05, 14.

1906. Project of P. Bunau-Varilla: (See below) Plan contemplates lock canal with a high summit level; after its completion, proceeding with its transformation into a sea-level canal. Estimated time, for lock canal, 4 years, with a summit level of 130'. The transformation would require a widening as well as a deepening of all channels above sea level. Widening above water to be done first by the ordinary methods for excavation in the dry, but all excavation below water to be by dredging. Dams to be used to gain electricity for power, making cost of work "low." Lock gates, etc., to be made deeper than ordinarily, and prism above them to be dredged down to them, in reducing to sea-level plan. Dredgings to be taken through a special lock chamber into Lake Gamboa. Time of completion considered too small. Plan expensive. "If the lock canal is likely to be retained for many years, it should be made for the most efficient service and not be encumbered with modifications in lock construction which would prove inconvenient in use." **P-06***, 30-33.

Projects of L. W. Bates: Three projects presented before Board of Consulting Engineers. Project B contemplates two terminal lakes—one on the Caribbean side formed by a dam at Mindi, called Lake Chagres, having a maximum elevation of water surface of 33.5' above mean tide; another at the Panama end formed by a dam connecting Ancon and Sosa Hills with each other; and a second dam from Sosa Hill to the high ground on the westerly side of the Rio Grande estuary. Four lockages necessary. Two terminal harbors. Breakwaters for harborage. Project A contemplates a summit level of 27' only above mean tide, maintained by two dams—one at Mindi and one connecting Ancon and Sosa Hills with the high ground above Farfan Point. Board of Consulting Engineers unanimously of opinion that if project A alone were to be considered it could not be preferred to a sea-level canal. Plan B preferred by Mr. Bates. Criticism of Board of Consulting Engineers adverse to its details. Disbelief of Board of Consulting Engineers that "Obispo triangle," to make floods of Chagres flow in opposite directions in canal, would be effective. Control of Chagres by number of small reservoirs not so good as plan of one large reservoir. General nature of Mr. Bates's data. Variant of plan B, called project B', calls for summit level 95' elevation; disapproved. The Board of Consulting Engineers' lock-level plan preferable to Mr. Bates's plan B. **P-06***, 26-30.

Correspondence with Mr. Bates relative to the desirability of his presenting the elucidating canal projects for examination by the Board of Consulting Engineers, **P-06***, 247.

New matter in connection with the projects he proposed, **P-06***, 251.

Breakwater at Panama. Disposal of rock from excavations. Cost of rock excavation. Basins kept empty to be ready for flood waters. Gamboa Dam and retention of silt. Mindi Dam data. Navigable capacity of canal. Speed through canals. Speed in curves and tangents. Health record at Panama not so bad as reported. Time of completing projects of Mr. Bates.

Appendices: Tables concerning lockage supply and capacity, low water in the Chagres, requirements of the water supply, prices, and estimates for dams, locks, barrage, etc., **P-06***, 247-265.

Gillette plan: An article which had been printed in the Engineering News, July 27, 1905, was submitted to the Board of Consulting Engineers, embracing a general description of various canal plans, ending with a description and recommendation of a plan for a 100' summit-level canal. Dam at Gatun; to prevent seepage, steel sheet piles and pipes filled with grout to be used. Straight lines for canal from Gatun to deep water in Limon Bay, "almost exactly the line which has been recommended by the board in the sea-level plan." Three locks, 90' by 900', with lifts of 35', 35', and 30' respectively. Suggests floating gates. Estimates considered markedly low; "probable that one cause of this discrepancy is the fact that the board has had the advantage of recent surveys, which show that the maps from which Maj. Gillette worked were inaccurate." **P-06***, 34.

Plan of Isthmian Canal Commission No. 1: (See p. 2549 of this index.) Locks were to have a clear length of 740' and width of 84'. "If the canal then contemplated were now in existence, it would not afford passage to the largest ships now in course of construction." * * * "The plan contemplated 5 lift locks. * * * The plan under consideration would not fulfill present and future requirements." **P-06***, 33.

The sea-level canal proposed by the majority to be a continuous, winding waterway from Limon Bay to dam near Panama Bay, with duplicate locks near Sosa Hill to overcome difference in tidal fluctuations at two ends of the canal. Prism to have depth of 40', minimum bottom width of 150' in earth and 200' in rock, with suitable side slopes for the former, and practically vertical sides for the latter. Floods of Chagres to be controlled by a dam at Gamboa 180' above sea level, with sluice gates for regulating discharge through canal. Dams and levees exterior to canal provided for diverting 5 of the 25 streams crossing the canal line, and for preventing overflows in vicinity of Panama.—**P-06***, v, X, 47.

Lock-level project: The Board of Consulting Engineers' lock-level committee submitted 4 projects to the Board of Consulting Engineers. No. 1: Summit level at elevation 85', to be maintained by a flight of 3 locks at Gatun on the Atlantic side, and with 1 lock at Pedro Miguel, and 2 locks in flight at Sosa Hill adjoining La Boca Pier on the Pacific side, the estimate being \$141,236,000. No. 2: Same as above, except that on the Pacific side there are 2 locks in flight at Pedro Miguel and 1 at Miraflores rather than at Sosa; estimate, \$148,272,000. No. 3: Based on an elevation at summit level of 60', maintained on the Atlantic side by a flight of 2 locks at Gatun, and on the Pacific side with a single lock at Pedro Miguel and another at Miraflores. For the purpose of control of the Chagres River and to furnish a water supply there is included a dam at Gamboa; estimate, \$171,190,000. No. 4: Summit level at elevation 60', to be maintained by a dam with single locks at Gatun and Bohio on the Atlantic side, and with single locks at Pedro Miguel and Miraflores on the Pacific side, with a dam at Alhajuela; estimate, \$175,929,720. **P-06***, 13.

Comparison of sea-level and lock plans: The Board of Consulting Engineers voted 8 to 5 to adopt for comparison with a sea-level canal, one having a summit level at an elevation of 60'. On the Pacific side there should be 1 lock at Sosa and 1 at Pedro Miguel; on the Atlantic side, 1 lock at Gatun and 1 at Bohio, all in duplicate; and there should be a dam for the regulation of the Chagres at Gamboa identical with that proposed for a sea-level canal. Plan not conceded to be the most feasible for conversion to a sea-level type; Board of Consulting Engineers not of opinion latter could be carried out. **P-06***, 14, 35.

Sea-level canal: Project of P. Bunau-Varilla. (See above.) Appendix F, Board of Consulting Engineers. **P-06***, 199-246.

First part: General conditions. Future necessity of a sea-level canal. Nature of the difficulties which prevent the immediate sea-level canal construction. Sources of really practical coefficients for the calculation of time of construction. The coefficients adopted by the Comité Technique would show that a delay of 30 years is necessary for the dry excavation of a sea-level canal. Seemingly incompatible conditions.—Immediate opening and sea-level construction; how they can be satisfied. **P-06***, 199-203.

Second part: Justification of the project. General description. Automatic regulation of Lake Bohio. Advantages of the channel selected for leading to the sea the Chagres floods below Bohio. The Chagres problem.

The Gamboa Dam compared with the Alhajuela Dam; its superiority. No Chagres sediments to be feared with the Gamboa Lake. The efficiency of Gamboa Lake for control of floods vastly superior to that of Alhajuela Lake. Other advantages resulting from the position of the Gamboa Dam. It gives no vital part to the Bohio Lake for the control of the Chagres floods. Proposed system for the control of floods and the storage for dry seasons. The Bohio Lake an emergency flood controller, which may gradually disappear. Storage for dry season. It will be ample for 50,000,000 tons of traffic. Construction of dam at Gamboa impossible with the spoils of the great cut. Must be a concrete dam. Characteristic features of the internal elements of the Culebra Cut. Many errors committed about this substance. No walls at Culebra are necessary. Instability of the spoils embankments during the rainy season paralyzed for years the execution of the work. A tentative dam of 8' to 10' head with the spoils of Culebra a failure. Proofs of the stability of the Culebra argillite when in its original place and under water. Construction of the dam at Bohio. No earth dam on the Isthmus should reach 92' without a core wall. Neither corrol nor masonry are admissible on the Isthmus, owing to lack of skilled and reliable labor. Earth dam at Bohio to consist of a mountain of clayish sand transported and deposited by water. Estimates of time of the Comité Technique can be reduced in the proportion of 4 to 5.375, according to the Isthmian Canal Commission. "My estimation of the time necessary for the Bohio works not contradicted by the Comité Technique's figures." All the works at Bohio can be made in four years. No fear from the pervious subground below the Bohio Dam. Systems proposed in the past for the control of the Chagres floods. The plans of the Isthmian Canal Commission perfect for a perpetual lock canal; defective if transformation to sea level is contemplated. The Culebra problem. Supply of water to summit level perfect in the plans proposed by Varilla. Why level 130 was chosen for the summit. The summit should not be lower in any case for the first form of the Panama waterway. **P-06***, 203-220.

Third part: Transformability of the canal built with locks into a sea-level waterway. The increased width of 300' at the bottom not resulting in an "extravagant cost." International navigation to preserve an independent channel of at least 75' if no increase in the width is admitted. Basic principal of the system of transformation. It has generally been thought that it was impracticable to lower the level without stopping navigation. The canal, when sea-level, will receive the high Chagres waters, controlled

and cleaned, from the Gamboa Lake, and the Chagres tributaries will flow into the canal direct between Gamboa and Bohio. No further tributaries to be received below Bohio. Essential conditions of the transformation. Not one inch of the channel devoted to international navigation will be used by the works of transformation. Not a minute of the time of the international navigation locks, not a drop of the water stored for the international navigation, will be used for the works of transformation. Gamboa Lake, already a flood controller and a water storer, to play a third and a most important part. It will receive all the spoils of the great cut. Computation of time of transformation a conservative one. Size, location, and cost of the locks uniting Lake Gamboa to summit level. Extraordinary superiority of excavation on water compared with dry excavation. Good foundations assured for the Gamboa Locks. How to avoid difficulty of constructing the low Gamboa Locks when summit level is reduced. Cost of Lake Gamboa Locks not to exceed \$15,000,000. Substitution of dredging for dry excavation during the period of transformation. Principal reasons why the wet method is so superior to the dry one for excavating on the Isthmus. Dredging was preferred to open-air rock excavation during the old Panama Co.'s work, with much less powerful dredges "than are now used." The suspension of dredging at Culebra a fatal mistake of the new Panama Canal Co. Why dredging sometimes failed on the Isthmus. The certain way to reduce expenses by dredging lies in the electric working of powerful instruments. Large decrease in the price of excavation and transformation. A depth of excavation 35' to 50' below water level perfectly advantageous for dredges built for the purpose. **P-06***, 220-234.

Fourth part: New prospects opened by the great reduction of price and of time of the works of excavation. The Straits of Panama. The proposed method makes a reality of what was yesterday a dream—the Straits of Panama—which, if built by methods hitherto known, would require three-quarters of a century and \$900,000,000 exclusive of interest. The currents due to tides and floods not to exceed 3.3 knots in the Straits of Panama. Excavation required for the Straits of Panama. Unit prices and total cost of the construction of the Straits of Panama. The Panama sea-level tide-locked narrow canal, if made by dry process, will take as much money and time to build as the Straits of Panama, if later is made by proposed new method. **P-06***, 234-236.

Conclusions: The high-level lock canal first; the Straits of Panama afterwards. Longitudinal profile of the Panama route showing the various points and levels. **P-06***, 237-238.

Memorandum: Omission of sand from concrete. Estimated time required for preparatory works. Time saved by omission of locks. Different costs of dredging on water and on land. Underwater rock breaking not a modern problem. Elements entering into cheap method of transformation of sea level to lock level. Earnings of lock canal should largely, if not fully, pay for transformation into sea-level canal. "My remarks before the Board of Consulting Engineers bearing on 61 different essential points of the Panama Canal problem fully explain the views based on 20 years' study of the great technical problem." Refutation of the popular opinion that the dump cars, locomotives, etc., of French régime were "toys" or inadequate. Equal to European plants. Working capacity hindered by necessarily poor trackage. "Mr. Stevens, chief engineer of the Panama Canal, has nobly declared before the Board of Consulting Engineers that the works made by the French deserved admiration." "The justification of the first Panama company at the beginning was that no human anterior experience was available, and that the only way open was to plunge heroically into the unknown to extract the necessary truth." **P-06***, 238-242.

Second memorandum: Price of dredging on water at the Isthmus. Price of rock breaking. Stone and sand for concrete. Time of construction of the locks. Margins of safety giving full guaranty that the opening of traffic within four years can be surely accomplished. **P-06***, 242-246.

EFFICIENCY OF LOCK AND SEA-LEVEL CANALS: Majority of Board of Consulting Engineers held lock-level canal dangerous because of the lock system required; many curves in sea-level canal; more channel surface in lock canal. In sea-level canal, considerable obstructive current. In passing through, for a small ship the canal at sea level has the advantage by about 36 minutes, provided the number of ships does not exceed 10 per day. If the number of ships exceed 30 per day, the canal with locks has the advantage by about 3 hours. For large ships the canal with locks has the advantage whatever be the number per day. If the number be 10, the advantage is about 36 minutes; if it be 30, the advantage is over 3½ hours. Should there be a current of 2.6 miles per hour, as in a sea-level canal, the time of passage might be greatly increased. Majority of Board of Consulting Engineers claim that locks limit the traffic capacity; that lockages can not exceed 10 per day for each lock, or 20 per day for the pair. The minority point to the experience at the Sault, * * * "and they show that with the double flight of locks proposed, a traffic of at least 80,000,000 tons per annum can be accommodated. Additional locks may be built hereafter if needed." To widen sea-level canal 100'

without deepening it would cost at least \$87,000,000; the canal with locks may be deepened easily and cheaply by simply raising the crests of the spillways and the height of the locks. Cost of operating and maintaining locks alone estimated at over \$500,000 annually; one lock only for sea-level canal, but \$225,000 should be charged against sea-level canal because of turning-out places, etc., totalling \$300,000 per annum as the apparent advantage in operating expenses of the sea-level. Against this is to be placed the interest on the additional investment. If the canal at "sea level will cost \$132,000,000 more than the canal with locks, * * * the interest * * * amounts to \$2,640,000 per annum; that is, the annual fixed charges of the canal at sea level will be \$2,340,000 more than those of a canal with locks." As to military points of view, both canals as vulnerable. "Should the U. S. depart from its true policy of making the canal neutral, it will not gain anything in a military point of view by adopting the canal at sea level in preference to the one with locks." "There is one valid argument, and one only, which can be brought against the canal with locks, and that is the difficulty of fixing the dimensions of the lock chambers to provide for the possible enlarged vessels of the future." Majority of B. C. E. propose locks 40' x 100' x 100', while minority 40' x 95' x 90'. Total estimated cost of all the locks and approach walls in the "present" project, including the contingency item of 20 per cent, is \$44,425,000. "They can therefore be entirely renewed for about half what it would cost to widen the sea-level canal 100'." The water supply for a lock canal is sufficient to accommodate a traffic of about 50,000,000 tons annually; a dam at Alhajuela could provide an additional supply sufficient for 100,000,000 tons, and the Chagres River with its tributaries can be made to provide still further supplies. Opinion unanimous that if sea-level canal is to be built, it should be built from the first. **P-06*, xiv.**

Time of completion: Sea-level type, 12 to 13 years. Lock type, 10 to 11 years. **P-06*, 14.**

Resolution by the Board of Consulting Engineers recommending the adoption of plans for a sea-level canal, **P-06*, 14.**

Sea-level plan: Details. Alignment and description. Estimate of excavation of a sea-level canal 40' deep. Harbors: Colon Harbor; Ancon Harbor; Pacific coast harbors. Cross sections of the canal prism. Estimate of cost. Estimate of time. The considerations held to be important. Canal makes a connection between oceans and continents. Interests it will affect vast. Not merely passage, but safe and uninterrupted passage required. Canal will endure for all time. Report recommending signed by Davis, Parsons, Burr, Hunter, Guerard, Tinceauzer, Welcker, Quellenec. **P-06*, 47-65.**

Plan recommended by majority of board follows essentially the line adopted "heretofore" by Congress, except near the terminals, the depth to be 40', and the width at bottom to be 150' where the side slopes are gentle, and 200' where the side slopes are nearly vertical, as in rock. At the Panama end is to be a tide lock, having a usable length of 1,000' with width of 100', and depth over the miter sills of 40'. In Panama Bay the channel is to be 35' deep at extreme low water of spring tides, which will give the full 40' provided elsewhere in the canal, except upon rare occasions. To control the Chagres River, a dam of masonry or of earth and masonry, is proposed at Gamboa, just off the line of the canal, built to a height 180' above the sea, forming a reservoir called Gamboa Lake, of which the maximum flow line is to be at elevation 170, into which the flood waters are to be received (no design submitted). Of the tributaries entering the Chagres below Gamboa, the most important are diverted entirely from the canal and conducted by separate channels to the sea. A number of tributaries would yet remain to be taken into the canal, creating currents of about 2.6 miles per hour. Extensive harbor improvements proposed at Colon. Cost of sea-level plan estimated at \$247,000,000. Table of more important streams entering such a canal. Total cost would more likely be \$272,000,000. Time required to build canal estimated at from 12 to 13 years; feared by Isthmian Canal Commission that time would be nearer 18 or 20 years. **P-06, x.**

Lock-level plan: Minority report. Reasons given in detail. Presents for comparison with the sea-level plan preferred by the majority of the Board of Consulting Engineers a project with summit level at elevation 85 instead of 60, maintained by a dam and duplicate flights of 3 locks at Gatun; recommended for adoption, "Gen. Abbot preferring a lower dam with duplicate flights of 2 locks at Gatun, supplemented by a dam and duplicate single locks at Bohio, raising the summit level to elevation 85." Colon entrance details. Gatun Dam details. Consideration of the stability of earthen dams. Plan of Gatun Dam. Regulating works. Saving effected by change in location of controlling dam to Gatun. Saving about \$11,894,821. Water supply of the canal ample. Details of the summit level. Lake Sosa details. Channel in Panama Bay. Dimensions and cost of channel. Comparison of two lock-level plans of 60 and 85 elevations. Comparison with the Board of Consulting Engineers sea-level project. Relative time for completion of sea-level and 85' projects. Relative time of transit. Capacity for traffic of the sea-level and 85' elevation lock-plan. The duplicate locks of the latter will afford convenient passage for an annual net registered tonnage of 80,000,000. Fallacy of the theory that locks and other

similar structures are unsafe to navigation as adduced by experience. Safety of gates. Guards against disasters of all kinds. Earthquakes not a danger at Panama. Relative safety of ships in the two types of canal not at all unfavorable to a lock-level plan. Land damages. Extensive lakes in the plans of both the lock-level and the sea-level plans would flood large areas (44.6 square miles for sea-level plan, and 118 square miles for lock-level plan). Estimated cost of these lands only \$300,000. Relocation Panama R. R. would be necessary by any plan. Estimate in detail for 85' elevation plan, \$139,705,200; does not embrace, nor does the sea-level estimate, allowance for any fortifying. Total excavation estimated at 95,955,000 c. y., of which 53,765,000 c. y. from Culebra Cut. Allowance of 20 per cent made for contingencies. Probable cost of maintenance and operation, \$2,360,000 annually. No fear for safety of dams. "The construction of earth dams to retain water 85' deep is not an untried experiment, as there are many earth dams of equal or greater height, nearly all of them made wholly of earth without a masonry core, and none of them having nearly the mass or the stability of those herein recommended."

Summary of conclusions in favor of recommending lock-level canal: "In view of the unquestioned fact that the lock canal herein advocated will cost about \$100,000,000 less than the proposed sea-level canal; believing that it can be built in much less time; that it will afford a better navigation; that it will be adequate for all its uses for a longer time, and can be enlarged, if need should arise, with greater facility and less cost, we recommend the lock canal at elevation 85 for adoption by the U. S." Signed by Noble, Abbot, Stearns, Ripley, and Randolph. P-06*, 67-101.

Plan recommended by Board of Consulting Engineers minority a canal with locks, following in general the same location as the sea-level plan, but with slight variations therefrom in Limon and Panama Bays. Its controlling feature a dam to close the valley of the Chagres at Gatun, thus creating an artificial lake of which the surface is to be 85' above the sea, and which is to constitute the summit level. Length of dam, 7,700'; height of its crest, 135', or 50' above the water surface. To contain about 21,200,000 c. y. of material, principally spoil from canal prism. Channel 500' wide at sea level leads from Limon Bay to the Gatun Dam, where is placed a double flight of 3 locks by means of which vessels are lifted into the artificial lake. The lake provides unrestricted navigation for a large part of its length, but becomes more contracted as the Continental Divide is approached, until in the Culebra Cut the width at bottom is reduced to 200'. It finally terminates at

Pedro Miguel, where the first lock on the Pacific side is placed, having a lift of 30'. By means of this lock vessels are lowered into another artificial lake created by a dam closing the valley of the Rio Grande, and by 2 other dams closing other depressions, the level of the lake being 55' above the sea. The crests of these dams are 80' above the sea. Communication between the lake and Panama Bay is effected by a double flight of 2 locks placed near the shore on the high ground called Sosa Hill. All locks are in duplicate and have a usable length 900', width 95', and depth over the miter sills 40'. The depth of the channel is everywhere at least 45', except in the locks and in Limon Bay, where it is 40'; the depth in Panama Bay, however, being measured from mean tide and not from dead low water. In the lakes the depth is often very much greater, being 75' near the Gatun Dam, and nearly as much for many miles. The width is nowhere less than 200' at bottom, and at most places is very much more. The length of the canal from deep water in Limon Bay to deep water in Panama Bay is 49.72 miles. Of this, 19½ miles is over 1,000' wide, 23 miles is over 800' wide, 35 miles is over 500' wide, and 42½ miles is over 300' wide. That is, for about half the distance navigation is entirely unrestricted, while for more than two-thirds the distance the channels are 500' wide or more, and for only one-seventh of the distance, including the locks, are they less than 300' wide. Estimated cost, \$139,705,200. Time to build, 9 years. The plan is the same recommended by the Isthmian Canal Commission No. 1 and adopted by Congress, at least by inference, act June 28, 1902. Some doubt expressed as to stability of Gatun Dam; opposite opinion to effect that there would be no seepage at this or the other dams. Locks larger than any which have heretofore been built; some express opinion they are beyond the limit of prudent design. "So the proposed locks can be made safer than the Poe Lock at the Soo, because they are designed after 9 years of practical experience with that lock, an experience which shows it to be a safe place for a vessel." P-06*, xiii.

Conclusion and recommendations of Isthmian Canal Commission No. 3: After studying majority and minority reports of the Board of Consulting Engineers on sea-level and lock-level canal at Panama—one signed by 8 members, and one signed by 5 members—the Isthmian Canal Commission No. 3 reported as follows: " * * * The canal proposed by the minority * * * can be built in half the time and a little more than half the cost of the canal proposed by a majority of the board, and that when completed it will be a better canal for the following reasons: (1) It provides greater safety for ships and less danger of interruption to traffic by

reason of its wider and deeper channels; (2) it provides quicker passage across the Isthmus for large ships or a large traffic; (3) it is in much less danger of damage to itself or of delays to ships from the flood waters of the Chagres and other streams; (4) its cost of operation and maintenance, including fixed charges, will be less by some \$2,000,000 or more per annum; (5) it can be enlarged hereafter much more easily and cheaply than can a sea-level canal; (6) its military defense can be effected with as little or, perhaps, less difficulty than the sea-level canal. * * * And, therefore, we recommend that the plan of the minority be adopted, subject, of course, to such changes as may be found desirable during construction and with the understanding that the works in Limon Bay are to be deferred for the present. The entrance now in use at that place must for the present be used in any event, in order to secure harbor room for the landing of supplies immediately needed. * * * What changes should be made can better be determined hereafter." P-06*, xvii.

Minority report of Isthmian Canal Commission No. 3: One member of the Isthmian Canal Commission (Endicott) regards a sea-level canal, as proposed by the majority of the Board of Consulting Engineers, a better canal for commercial and military purposes. Less time of transit, less chance of interruption of traffic from accident, maintenance and operation charges would be less; sea-level canal would permit of ready enlargement for enlarged traffic; better, safer, and more capacious from a military standpoint. "An 85' summit-lock canal once constructed means a lock canal always. If a sea-level canal is desired, it must be built directly without first building a lock canal." P-06*, xviii.

Lock-level canal: Letter of Chief Engineer Stevens, Jan. 26, 1906, after pointing to some "minor" changes in plan proposed, such as building of locks at Miraflores and Pedro Miguel instead of at La Boca, etc., says: "I therefore recommend the adoption of the plan for an 85' summit-level lock canal, as set forth in the minority report of the Board of Consulting Engineers," P-06*, xx.

Lock and sea level canals: The Sec. of War, after summing up the various arguments pro and con, as furnished by the labors of the Board of Consulting Engineers, reports, Feb. 19, 1906, as follows: "I recommend the adoption of the type of canal proposed by the minority of the Board of Consulting Engineers, except so far as relates to the location of the locks at Sosa Hill. * * * Object * * * is the possibility of their destruction by the fire from an enemy's ships. * * * If, however, Sosa Hill will not afford a site with such protection, then

it seems to me wiser to place the locks at Miraflores. * * * When I visited the Isthmus a year and a half ago * * * I received a strong impression that the work of construction upon which the U. S. was about to enter was of such world-wide importance and so likely to continue in active use for centuries to come, that it was wise for the Government not to be impatient of the time to be taken or of the treasure to be spent." Expresses conviction in favor of sea-level canal, "but the report of the minority, in showing the actual result of the use of the locks in ship canals, in pointing out the dangers of so narrow and contracted a canal prism as that which the majority proposes, and in making clear the great additional cost in time and money of a sea-level canal, has led me to a different conclusion." P-06*, vii, viii.

President Roosevelt of opinion that the Board of Consulting Engineers failed to give proper attention to the lessons taught by the Soo Canal, in their study of lock-level and sea-level canals at Isthmus of Panama. "The law now on our statute books seems to contemplate a lock canal. In my judgment, a lock canal, as herein recommended, is advisable. If the Congress directs that a sea-level canal be constructed, its direction will of course, be carried out. Otherwise the canal will be built on substantially the plan for a lock canal outlined in the accompanying papers, such changes being made, of course, as may be found actually necessary, including possibly the change recommended by the Sec. of War as to the size of the dam on the Pacific side." P-06*, iv.

1907. Project adopted by Congress estimated by Board of Consulting Engineers to cost \$139,705,200, exclusive of sanitation and expenses of zone government. Estimates did not contemplate or provide for waterworks, sewers, and paving in Panama and Colon nor was provision made for reequipment of Panama R. R. P-07, 34-38.

(d) Project, Adopted. (See p. 2549 of this Index.)

1909. Lock-canal project as of Jan. 1, 1909: This project is for a lock canal from the -41' contour in the Caribbean Sea to the -45' contour in the Bay of Panama, with a flight of 3 twin locks at Gatun, 1 twin lock at Pedro Miguel, and a flight of 2 twin locks at Miraflores.

The channel from M. 0, in the Caribbean, to the head of Limon Bay, to be 500' wide on the bottom and 41' deep at mean tide. The depth throughout the remainder of the canal and in Panama Bay to be 45' deep below mean tide. The channel from the head of Limon Bay to Gatun Locks to be 500' wide; from south end of Gatun Locks to M. 23.50, not less than 1,000' wide; from M. 23.50 to M. 26.50, 800' wide; from M. 26.50 to M. 27.00,

700' wide; from M. 27.00 to M. 31.25, 500' wide; from M. 31.25 to Pedro Miguel Lock, 300' wide from Pedro Miguel Lock to Miraflores Locks, and from Miraflores Locks to deep water in Panama Bay, 500' wide.

Breakwaters to be constructed in Colon Harbor on different lines from those established by the minority of the Board of Consulting Engineers. The locks to have chambers 110' by 1,000' usable dimensions and to be provided with emergency dams and safety gates.

The summit level extending from Gatun to Pedro Miguel is to be regulated between +82 and +87 by means of the spillway in the dam at Gatun. The level between Pedro Miguel and Miraflores is +55'. These levels are to be maintained by earth dams at Gatun and Pedro Miguel and by an earth dam on the west side and a concrete dam with spillway on the east side of Miraflores.

The principal streams adjacent to the Culebra Cut to be diverted; the Obispo, Camacho, and Mandinga into the Chagres, and the Rio Grande as may hereafter be determined.

The average bottom width of channel in this project is 649'. The minimum width is 300'. This project provides a two-way canal for the largest vessels now afloat or likely to be in the near future. **P-09**, 352.

Property.

Accountability, **P-09**, 212.

Record keeping, **P-05**, 164.

Returns, **P-10**, 310.

Statement of, Isthmian Canal Commission No. 3, in preparation, **P-05**, 21.

Surveys, real estate, **P-11**, 277.

Proposals. (See No. 148, p. 2364 of this Index.)
Forms, **P-05**, 171.

Protective Devices. (See Dams; Gates; Locks.)
Lock gates and protective devices, **P-09**, 37;
P-10, 49; **P-11**, 68; **P-12**, 74; **P-13**, 77.

Public Order. (See No. 56, p. 2362 of this Index.)

Public Schools. (See No. 113, p. 2363 of this Index.)

Public Works. (See Civil Administration; Municipalities; see No. 61, p. 2362 of this Index.)
Executive officer, duties of, **P-05**, 58.
Legal system (court, etc.) established, **P-05**, 67.
Mechanical division, duties of, **P-05**, 113.
Monetary system, Tropics, **P-05**, 20.
Religious activity, Tropics, **P-05**, 56.
Sanitation measure, **P-05**, 59.
School system established, Tropics, **P-05**, 65.

Public Works, Division of, **P-07**, 166; **P-08**, 261; **P-09**, 265; **P-10**, 370; **P-11**, 424; **P-12**, 468; **P-13**, 471.

Pump, Hydraulic.

Concrete barge to support hydraulic pump, details, **P-10**, 49, 50, pl. 115.

Pumping.

Ancon station, **P-08**, 85; **P-09**, 103; **P-10**, 180; **P-11**, 174; **P-12**, 188; **P-13**, 176.

Bas Obispo station, **P-08**, 86.

Camacho station, **P-08**, 85.

Central pumping station, Agua Dulce, **P-10**, 196, pl. 48.

Chagres station, **P-08**, 86.

Coccol pumping and filtration plant, **P-10**, 181, pl. 117; **P-12**, 188, 189; **P-13**, 177.

Cucaracha station, **P-08**, 85.

Gatun Locks, **P-10**, 122.

Gatun station, **P-08**, 84; **P-09**, 61; **P-10**, 126; **P-11**, 132, pl. 24.

Gorgona, **P-08**, 86.

Hydraulic excavation, Agua Dulce, **P-10**, 196, pl. 48.

Mount Hope station, **P-07**, 76; **P-08**, 86; **P-10**, 135; **P-11**, 127; **P-14**, pl. 18.

Mount Zion, **P-08**, 85.

Paraiso, **P-08**, 85.

Station, central, Pacific division, **P-10**, 177.

Tabernilla, **P-08**, 84.

Pumps and Motors.

Chain-fender sump pumps, **P-14**, 113.

Drainage sump and culvert pumps, **P-14**, 114, 124.

Dredging pumps, hydraulic excavation, Pacific division, **P-10**, 177.

Lock-operating machinery, **P-12**, 90.

Motors and, for cable crossovers, **P-14**, 125.

Spillway, **P-12**, 89.

Purchases. (See Contracts; Material; Supplies; see Nos. 147, 227, pp. 2364, 2366 of this Index.)
Act relating to purchase of Panama R. R. by U. S., **P-11**, 550.

Executive order to prevent unauthorized purchase of supplies and equipment from persons in Army and Navy, **P-12**, 612.

General purchasing officer, reports. (See No. 274, p. 2368 of this Index.)

Important items since beginning of canal work, **P-13**, 392.

Local, on Isthmus, **P-08**, 229.

Methods toward close of canal work, **P-12**, 383.
Regulation, **P-05**, 159.

To be purchased from lowest responsible bidder in U. S. except when price is unreasonable or extortionate, acts, **P-11**, 560.

Purchases. Operations.

1905. Materials and supplies obtained through various offices in the U. S., the general purchasing office located at Washington. Bids called for on basis of price delivered on the Isthmus. Rates on the Panama steamships from New York equalized for all roads delivering to it: Medical supplies, etc., obtained from medical supply depot of the

Army at New York. Purchases to amount of \$9,000,000. List of. Complete inventory of material, etc., acquired from the New Panama Canal Co. found inexpedient. Two steamships purchased to provide facilities for the increased freight and passenger movement; chartered to the Panama R. R. Co. **P-05, 15.**

1906. June 25, 1906, Congress resolved, " * * that purchases of material and

equipment for use in the construction of the Panama Canal shall be restricted to articles of domestic production and manufacture, from the lowest responsible bidder, unless the President shall, in any case, deem the bidder or bidders therefor to be extortionate or unreasonable," **P-06, 14.**
(See Material and Supplies.)

Q.

Quantities, Table of.

Estimates, canal cost, **P-09, 350.**

Quarantine. (See Harbors; see No. 107, p. 2363 of this Index.)

Ancon, **P-10, 433.**

Bocas del Toro, **P-07, 209; P-10, 433; P-11, 530; P-12, 555.**

Division, quarantine, **P-14, 65.** (See No. 270, p. 2368 of this Index.)

Panama-Ancon, and Colon-Cristobal, **P-07, 209; P-10, 433; P-11, 530.**

Ports, zone, **P-10, 433.**

Provision for, Executive order, **P-13, 625.**

Regulations, and bills of health, **P-13, 626.**

Service, quarantine, **P-08, 323; P-09, 330; P-10, 433; P-12, 555; P-13, 553.**

Station, Culebra Island, **P-11, 480, pl. 77.**

Quarantine, Efficiency of.

Although plague, yellow fever, and smallpox have been prevalent in ports to the north and south of Panama, none of these diseases gained a foothold in the city. Plague appearing at La Boca was stamped out. Outbreak of yellow fever at Colon isolated (1 of the 2 cases fatal); 39 cases of smallpox at Colon; 2 deaths. **P-06, 30.**

Quarries. (See Breakwaters; Costs; Excavation; Geology; Rock.)

Ancon, **P-09, 104, 134, pl. 65; P-10, 195, pl. 51; P-11, 189; P-12, 202; P-13, 184; P-14, 43, 208.**

Breakwater quarries, **P-12, 117, 117; P-13, 113; P-14, 226.**

Comparative statement, Porto Bello, **P-10, 118; P-12, 117.**

Cost of product, Porto Bello and Ancon, **P-11, 296; P-12, 116.**

Crushers, Ancon, **P-10, 195; P-12, 115; P-13, 184.**

Crushers, Porto Bello, **P-09, 66, pl. 23.**

Excavation, Ancon stone quarry, **P-09, 97.**

General plan, Ancon, **P-09, 134, pl. 57.**

Geology, Ancon Hill, **P-13, 582, pl. 74.**

Large rock, Porto Bello, **P-12, 119.**

Layout of crushers and storage bin, Ancon, **P-09, 134, pl. 58.**

Loading rock, Lidgerwood flat cars, Toro Point, **P-11, 132, pl. 6.**

Mining, Ancon, **P-09, 98; P-12, 202; P-13, 184.**

Performance, Ancon, **P-12, 203.**

Porto Bello, **P-09, 48; P-10, 136, pl. 18; P-12, 115.**

Possibilities, zone, **P-13, 575.**

Product for public works, Ancon, **P-09, 104.**

Rio Grande, **P-09, 104; P-10, 182.**

Stone, Ancon Hill, **P-09, 97.**

Tracks, Ancon, **P-09, 98.**

West face of quarry, Porto Bello, **P-11, 132, pl. 26.**

Quartermaster.

Reports. (See No. 245, p. 2367 of this Index.)

Quartermaster's Department. Operations.

1905. Quarters: Old houses of the French company made available. Dormitories constructed, and new houses. Quarters assigned under definite regulations; details. Views of hotels. General specification for barracks for laborers. Cottages for married employees; views. **P-05, 44.**

1906. (See pp. 1263, 2364 of this Index.)

1907. Building construction division: Embraces construction of buildings for the different departments and divisions of the Isthmian Canal Commission. 656 quarters for gold employees built; 335 for silver employees (consisting of barracks, bathhouses, cook sheds, kitchens, etc.). 33 buildings built for sanitary department. Larger office quarters constructed at Empire and Ancon. School building built at Culebra, and similar ones begun at other points. Seven mess halls for American employees, and 11 for laborers completed. Large hotel at Tivoli completed. Machine shed, engine houses, pattern shop, etc., numbering 10, completed.

Extensive plants at Paraiso and Empire begun. Commissaries, storehouses, coal chutes, etc., built. Four clubhouses built. Manufacturing plants operated at Ancon and Lirio. Expenditure, manufacturing, \$276,884.19. 252 of the 2,265 buildings received from the French repaired; 113 destroyed. A total of 767 new buildings were built; on hand June 30, 1907, 2,919 buildings of all classes. Six buildings begun at Porto Bello. Fire houses, jails, churches, post offices, fumigation houses, etc., built along the line.

Employees: 3,570 men; spent, \$4,357,587.57; largest item being \$1,432,415.51 for American quarters. \$482,502.88 for silver quarters. Hospital buildings, \$315,196.57. Supervision and clerical force, \$193,763.73.

Architect's office: 145 finished sets of drawings, consisting of 605 tracings, etc. **P-07**, 12, 13.

1908. Building construction: New buildings, 505 during the year; 1,147 American buildings repaired; additions made to 423 buildings. 1,178 French buildings repaired and additions and improvements made to 275.

Expenditures: \$3,086,138.01.

Employees: Average, 2,366.

Pay: Gold men, \$0.625; silver men, \$0.169.

New buildings: \$2,181,913.39 spent for these; largest item being quarters for gold employees, \$982,771.86.

Total cost: Since American occupation, \$9,824,089.15 (\$421,882.64 being for wire screening, with which all buildings are inclosed).

Important items of construction done: During the year, 33 hospital buildings, 37 storehouses, 7 fire-department houses, 9 laborers' bathhouses, 26 laborers' range closets, 6 fumigation houses, 5 corrals, 9 schoolhouses, 5 commissaries, 1 clubhouse, 4 post offices, 9 office buildings, 2 lodge halls, 18 standard laborers' barracks, 5 band stands, 2 Gallego mess halls, 5 hotels, 4 jails, 8 powder and detonator houses, 4 markets, 35 shop buildings, 8 laborers' washhouses, 3 bridges, and 200 type quarters for gold employees. There are 24 different types of living quarters for the accommodation of gold employees. Total number of buildings built since U. S. occupation, 1,462; total on hand, 3,313.

Ancon wood and machine shop: Cost, \$39,327.87 for labor; 70 men.

Lirio planing mill: Principal manufacturing shop of the division. 56 men. Annual cost, \$55,880.59. All millwork for buildings done at this shop.

Ancon stone crusher: Operated to furnish stone for masonry division. 2,002 c. y. stone crushed. Cost, 88 cents per c. y.

Cement plant, Ancon: 17,969 concrete blocks made; cost, 12½ cents per cubic foot.

Costs: Various measures in force for reducing costs. Economic building work stimulated by a comparison of the cost of buildings erected by contract. Principal type of

buildings constructed by Isthmian Canal Commission costing from 7½ to 9½ cents per foot for bachelor apartments, and from 11 to 13 cents for family quarters. **P-08**, 18, 19.

1909. Organization: Repairs of buildings, not exceeding \$200 in value, placed under the Q. M. department Aug. 1, 1908; the construction work under the various division engineers. Order modified, and effective July 1, 1909, construction and repair of all buildings placed with Q. M. Division of materials and supplies merged, Sept. 1, 1908, into the Q. M. department. On the same date, grass cutting and disposal of night soil and garbage taken over from sanitary department. Physical accountability of property instituted Oct. 1, 1908, with audit by the chief Q. M.

Labor: During the year, 1,093 new employments and 884 reemployments made on the Isthmus; of those appointed in the U. S., 754 arrived on the Isthmus. These figures point to a decrease of over 50 per cent in the number of men employed in the U. S., and 40 per cent in the number of men employed and reemployed on the Isthmus; indicating a more stable population, although there has been an actual decrease in the personnel of the gold force. Steady increase of the unskilled labor force continued until its maximum on Apr. 28, 1909; then 33,699 actually working for the Isthmian Canal Commission and Panama R. R. (largest force on record). Decrease in number of Europeans brought to Isthmus; Spanish Government prohibited emigration to Panama. Assignment of married quarters not guaranteed, beginning Jan. 1, 1908, to those on gold rolls. June 30, 1908, 306 applications for married quarters on file; June 30, 1909, 115 applications from those entitled to quarters and 305 applications from employees not so entitled.

Buildings: Kept in repair; extensive repairs necessary due to climate and insects; minor repairs during last 6 months of the year averaged about \$20,000 monthly. New building done by contractors; Isthmian Canal Commission furnished materials. Repairs, etc., done by Q. M. forces.

Transportation: 12 corral, with 500 mules, 139 horses and ponies; and 136 private animals. Delivery system reorganized to decrease expense.

Supplies: Delay in securing necessary supplies a difficulty, because of distance from available markets and limited transportation facilities to the Isthmus. Annual estimates instead of scattered estimates adopted; and yearly contracts. Specifications being standardized. Storehouses at Culebra and Paraiso consolidated. Main distributing storehouse at Mount Hope. Total value of material received during the year, \$9,600,000; stock on hand June 30, 1909, totaled \$3,000,000. Two new dynamite storehouses erected.

Inspection of magazines, and special transportation of explosives instituted.

Printing plant: Moved from old administration building at Panama to new structure at Mount Hope; consolidated with that of the Panama R. R.

Sanitary work: Grass cutting; garbage removal, etc., taken over by the various district quartermasters Sept. 1, 1908. Work done costs less; appearance of settlements improved.

Property: New system begun, Sept. 15, 1908, that of U. S. Army. An exact check instituted on all property. P-09, 23, 24.

1910. Department charged with recruitment of labor; care, furnishing, and assignment of quarters; distributing fuel, commissary supplies, and distilled water; construction and repair of all buildings; requisitioning for supplies of all kinds, together with receipt and distribution; cutting of grass and disposal of night soil and garbage as prescribed by sanitary department, and auditing of property returns. In charge of Lt. Col. C. A. Devol, chief quartermaster.

Effective July 1, 1909, construction work connected with quarters and other buildings reduced so as not to warrant maintenance of separate gangs by each construction division for erection of buildings; this and all repair work transferred to Q. M. department. Operation of Dock 14, Cristobal, transferred from Panama R. R. to Q. M. department Dec. 1, 1909. Test inventories having disclosed unsatisfactory methods in handling and accounting for property, storehouses at Gatun, Cristobal Dry Dock, and Porto Bello transferred from Atlantic division to Q. M. department Jan. 1, 1910; on same date storehouses at Balboa and Miraflores in Pacific division also transferred, thus placing all storehouses under Q. M. department. Requisitioning for skilled labor transferred from Q. M. department to chairman's office.

Average gold employees, 4,369; and of Panama R. R., 753; or total of 5,122. 2,890 separations from service, and there were employed in U. S. 1,099, on Isthmus 1,092, and reemployments on Isthmus 967, or total of 3,158, indicating more than 60 per cent of force changed during year, showing usual unstable condition of gold force.

Laborers recruited, 2,519; West Indians, larger part from Barbados. Last recruiting, Jan., 1910, since which date immigration exceeded emigration, and, as work has reached maximum, population of zone furnishes ample labor. There has always been independent immigration from West Indian Islands, but it was not until within last 4 months there has been any such movement on part of European laborers. During this period 2,000 came from Spain and Italy. From beginning of year steady increase in force, until maximum—38,676—reached Mar. 30, 1910, including Panama R. R. and relocation, and is largest force on record. Since that a slight decrease, but total effective

force June 30 was 35,578, as compared with 33,493 June 30, 1909.

New quarters constructed, 19 houses for married employees, or 38 families. Eleven buildings, accommodating 29 families, converted into "gold" married quarters. Bulk of new construction at Ancon and Gatun. Under conditions of employment Isthmian Canal Commission obliged to furnish married quarters to all employed prior to Jan. 1, 1908, and all such employees supplied. Of those employed subsequent to Jan. 1, 1908, 525 applications for married quarters. Expansion of work at Gatun created demand for bachelor quarters, and four type 18 houses for 192 bachelors constructed.

Every building on Isthmus utilized, and as progress of work caused employees at Culebra, Empire, and Paraiso to decrease, vacant bachelor quarters have been utilized for "nonhousekeeping married quarters" for employees working at points where unable to secure family quarters. Suites of two or three rooms assigned to each family.

Negroes in quarters remain practically the same—4,925 bachelors and 1,067 families. Increase of 1,300 Europeans occupying Isthmian Canal Commission quarters.

Work performed for sanitary department increased, grass cutting covering largely increased acreage, and increase in population has increased garbage. New incinerator installed at Empire, and new ones erected at Pedro Miguel and Miraflores.

Corral constructed at Ancon; largest on Isthmus; useful after completion of canal. More animals available and used than at any previous period. Unusually heavy loss of mules, due to "swamp fever."

3,078 buildings in zone owned by Isthmian Canal Commission, of which 1,147 acquired by purchase from French. \$478,000 expended for new construction and repairs during year in completing 90 new buildings of every class of construction, clubhouses, hospital wards, corrals, engine houses, storehouses, fire stations, markets, schoolhouses, and quarters; 50 constructed by contract. Reduction in unit cost, 30 per cent type 14 and type 17 houses, and 33 per cent in type 18 houses; cost of repairs, \$78,980. Four traveling gangs of carpenters and two of painters organized.

Total material received from U. S., 350,000 tons, valued at \$10,103,552.34. Local purchases, including coal and oil, \$2,094,131.02; 345,185 tons coal and 465,921 barrels fuel oil used. Stock in storehouses at end of year, \$4,691,034.10. Experiment of annual contracts for standard articles satisfactory; has diminished time between placing of requisition and delivery of material on Isthmus, resulting in fewer shortages of stock in storehouses.

Transfer of Dock 14 from Panama R. R. resulted in reduction of charges, rate on handling general cargo reduced from 40 cents

per ton to 32 cents. Since transfer 100,000 tons handled over dock. Storehouse facilities added at Porto Bello, Gatun, Miraflores, and Balboa.

1911. Transfer of Gatun lumber yard from Atlantic division July 15, 1910; construction of storehouses for care of obsolete material Aug. 24, 1910; transfer of storehouse at Pedro Miguel from mechanical division Oct. 11, 1910; transfer of construction and repair of sidewalks from construction divisions Sept. 1, 1910; transfer of Panama R. R. storehouse at Cristobal Jan. 1, 1911; closing of Lirio planing mill and transfer of work and force to mechanical division Apr. 1, 1911; transfer of scrap operations from Panama R. R. Apr. 10, 1911; and transfer of storehouses containing dredge repair parts at Gatun and Cristobal from Atlantic division Apr. 15, 1911.

Average employees of Panama R. R. and Isthmian Canal Commission at maximum for year in Jan., 1911, when it fell to 37,271. Minimum June, 1911, when it fell to 32,690. Average gold employees of Isthmian Canal Commission, 4,552; of Panama R. R. Co., 833; or total of 5,385. 2,896 separations from service—employed in U. S., 987; and employed on Isthmus, 1,488—indicating more than 60 per cent of force changed during year, unstable condition of gold force still ruling.

First year since inception of work no contract laborers brought to Isthmus. Decided falling off in immigration to zone. Excess of arrivals over departures, 4,910, against 21,114 during previous year. Departure of steerage passengers to foreign ports exceeded arrivals by more than 1,600, and probable at least 1,000 were Europeans. Number of West Indian laborers have gone to the brush and can be relied upon no longer for steady work.

New family quarters erected only at Toro Point. Bachelor quarters became available and utilized for nonhousekeeping quarters; at close of year 122 families accommodated. When work in Chagres section closed in spring, all laborers and gold employees of that division in San Pablo and Tabernilla district transferred to other districts and houses made available assigned to employees of other districts unable to secure family quarters.

Total West Indians in laborers' barracks 200 less than at close of preceding year, and of Europeans 1,000 less. Laborers' barracks in territory Bohio to Mamei abandoned. Camps at Santa Cruz, Cucaracha, and Cartagena abandoned and buildings at Santa Cruz demolished and sold.

Two additional traveling gangs were formed, one of carpenters and one of painters, and corresponding reduction of artisans in districts made. Nine buildings and one addition put up under contract at total of \$44,429.30, nearly all at Toro Point. Con-

tract price on types of houses erected showed reduction; 29 buildings were taken down in sections and reerected at other points. Total buildings June 30, 1911, 2,985, as compared with 3,078 June 30, 1910. Increase in American buildings and decrease of 112 in number of French buildings; 86 buildings demolished and 109 sold.

Centralization of storehouses under one head resulted in more efficient operation. Surplus stock concentrated at Mount Hope, Empire, and Gorgona, certain classes of material being localized, so that steam-shovel, drill repair parts, and electrical material concentrated at Empire, and air-brake material, lubricators, injectors, car, locomotive, and other similar repair parts concentrated at Gorgona. Policy of stock reduction may make it necessary to resort more frequently to emergency purchases, but it is in line with ultimate economy.

Besides regular delivery work and that performed for sanitary department, teams used in construction of Sweet Water Reservoir at Toro Point; Gatun Reservoir; road work between Pedro Miguel and Corozal; street work at Panama and Colon and on the Obispo diversion. Teams and brakes used by department of civil administration during school year. Loss of mules not as heavy as during preceding year; 54 animals died, were condemned, sold, or destroyed. No mules purchased during past two years and no new saddle horses during past two and one-half years. Majority of stock has been in service on Isthmus four to five years and is beginning to show effects.

Work for sanitary department increased, grass-cutting area further extended. Removal of garbage slightly increased. New incinerator installed at Gatun Nov., 1910, and road built to it from New Gatun. Amount expended by Q. M. department on orders from sanitary department for zone sanitation, \$210,403.29, and for hospitals, quarantine, etc., \$77,284.48.

Removing French scrap iron and steel and shipping it to States continued, and since Apr. 10, 1911, under direction of Q. M. department. From inception of work to end of fiscal year 28,933 long tons of iron and steel shipped and disposed of at average selling price of \$11.86 per ton. In addition, 231,598 pounds old screening shipped and sold at average selling price of \$7.75 per cwt.; 58,689 pounds of rope at average selling price of \$2.15 per cwt.; 83,188 pounds of rubber at average selling price of \$2.01 per cwt.; and 113,904 pounds of hose at average selling price of \$2.50 per cwt. Advertisements issued seeking new bids for sale of all French scrap on Isthmus.

Department attends to all purchases on Isthmus, and amount expended in such purchases aggregated \$2,440,226.40, of which \$1,547,568.71 for purchase of coal from Panama R. R. Co., \$772,901.22 for crude oil from Union

Oil Co., \$103,703.62 for miscellaneous purchases from the Panama R. R. Co., leaving \$15,870.10 for purchase of miscellaneous supplies from local merchants; balance used for postage stamps.

1912. Employees on Isthmus fluctuated during year; Mar., 1910, highest recorded force 38,676; June 30, 1911, 32,690; and June 30, 1912, 34,957 men. While there was decrease between June 30, 1911, and June 30, 1912, of approximately 2,900 men in Atlantic division and on relocation of Panama R. R., this more than offset by increases because of construction of docks at Cristobal under Panama R. R., terminals at Balboa under Pacific division, work of first division of O. C. E., and fortifications. Immigration to Isthmus continued to decrease; excess of arrivals over departures, 3,510. At beginning of fiscal year 941 laborers recruited in Barbados and islands adjacent thereto, to meet demand for unskilled labor, which could not be recruited on Isthmus from unemployed living in the brush. Supply of and demand for labor about balanced at end of year. During last three months of year 1,339 laborers taken over by United Fruit Co. for work in Guatemala.

Average American employees, 4,264; on rolls of Panama R. R., 837; or total of 5,101; 2,123 separations from service—559 persons employed in U. S. and 1,286 employed on Isthmus, indicating more than 49 per cent of force changed.

22 new buildings constructed, at total cost of \$26,000; of these, fire station at Cristobal, caretaker's residence at Brazos Brook Reservoir, and type 27 at Toro Point cost \$21,000; remaining 19 costing \$5,000. Fire station and caretaker's house permanent structures of concrete. 18 additions to existing buildings made, at cost of \$71,000; of this \$63,000 expended for alterations and additions to Hotel Tivoli. 36 buildings taken down in sections and moved to new locations, at cost of \$58,000. 15 buildings demolished, material moved to other points and used in construction of 13 buildings, costing \$26,790.30. Of these 51 buildings, 14 removed from Culebra on account of slides and 25 from Tabernilla and San Pablo on account of flooding of lake area. Removal and reerection of American buildings still good, but useless in old locations, accounts for small amount of new construction. Purchase from Pacific Mail Steamship Co. of their undivided half interest in islands in Pacific brought with it 22 buildings, utilized for quarters in connection with fortifications. Of old French buildings, 149 sold, realizing \$8,000, and 131 demolished; loss of 280 buildings. Of 2,148 buildings turned over by French, 1904, 850 remain. Laborers' camp at White House and other buildings in Las Cascadas district altered and repaired

as quarters for Tenth Infantry, U. S. Army. These alterations and repairs made at expense of \$50,000, payable from appropriation for barracks and quarters, U. S. Army.

Analysis of census of occupants of quarters shows decrease of 300 Americans and increase of 700 West Indians in quarters. Number of Europeans remains the same. Of Americans, 210 employees of McClintic-Marshall Construction Co. Census also shows 48 per cent of married men and 20 per cent of bachelors hired prior to 1908. No diminution in demand for married quarters; applications on file June 30, 1912, or 54 more than year before.

Few annual contracts made during spring, as on certain classes of stock prospective requirements so small that orders can be placed when needed.

Quantity and value of supplies received from U. S. larger than during any previous year; 504,004 tons of material, with value of \$10,517,260.99. This does not include piling nor material for McClintic-Marshall Construction Co. Decrease in cement receipts, but increase in amount of piling and of over 4,000,000' b. m. in lumber. Large amount of material recovered from work and returned to stock. Central and Atlantic divisions and relocation, part of whose work completed, turned in material to value of \$680,000. Clean-ups of repair shops made, and repair parts, fittings, and miscellaneous material turned in in large quantities. Total amount of reduction, including material turned in, \$1,652,969.34.

So far, but little of Isthmian Canal Commission's plant retired. Material to value of \$193,313.34 surveyed and turned into storehouse for obsolete material, amount remaining, at price-book prices, \$369,000. Quantity such that additional facilities had to be provided and addition to storehouse for obsolete material constructed. Property to value of \$21,704.65 reissued and \$10,708.94 disposed of by local sales from storehouse for obsolete material. Much of obsolete material and equipment advertised for sale Feb.; bids on 18 classes rejected and awards made on 8 classes for \$20,858.

On Sept. 26, 1911, contract entered into for sale of all French scrap on Isthmus for \$215,000. Approximately 10,000 tons collected for shipment. About 4,603 tons of American scrap collected at Empire and Gorgona shops and stored at Mount Hope. Of this, 1,892 tons shipped and sold in New York at price of \$10.35 per ton, the net price being about \$5 per ton. Sales of scrap screening, rope, rubber hose, and rubber belting continued. Contract, Oct. 12, 1911, for delivery at New York of screening at \$8.25 per cwt., rope at \$2.18 per cwt., rubber at \$2.10 per cwt., and hose at \$2.50 per cwt.

Work for sanitary department, consisting of grass and brush cutting, disposal of night soil and garbage, continued. In accordance with recommendations of a board, grass-cutting areas in various districts plotted and measured and regulations compiled for sanitary inspectors and district quartermasters with reference to method of handling work performed by Q. M. department for department of sanitation. Less grass cutting done since Jan. 9, 1912, as objection raised by sanitary department that keeping grass cut close around quarters not necessary except for æsthetic reasons, and that it could be allowed to grow a foot high, so far as sanitary purposes concerned. As there are no funds available except for sanitary grass cutting, no work of this kind done under existing regulations except on requests by sanitary department. Cost of sanitary work done by Q. M. department, \$251,768.07.

Regular delivery work done by Q. M. department continued, and, in addition, delivery service furnished to Tenth Infantry. Horse mowing machines introduced into all districts, which necessitates use of more teams by sanitary department. 24 horses and mules condemned and destroyed, 10 condemned and sold, 6 killed, and 8 died; total of 48. No animals purchased for over 3 years, and service of those in corrals averages over 6 years.

All purchases on the Isthmus aggregated \$2,639,416.09, of which \$1,540,700.65 for coal from Panama R. R. Co., \$978,055.26 for purchase crude oil from Union Oil Co., and \$96,176.24 for miscellaneous purchases from Panama R. R. Co., leaving \$24,035.94 for purchase of miscellaneous supplies from local merchants. Balance used for postage stamps.

1913. May 27, 1913, Capt. R. E. Wood, U. S. Army, appointed chief Q. M. Force employed increased steadily during first 9 months, until Mar. 26 number reached highest point in history of work; on that date effective working force was 44,733, of which 39,089 on pay rolls of Isthmian Canal Commission and Panama R. R. and 5,644 on pay rolls of contractors handling work on lock gates, emergency dams, and other contracts. Force fluctuated between 34,957, June 30, 1912, to maximum on date specified, and numbered 43,350 at close of fiscal year. In Dec., 1912, necessary to recruit laborers, and 528 received from Barbados during Jan. and Feb., 1913. Decided decrease in immigration to Isthmus as compared with previous years. Excess of arrivals over departures but 3,510. Average American employees on rolls of Isthmian Canal Commission, 4,340; and on rolls of Panama R. R., 870; or total of 5,110. 2,495 separations from service—1,010 persons employed in the U. S. and 1,331 employed on the Isthmus, indicating that more than 57 per cent of gold force changed.

Isthmian Canal Commission has 2,618 buildings in zone, of which 1,856 constructed by Ameri-

cans and 762 by French. Decrease of 121 from total of preceding year. Buildings located at Nombre de Dios abandoned when this locality ceased to be used as a source of sand supply; sold. In addition, 122 demolished and 4 blown down or destroyed by fire. Those demolished located at Bas Obispo, Culebra, Balboa, and Naos Island, and destruction necessary by reason of work or on account of slides. Those demolished small and of no value. New construction less than at any previous time; 20 buildings put up and 15 additions made. Buildings small and only two cost over \$2,000. Additions as a rule chargeable to Hotel Tivoli. Due to slides at Culebra and necessity of transferring buildings from Gorgona and old Balboa, work of removal and reconstruction on large scale. 62 buildings taken down in sections and reconstructed in new locations. Completed work amounted to \$142,000, not including buildings in course of reconstruction June 30, 1913, on which \$33,000 already expended. Up to Apr. 1 new construction, moving, and part of maintenance work handled by 5 traveling gangs of carpenters. All American buildings in Gorgona had to be removed and reerected by Sept. 1, 1913, so that 9 new gangs formed to complete work on schedule time.

On June 30, 1913, 23,184 men, women, and children occupying quarters, practically same as during previous year. Of these, 9,173 in gold quarters, 4,295 in European quarters, and 9,716 in West Indian quarters. Over 90 per cent of American and European employees occupy Isthmian Canal Commission quarters, but less than 25 per cent of West Indians take advantage of them. Problem of housing, employees properly difficult one. Because of opening up of terminal work congestion, especially in bachelor quarters, in this territory. Necessary to move and reerect a large number of houses for use as quarters. Demolition of old settlements of Balboa and Gorgona complicated situation. In moving Gorgona necessary to care for 200 American families, 600 American bachelors, and several hundred West Indians. Movement began in Mar. and was almost completed at close of year.

Value of material received from U. S. greater than for any preceding year; \$13,980,071, not including \$2,535,860 paid to McClintic-Marshall Construction Co., or value of local purchases amounting to \$2,733,867. Consumption of cement decreased from 1,600,000 barrels, 1912, to 1,200,000 barrels, 1913; total consumption to date, 5,797,910 barrels. During year all cement was purchased in sacks, of which 33,475,408 received and 29,882,968 returned to U. S.; of those returned, 269,775 sacks rejected, or less than 1 per cent returned. Consumption of lumber 27,000,000' b. m., about the same as preceding year, and total receipts of lumber since inception of work 231,000,000' b. m. Stock on hand at all storehouses June 30, \$3,436,995; decrease of

\$234,217 from stock June 30, 1912. Actual reduction greater than net decrease would indicate, as approximately \$638,000 worth of material returned to stock by various divisions. Problem of supply especially difficult during year. As work draws to completion considered advisable to keep stock on hand at as low a figure as possible and operate on close margin. This necessitates large number of rush and cable orders, increasing work of supply department on Isthmus and of purchasing agency in U. S. Hoped that spare parts now in stock can be worked off, particularly car, steam shovel, and locomotive repair parts. before completion of work.

Under contract for sale and removal of French scrap, entered into Sept., 1911, 21,730 tons collected from points along line and shipped to storage yard at Cristobal. Price, \$215,000. Time allotted for removal of material, 3 years; almost 2 years have elapsed and Isthmian Canal Commission received but \$13,473. Contract entered into with Chicago House Wrecking Co. covering American iron and steel scrap already accumulated or that would accumulate during fiscal year. Scrap totaled 12,109 tons. Payment to be made on ship's bill of lading as shipped from Isthmus; the Isthmian Canal Commission received only \$18,571, as but 2,466 tons shipped. Sale of scrap screenings removed from buildings netted \$6,866 and scrap rope and hose sold to value of \$4,693. Approximately \$75,000 realized from sale of copper and brass scrap accumulated in operation of Gorgona brass foundry.

Besides regular issues to departments and divisions, sales made to employees, contractors, private individuals, and companies, total aggregating \$106,037.77. Value of stock at obsolete storehouse June 30, \$431,916, an increase of \$70,000 over total on hand at close of previous year. Bids invited for material in obsolete storehouse Feb. 23, 1912; of 24 classes advertised awards made on 6, as either no bids received on other classes or bids below upset price. Under circular issued Feb. 1, 1913, satisfactory bids received on only 4 of 27 classes. These sales demonstrate method of sale of entire equipment and material not satisfactory. Believed that best results would be obtained by placing fair upset price on such material and equipment and selling it when opportunity offers. Board of appraisal appointed to place values on all articles offered for sale. Under this arrangement equipment to value of \$32,000 sold and paid for. In addition, \$18,670 worth of equipment appraised sold to United Fruit Co. in June, 1913, but delivery not yet been effected.

All purchases on Isthmus aggregated \$2,733,867, of which \$1,492,322.52 were for coal from Panama R. R., \$395,408.92 for crude oil from Union Oil Co., and \$223,208.26 for miscellaneous purchases from Panama R. R. Co., leaving \$22,672.81 for purchase of mis-

cellaneous supplies from local merchants. Balance used for postage stamps.

Work done for sanitary department, consisting of grass and brush cutting, disposal of night soil and garbage, continued. Grass cut on request from sanitary department. Total cut, 7,356 acres, of which 4,822 acres cut by scythe and 2,534 acres by horse mower. Area covered by sanitary work, 2,980 acres. Cost of sanitary work done by Q. M. department, \$125,983.21.

Animal transportation inadequate to meet demands, and 50 mules purchased at a cost of \$10,562, reaching Isthmus May 26; scarcely replaced animals condemned or which died. Six horses and 20 mules condemned and destroyed and 5 horses and 4 mules died; total of 35 animals. **P-13**, 53, 57.

1914. (See No. 267, p. 2368 of this Index.)

Quarters, P-08, 247; **P-09**, 208; **P-10**, 306; **P-11**, 354; **P-12**, 378; **P-13**, 373. (See Employees; Labor; Quartermaster; see Nos. 90, 126, 224, pp. 2363, 2366 of this Index.)

Cost, **P-07**, 139, 143.

Culebra, **P-07**, 96, pl. 126.

Empire, **P-07**, 96, pl. 121.

Occupants, **P-08**, 253; **P-09**, 208; **P-10**, 311;

P-11, 359; **P-12**, 378; **P-13**, 386; **P-14**, 297.

Physicians', **P-10**, 434, pl. 68.

Silver employees, **P-09**, 209.

Sleeping quarters, Europeans, **P-07**, 96, pl. 119.

Sleeping quarters, negroes, **P-07**, 96, pls. 117, 118.

Quarters, Bachelor.

Gold roll, **P-09**, 208.

Room, Culebra, **P-09**, 220, pl. 96.

Quarters, Department of. (See above.)

Organization, chart, **P-07**, pl. 145. (See No. 224, p. 2366 of this Index.)

Reports, **P-07**, 139-143. (See above.)

Quarters, Labor, and Subsistence.

Costs of department, **P-07**, 143.

Quarters, Marine.

Appropriation for, **P-13**, 607.

Quarters, Married, P-14, 297.

Applications for, **P-10**, 311; **P-11**, 359; **P-12**, 378; **P-13**, 386.

For Americans, **P-09**, 208.

Quarters, Permanent, P-14, 313.

Quarters, Sick In. (See Civil Administration; Health.)

Quays. (See Harbors; Terminals; Walls.)

Construction, Pacific terminals, **P-14**, 196, 204, 205.

Section of walls, **P-13**, 220.

Walls, Pacific terminals, **P-13**, 198, 219.

Walls and pier, **P-14**, 41.

Quellenec, M. (See No. 164, p. 2365 of this Index.)

Quinine.

Issues of, **P-08**, 315; **P-09**, 324; **P-10**, 432; **P-11**, 528; **P-12**, 554; **P-13**, 552.

R.**Haces.**

Deaths by. (See Sanitation.)

Rack.

Rack track, locks, **P-14**, 108.

Radlos.

Executive order concerning, **P-14**, 60.

Radio stations, equipment, **P-14**, 180, 192, 320.

Rail.

Sales of, **P-14**, 307.

Railings, P-13, 74.**Railroads.** (See Railways, below; see Bridges, Equipment, Panama R. R.)

Automatic railroad signals, **P-13**, 272, pls. 63, 64.

Construction along ridge, Gatun, **P-09**, 138.

Crossing, Gatun River and Valley, **P-09**, 138; **P-10**, 198.

Emergency traffic, joining track, **P-10**, 197.

Equipment, proper, Tropics, **P-05**, 138.

Narrow gauge, Pedro Miguel, **P-10**, 163.

Reorganization, Panama R. R., **P-05**, 18.

Street Railway, Panama, **P-07**, 149.

Tracks, maintenance difficult in Tropics, **P-05**, 138.

Rail-top Box, Standard.

Pile foundation, Panama R. R. culvert, **P-09**, 142, pl. 72.

Railways. (See No. 157, p. 2364 of this Index.)

Equipment: 92 locomotives, 800 40-ton cars, 325 dump cars, four 10-ton and four 20-ton locomotive cranes, 2 dipper dredges, and 1 tugboat delivered. Of the order of the Panama R. R., the following delivered: 24 locomotives, 500 box cars, 12 caboose cars, 6 passenger coaches, 10 refrigerator cars, 100 ballast cars, 2 flat cars, 1 tugboat, 2 wrecking cranes, and 1 pile driver. **P-06**, 11.

Rainfall. (See Meteorology.)

Agua Clara, **P-12**, 137.

Along the canal prism, 1907, 1908, **P-08**, 204, pl. 79.

Along location, **P-11**, pl. 120.

Along canal, annually, **P-12**, pl. 98; **P-13**, pl. 108.

Brazos, **P-07**, 76.

Colon dredging division, **P-08**, 50.

Diagram, central division, **P-13**, pl. 93.

Distribution of, 1909, **P-10**, 282.

Drinking water and, **P-08**, 112.

Excessive rainfall, 1905 to 1910, **P-10**, 282.

Gatun Lake and watershed, **P-13**, pl. 122; **P-14**, pls. 103, 104.

Hourly distribution, **P-11**, 256; **P-12**, 231; **P-13**, 228.

Isthmus, **P-10**, 276.

Maximum, 1905 to 1912, **P-12**, 230; **P-13**, 228; **P-14**, 146.

Minimum periods, **P-10**, 283.

Monthly, **P-10**, 279, pl. 126; **P-11**, pl. 121;

P-12, 228, 230; **P-13**, 226, 228; **P-14**, 145.

Run-off, retention curves and, Gatun, **P-12**, pl. 106.

View of Culebra Cut after heavy rains, **P-10**, 160, pl. 23.

Wind roses, dry and wet seasons, **P-11**, pl. 122; **P-12**, pl. 99.

Yardage and, diagrams, **P-08**, 36; **P-09**, 69;

P-10, pl. 102; **P-11**, pl. 104; **P-12**, pl. 82.

Zone, **P-10**, pl. 125.

Zone, 1905-1911, **P-11**, 256.

Randolph, Isham. (See Nos. 164, 210, p. 2365, of this Index.)

Equipment required for excavation, **P-08**, 405.

Ranges.

Beacons, Gatun Lake, **P-13**, 110, 116, pl. 18.

Constructing towers, **P-12**, 101.

Front tower, Atlantic division, **P-12**, 108, pl. 13.

Front tower, Gatun Lake section, on south middle approach wall of Gatun Locks, **P-12**, 108, pl. 14.

Front tower, Pacific entrance, looking south-east, **P-12**, 108, pl. 17.

Lighting, **P-13**, 12.

Pacific entrance at low tide, **P-12**, 108, pl. 15.

Plans of towers, **P-11**, pls. 90-92; **P-12**, pls. 13, 14, 15, 16, 17, 75.

Profile of, showing towers, lighting and buoying of the canal, **P-12**, pl. 75.

Range lights, clearing for, **P-12**, 101.

Range Tower No. 17, Gatun Lake section, showing submarine foundation, **P-13**, 110, pl. 15.

Range Tower No. 18, Gatun Lake section, **P-13**, 110, pl. 16.

Rear tower, Pacific entrance, looking north-west, **P-12**, 108, pl. 16.

Reinforced concrete stairway, Atlantic and Pacific division type of range towers, **P-12**, 108, pl. 18.

Rations.

Laborers' kitchens, **P-09**, 212.

Meals served at hotels, messes, and kitchens, **P-09**, 230.

Number and cost, European mess, **P-09**, 229.

Relative value of, supplied common laborers' kitchens, **P-13**, 397.

Relative value of, supplied European laborers' mess, **P-13**, 396.

Weight and cost, common laborers, **P-10**, 324.

Weight and value of, European laborers, **P-10**, 324.

Reading Rooms. (See Recreation.)

Real Estate.

Conveyance by married women, **P-11**, 433.

Rebuilding.

Shops, Balboa, **P-09**, 102.

Receipts. (See Nos. 63, 151, p. 2362, 2364, of this Index.)

Disbursements and, by regular heading of accounts, **P-08**, 350.

Disbursements and, table, **P-04**, 94, 95.

Report by Treasurer A. S. Kenny, **P-04**, 75, 76.

1905. Apr. 1 to June 30, 1905, U. S. funds including sales of material and supplies, water, lighting, commissary supplies, receipts from sanitary patients, rentals of land, taxes, work done, reimbursements, earnings of telegraph lines, etc., \$71,640.84. Zone revenues: Postal, internal revenues, court fees, fines, permits, etc., \$21,318.45. Total, \$92,959.29. **P-05**, 194.

1906. To June 30 and to Sept. 30, 1906, receipts, \$103,496,553.45. Disbursements, \$25,472,446.90. **P-06**, 118-127.

Recesses. (See Gates; Locks.)

Reclamations.

Land, terminals, **P-14**, 207.

Recreation Department. (See Clubhouse and Employees.)

1905. Isthmian Canal Commission convinced social environment of U. S. should be transferred to the Isthmus for American employees. Buildings assigned for churches; schoolhouses building. Houses to be provided for clubs. Reading rooms established. Vessel assigned for free excursions for employees. Free quarters for families of certain employees. **P-05**, 8, 9.

1906. Erection of clubhouses authorized, a few ready; cooperation with Y. M. C. A. in management of club centers planned. Authority given for erection of suitable accommodations for divine service, lodge purposes, etc. Employees solving the problem of entertainment and recreation themselves to a degree. **P-06**, 4.

1907. Four clubhouses completed; under management of Y. M. C. A., subject to an advisory board. "The influences of the clubhouses are excellent." Several religious buildings built. Upper floors of religious service buildings used as lodge rooms, etc. **P-07**, 34.

1908. Lodge and church buildings built. Five bandstands erected. Isthmian Canal Commission band played every Sunday at some point on the line. Clubhouses (4) under care of Y. M. C. A. successful; more recommended. **P-08**, 30.

1909. Type lodge houses erected at Empire and Gatun, band stand at Gatun, and chapel at Ancon; Isthmian Canal Commission clubhouses located at Culebra, Empire, Gorgona,

and Cristobal; operated under the Y. M. C. A. Allotment made for new one at Gatun, and for small recreation halls at Corozal and Porto Bello. Question whether additional clubhouses will be built; fixed charges a factor. **P-09**, 30.

1910. New clubhouse erected at Gatun at cost of \$21,312.88, and smaller hall at Porto Bello at cost of \$4,426.59. These 2 added to 4 clubhouses already constructed at Culebra, Empire, Gorgona, and Cristobal under supervision of Y. M. C. A. Membership largest in June, when it reached 1,643; average monthly membership for year, 1,264. Expenditures from Isthmian Canal Commission funds for clubhouses, \$38,812.41. Small recreation hall constructed at Corozal at cost of \$3,954.66; since completion, under management of employees themselves. **P-10**, 45, 46.

1911. Seven clubhouses in operation. Small recreation hall at Corozal, operated under employees, enlarged and turned over Jan. 24 to supervision of Y. M. C. A. Additions made to clubhouse buildings at Empire and Cristobal and additional bowling alley in stalled in each. Additions, including alleys, paid for from Y. M. C. A. funds at cost of \$4,762.80. Additional equipment, consisting of phonographs, umbrella racks, library books, bowling and pool equipment, and vibrators for the barber shops added. Average monthly membership for year, 1,947, as against 1,264 for previous year. Smallest membership for any month, 1,712, July, 1910; and largest, 2,121, Jan., 1911. Expenditures from funds for support of clubhouses, \$60,488.46, of which \$51,193.90 for operation of clubhouses and \$9,294.56 for equipment for new clubhouses at Gatun and Corozal. **P-11**, 57, 58.

1912. June 30, 1912, clubhouses in operation at Corozal, Culebra, Empire, Gorgona, Gatun, Cristobal, and Porto Bello, under supervision of Y. M. C. A. Bowling alleys, locker rooms, shower baths, and barber shop added to Corozal clubhouse at cost of \$5,000. Average monthly membership for year, 1,944, as against 1,947 for previous year. Smallest membership for any month, 1,784 for Aug., 1911, and largest, 2,092, June, 1912. Expenditures from Isthmian Canal Commission funds for support of clubhouses, \$50,565.61. **P-12**, 65, 66.

1913. June 30, 1913, clubhouses in operation at Corozal, Empire, Gorgona, Gatun, and Cristobal in zone, and at Porto Bello, about 20 miles down Atlantic coast. Clubhouse at Culebra removed because of slides and portion of building reerected at rear of administration building annex at cost of about \$1,700, paid from clubhouse funds. Bowling alleys, pool and billiard tables, soda fountain, barber shop, and reading room were thus provided in this new location. Entertain-

ments given in second story of schoolhouse. Average monthly membership for year, 2,023, as against 1,944 for previous year. Largest membership for any given month, 2,127, largest since organization. Expenditures from Isthmian Canal Commission funds for support of clubhouses, \$49,925.96. **P-13**, 68.

Reflectors.

Lighting system, Gatun Locks, **P-14**, pls. 87, 88, 89, 90.

Regulating Works. (See Works, Regulating; see No. 239, p. 2367 of this Index.)

Relations, Diplomatic.

Republic of Panama, etc., **P-07**, 146; **P-08**, 255; **P-09**, 257; **P-10**, 364; **P-11**, 414; **P-12**, 456.

Religion. (For Y. M. C. A. work, etc., see Recreation; see Nos. 98, 102, p. 2363 of this Index.) Cooperation of zone government in establishment of religious work, **P-05**, 58.

Relocation. (See Panama R. R.)

Rents. (See Civil Administration.)

Repairs.

 (See Buildings.)

Balboa shops and shipways, **P-11**, 170; **P-12**, 186.

Buildings, estimates, **P-09**, 347.

Cars, **P-11**, 241; **P-12**, 275.

Cost of, for machinery, **P-13**, 245.

Cost of, to equipment, **P-12**, 249.

Cost of, to plant and equipment, per unit of work accomplished, **P-10**, 231.

Division of motive power and machinery, **P-08**, 78.

Equipment, **P-10**, 231; **P-11**, 208; **P-13**, 245, 265.

Equipment, all, except locomotives, **P-11**, 241.

Equipment, marine, **P-11**, 214; **P-12**, 250; **P-13**, 246.

Equipment other than cars and locomotives, **P-10**, 273; **P-12**, 275.

Facilities, terminals, **P-12**, 219.

Field repairs, **P-13**, 265.

Heavy repair work, consolidation of manufacturing and, **P-11**, 223.

Hotel Tivoli, **P-13**, 399.

Locomotives, **P-10**, 271; **P-11**, 235; **P-12**, 275; **P-13**, 264; **P-14**, 259.

Mechanical appliances, **P-11**, 204.

Roads, fifth division, **P-13**, 183.

Shops, **P-09**, 102; **P-13**, 265.

Steam shovel, **P-10**, 156; **P-11**, 152; **P-12**, 166.

Waterworks, **P-11**, 180; **P-12**, 194; **P-13**, 182.

Representatives, Foreign.

Relations with. (See Relations, Diplomatic.)

Requisitions.

Important, 1904-1914, **P-14**, 302.

Material, **P-08**, 222.

System, **P-07**, 106.

Reservations.

Executive order relating to trespasses, **P-12**, 617.

Reservoir, High Service.

Ancon, **P-09**, 134, pls. 59, 66.

Reservoirs.

Agua Clara, **P-10**, 136, pl. 17; **P-11**, 125; **P-12**, 136; **P-13**, 132, 133.

Bacteriological examination, **P-07**, 78.

Brazos Brook, **P-08**, 83, 117; **P-09**, 64; **P-10**, 130; **P-11**, 128, 128; **P-12**, 134, 136, 139.

Camacho, **P-07**, pl. 3; **P-08**, 84, 116; **P-09**, 86.

Carabali, **P-08**, 84; **P-09**, 86.

Carabali or Gorgona, **P-08**, 117.

Coccolí, **P-11**, 176; **P-12**, 189; **P-13**, 178.

Concrete reservoir, Naos Island, **P-10**, 192, 196, pl. 53.

Cost of construction, Naos Island, **P-10**, 193.

Cost of construction, Palo Seco, **P-10**, 192.

Details, Camacho, **P-07**, 71.

Details, Rio Grande, **P-07**, 68.

Gorgona, **P-08**, 120, pl. 45.

Mount Hope, **P-07**, pls. 5, 6.

Naos Island, 100,000 gallons, **P-10**, pl. 119.

Pacific division, **P-11**, 176; **P-12**, 190.

Panama, **P-07**, pls. 3, 4, 5, 6.

Porto Bello, **P-08**, 70, pl. 34.

Rio Grande, **P-07**, 68; **P-08**, 116; **P-09**, 86, 105; **P-10**, 182; **P-11**, 176; **P-12**, 189; **P-13**, 178.

Rio Grande and Coccolí, **P-12**, 188.

Rio Grande, trackage to, **P-08**, 204.

Resignations.

Boiler makers, **P-11**, 226.

Resistances.

Water to soils, tests, **P-08**, 196, pl. 63.

Resolutions.

 (See No. 152, p. 2364 of this Index.)

Proceedings of the commission from the 61st meeting, Dec. 8, 1904, to Mar. 29, 1905, or 90th meeting. Covers board meeting details of a multitude of miscellaneous matters, such as appointments of clerks, stenographers, assignments, purchases, wharfage charges, discharges, leaves of absences, supplies, currency, shipments, etc. **P-05**, 214-340.

Returns, Property, P-08, 227.

Revenues.

 (See Nos. 109, 111, p. 2363 of this Index.) (See Administration, Civil.)

Accounts, **P-08**, 346, 347.

Department of, **P-07**, 154.

Department of, organization; Tom M. Cooke, collector, **P-05**, 107.

Disbursements and, table, **P-05**, 75.

Expenditures from, **P-09**, 248.

Summary of collections, etc., **P-13**, 467.

Table of, up to Oct. 31, 1906, **P-06**, 48.

Tabular statements, **P-07**, 171.

Ridges.

Blanketing ridge of Gatun Dam, **P-11**, pl. 20.

Railroad construction along, Gatun, **P-09**, 138.

Rights. (See No. 8, p. 2361 of this Index.)

Act relating to payment for rights granted to U. S. by Republic of Panama, **P-11**, 555, 573, 575.

Purchase of rights of the New Panama Canal Co., **P-11**, 549.

Ripley, Joseph. (See Nos. 164, 203, p. 2365 of this Index.)

Paper on artificial waterways, **P-06***, 421, 423.

Rising Stem Valves. (See Valves.)**Rivers.** (See Chagres; Discharge; see No. 138, p. 2364 of this Index.)

Break, Chagres River, **P-10**, 160, pl. 28.

Closing Chagres, Gatun, **P-07**, 56, pl. 43; **P-08**, 70, pls. 27, 28.

Cross section, Chagres River, Gamboa, **P-13**, pl. 120.

Drainage basin, Chagres, **P-09**, 204, pl. 83.

Hydraulics, lock and dams, **P-07**, 58.

Meteorology and river hydraulics, **P-08**, 68.

River bed sections, study for underground flow of water, **P-08**, 196, pl. 100.

Tabernilla River, **P-10**, 151.

Rivers, Control of.

Plans for diverting or controlling the waters of the Chagres and Gatuncillo, **P-05**, 295.

Control of Chagres and other streams: Above Bohio a clear mountain stream; entire area never determined; drainage estimated to range from 700 to 875 square miles above Bohio. Observations of the discharge of the Chagres at Gamboa have been maintained from 1882 to the "present" (1906) time. There have been but 6 severe floods in half a century, of short duration. Data sufficient for determination of complete reservoir control of the Chagres floods by a dam at Gamboa. This dam would have control only in case of a sea-level canal, and control and water supply in case of a lock canal. During three-fourths of the time the Chagres and other streams discharge an insignificant amount of clear water. When they are in flood they will bring down some silt, and it is recognized that the maintenance of the navigable channel will require a small amount of dredging. **P-06***, 42.

Roads. (See Nos. 96, 130, p. 2363 of this Index.)

Ancon, **P-07**, 64, pls. 70, 71, 72.

Ancon and vicinity, **P-07**, 63.

Asphalt-concrete, Balboa, **P-14**, pl. 30.

Atlantic division, **P-09**, 64; **P-10**, 129; **P-11**, 127; **P-12**, 137; **P-13**, 133.

Bas Obispo, **P-07**, 72, 75.

Before and after improvement, Mount Hope, **P-08**, 120, pls. 47, 48.

Building, **P-10**, 157; **P-11**, 153; **P-12**, 167; **P-13**, 150.

Camacho. (See Systems, below.)

Central division, **P-09**, 85, 89.

Colon, **P-10**, 130.

Cristobal, **P-07**, 77; **P-09**, 65.

Fifth division, **P-13**, 182.

Gatun, **P-07**, 75.

Gorgona, **P-07**, 75.

In progress at La Boca, the Savanas, Ancon Hill, Panama to Corozal, **P-05**, 111.

La Boca to Panama, **P-07**, 64, pl. 61.

Las Cascadas, **P-07**, 75.

Macadamizing and oiling, fifth division, **P-13**, 183.

Mandingo stockade for convicts engaged in road building, **P-13**, 514, pl. 68.

Mount Hope, **P-07**, 77.

Mount Hope-Gatun, **P-08**, 120, pls. 47, 48; **P-09**, 64; **P-10**, 129.

Sixteen-inch macadam road under construction with prison labor, Empire-Chorrera, **P-12**, 514, pl. 67.

Status, **P-05**, 135, 142.

Streets and, **P-07**, pls. 47-73.

Systems, Empire and Camacho, **P-07**, 72.

Toro Point, **P-11**, 131.

Vicinity of Panama, work done, **P-05**, 13.

White House district, **P-07**, 75.

Zone, **P-09**, 107, 114; **P-10**, 191, 192; **P-11**, 186; **P-12**, 194, 201.

Road, Savanas.

1905. Road to Savanas (suburb of Panama) under way. Estimate, \$38,000. **P-05**, 50.

Robinson, A. L.

Report, superintendent, mechanical division. (See No. 251, p. 2368 of this Index.)

Rock. (See Breakwaters; Costs; Quarries.)

Absorption by, **P-08**, 177.

Armor rock, placing, at Toro Point Breakwater, **P-13**, 138, pl. 30.

Bank of rock, break in, at Empire which let Obispo diversion through, **P-10**, 160, pl. 24.

Bedded rocks of Culebra formation, **P-13**, 582, pl. 71.

Breakers, performance of, **P-10**, 176.

Caissons sunk to, Balboa, **P-14**, pl. 22.

Capacity to absorb water, Gatun Dam study, **P-08**, 177.

Channelers working, Bas Obispo, **P-07**, 48, pl. 25.

Chemical composition, Gatun, **P-08**, 137.

Contours of, Gatun Dam, **P-08**, 196, pl. 165.

Crushers, performances, **P-11**, 299; **P-12**, 307.

Depth to rock, Gamboa Dam, **P-06***, 7, pls. 5, 6.

Drills at work, Gold Hill, **P-07**, 40, pl. 15.

Dumping of rock on face of Gatun Dam, **P-11**, 132, pl. 19.

Excavation, **P-09**, 100; **P-10**, 173; **P-11**, 168, 167; **P-12**, 184; **P-13**, 188. (See Excavation.)

Excavation at Gold Hill, **P-07**, 40, pl. 15.

Fall of, steam shovel buried, Las Cascadas, **P-12**, 170, pl. 43.

Flows, Gatun Dam studies, **P-08**, 182.

For breakwater, from Porto Bello, **P-13**, 114.

Formations, zone, **P-13**, 568.

Frictional resistance, apparatus, etc., in determining, Gatun Dam studies, **P-08**, 136.

Gatun Dam region, **P-08**, 175.

Igneous rock, zone, **P-13**, 570.

Large rock, Porto Bello quarry, **P-12**, 119.

- Loading, **P-07**, pl. 24; **P-11**, 132, pl. 6.
 Lohnitz rock breaker, operation, **P-10**, 175; **P-11**, 169; **P-12**, 185.
 Location of rock shoals worked, etc., sixth division, **P-13**, 189.
 Permeability, apparatus for testing, **P-08**, 196, pl. 62.
 Placing, Toro Point Breakwater, **P-12**, 142, pl. 19.
 Porto Bello rock plant, **P-10**, 108, 117; **P-12**, 115.
 Rock breaker "Vulcan," performances, **P-11**, 169; **P-12**, 185; **P-13**, 286.
 Samples of, Gatun Dam studies, **P-08**, 196, pls. 82, 83.
 Spillway Hill, Gatun Dam study, **P-08**, 162.
 Steam shovels wrecked in rock slide, Gold Hill, **P-11**, 156, pl. 36.
 Stratification, Culebra slides, **P-12**, 170, pl. 42.
 Subaqueous rock, excavation, **P-12**, 184; **P-13**, 191.
 Tests, Gatun Dam studies, **P-08**, 196, pls. 101-104.
 Unloading, Toro Point Breakwater, **P-11**, 132, pl. 5.
 West breakwater, Pacific, **P-13**, 192.
- Rock Breakers.** (See Breakers, Rock.)
- Rock Drills.** (See Drills, Rock.)
- Rodman, Capt. H.** (See No. 266, p. 2368 of this Index.)
- Rolling Stock.** (See Stock, Rolling.)
 Statement of, in use by the various departments, **P-10**, 206; **P-11**, 202.
- Roofing.**
 Contracts for, Pacific terminals, **P-13**, 205.
 Shops, **P-14**, 173.
 Terminal construction, **P-14**, 168.
- Rooms.**
 Bachelor quarters, Culebra, **P-09**, 220, pl. 96.
 Machinery rooms, cover seats for crab gear, at locks, **P-13**, 98.
 Seismograph room, interior, Ancon, **P-10**, 303, pl. 62.
 Transformer rooms, equipment, locks, **P-12**, 91; **P-13**, 94, 110, pl. 12.
- Roosevelt, Theodore.** (See No. 1, p. 2361 of this Index.)
- Roses, Wind.** (See Winds.)
- Rousseau, Civil Engineer H. H.**
 Reports. (See Nos. 217, 221, 243, 263, pp. 2366, 2367, 2368 of this Index.)
- Routes, Isthmian.** (See Nos. 4, 5, 6, 25, 26, pp. 2361, 2362 of this Index.) (See Canals, Isthmian.)
- Rules.**
 Canal work, **P-11**, 433.
 Rules of procedure, adopted by the Board of Consulting Engineers, **P-06***, 108.
 Rules, shops, **P-11**, 225.
- Run-off.**
 Alhajuela and Gatun, **P-13**, 238.
 Distribution of, Chagres Basin, **P-10**, 293.
 Floods exceeding elevation 60 at Gamboa, **P-10**, 296.
 Gatun Lake watershed, **P-12**, pl. 106.
 Gatun Lake, **P-13**, pl. 122; **P-14**, pl. 103.
- S.**
- Safety Gates.** (See Locks.)
- Salaries.** (See Nos. 254, 275, p. 2368 of this Index.)
 Disbursement, increase, and personnel, **P-11**, 302; **P-12**, 310, 580; **P-13**, 288, 583-604; **P-14**, 531-551.
 Conditions of employment where pay is fixed in the U. S., **P-05**, 157.
- Sales, P-13**, 380; **P-14**, 306, 307.
 Buildings, **P-11**, 359; **P-13**, 388.
 Chief of Q. M. department, **P-14**, 284.
 Old or condemned material, **P-11**, 577.
 Scrap iron, **P-11**, 359.
- Sand.** (See Costs.)
 Apparatus for testing, **P-08**, 196, pls. 105, 106.
 Concrete, for, **P-08**, 60; **P-09**, 401; **P-10**, 178; **P-11**, 170; **P-12**, 185.
 Dredged by "Gopher," **P-11**, 170.
 Flow of water through, **P-08**, 185-196.
- Gravel and, Schlieter's scale for estimating, **P-08**, 196, pl. 171.
 Procuring, **P-09**, 49; **P-10**, 118; **P-11**, 110; **P-12**, 121.
 Production of, **P-11**, 296; **P-12**, 122, 185, 303; **P-13**, 281; **P-14**, 450.
 Service of, **P-14**, 44, 209.
 Sources of, for concrete, **P-08**, 66.
 Statement, Nombre de Dios, **P-10**, 119.
 Stone, cement, and sand service, Gatun, **P-11**, 103; **P-12**, 111.
 Stone and, procuring and delivery, Gatun, **P-09**, 48.
 Supply, **P-10**, 111, 179.
 Unloading, cranes, **P-10**, 196, pls. 52, 116.
 Unloading, terminals, **P-14**, 218.
- Sanitariums, P-07**, pl. 11; **P-08**, 298-313.
 Tobago Island, **P-07**, pl. 11; **P-09**, 304; **P-10**, 430; **P-11**, 526; **P-12**, 552; **P-13**, 550.

Sanitation. (See Nos. 41, 59, 66, 85, 105, 168, 226, pp. 2362, 2363, 2365, 2366 of this Index.)
Act, **P-12**, 599.
Bocas del Toro, **P-08**, 322; **P-09**, 329.
City of Panama, **P-07**, 205; **P-08**, 315; **P-09**, 324; **P-10**, 432; **P-11**, 529; **P-12**, 554; **P-13**, 552.
Colon, Cristobal, and Mount Hope, **P-07**, 207; **P-08**, 316; **P-09**, 325; **P-10**, 432; **P-11**, 529; **P-12**, 554; **P-13**, 552.
Details, **P-07**, 205.
Ditches, sanitary. (See Ditches.)
Engineering, sanitary. (See Engineering.)
Executive orders relating to, **P-12**, 610.
Fifth division, **P-13**, 176, 183.
Maintenance, **P-11**, 127; **P-12**, 137.
Margarita Point, **P-12**, 554; **P-13**, 552.
Methods, **P-04**, 49.
Mount Hope, **P-10**, 452; **P-12**, 554; **P-13**, 552.
Municipal and sanitary work, **P-12**, 201.
Officer, sanitary. (See No. —, p. — of this Index.)
Pacific division, **P-09**, 103, 114, 115; **P-10**, 180, 193; **P-11**, 174, 187, 188, 529; **P-12**, 188, 201.
Q. M. department, work of, **P-09**, 209; **P-10**, 307; **P-11**, 355; **P-12**, 379.
Toro Point, **P-12**, 554; **P-13**, 552.

Sanitation, Operations.

1904. Preliminary steps taken, Apr., 1904, for organization of health department. Isthmian Canal Commission No. 2 on its first visit to Isthmus, accompanied by Dr. W. C. Gorgas, colonel, U. S. Army; by Dr. John W. Ross, U. S. Navy; by Dr. L. A. La Garde, major, U. S. Army; and an engineer officer of the Army, Capt. (now Maj.) C. E. Gillette, to study health subject. Officers named of the staff which gained distinction in sanitation matters during the American occupation of Cuba. Final organization of the health department perfected Aug., 1904. The department of health, with jurisdiction extending beyond the limits of the Canal Zone into the cities of Colon and Panama and over the waters adjacent thereto, a branch of the government of the zone, and made an administrative department thereof. Four members in the board of health—the chief sanitary officer, the director of hospitals, the chief quarantine officer, and the chief sanitary inspector of the zone. There were found on the Isthmus as a part of it an extensive hospital at Ancon, and several neglected hospital buildings at Colon. Second hospital at Colon operated by the Panama R. R. In addition to caring for these hospitals, emergency hospitals were established, and dispensaries. Employees on the Isthmus entitled to free medical attention, etc. The sanitary inspectors examined properties, pools, etc., and insisted upon the following of sanitary precautions of all kinds. Quarantine service established, and stations opened. Rules and regulations adopted for Colon and Panama, and Republic asked to enforce them. In the

10 months of service succeeding Aug., 1904, about \$1,100,000 to be spent. Examination made of methods pursued by the Republic of Panama for the care of the sick, etc. **P-04**, 49.
Health and sanitation: Indifferent at transfer. French company could not compel adjacent communities to clean up. French hospital expenditures lavish. Health of zone good at transfer, and so continued. Departmental work begun; force put to work improving sanitary condition in zone and adjacent places; plans preparing for water supply and sewage for towns; hospital service improved. Climate not a deadly one. Statistics of health and sanitary service. **P-04**, 86-91.

1905. Results of the sanitary department such that health of the zone assured. Climate no more a handicap than would be U. S. places 50 miles or so from Gulf of Mexico. **P-05**, 120.

Republic of Panama unable to enforce sanitary regulations in cities of Panama and Colon, and assumption of this duty by Isthmian Canal Commission No. 2, **P-05**, 269.

Disposal of night soil, methods, **P-05**, 273.

Cooperation of Isthmian Canal Commission sanitary department and Republic of Panama with regard to hospitals, and care of sick, insane, etc., **P-05**, 339.

1906. Yellow fever abolished. Last case Nov. 11, 1905. Average daily sick rate among employees during 10 months from Jan. 1, 1906, to Oct. 31, 1906, 28 per thousand; death rate, 17½ per thousand among the whites, and nearly 53 per thousand among the blacks. **P-06**, 2.

Sanitation of near-by countries: Outbreaks of communicable diseases in adjacent countries suggest desirability of U. S. making some arrangements for better sanitation. Yellow fever in Ecuador. Government of that place willing to cooperate with U. S. in abolishing it, but notable local opposition to interference of U. S. **P-06**, 22.

Municipal sanitation: Pushed with energy through the year. 50,000 sq. y. paving in Panama. Sewer system practically completed, 55,840' of piping laid. Water system complete, curb connections being made. Ancon Reservoir in operation; sewer system connected with Ancon. La Boca connected with Rio Grande Reservoir. Corozal and Miraflores connected with Rio Grande Reservoir. At Paraiso, sewer being laid; town supplied with water from Rio Grande. For town of Culebra, reservoir constructed on Mount Zion. Water supply provided for various other points. Dam built across Rio Carabali, impounding approximately 40,000,000 gallons at elevation of 65' above sea level, for Gorgona. Emergency supply for Colon provided by building temporary reservoir connecting with an old French system. Permanent water system for Colon under way, and sewer system. Water

tested; found good; but sterilizing plants, etc., existing or under way. **P-06, 25.**

One of the chief aims of the sanitary brigades the extermination of mosquitoes. Bulk of work against *Anopheles* species. 2,000,000 sq. y. of ground cleared. Zone covered with network of ditches, some of them being lined with stones. Screening of edifices, etc., insisted upon. Screening reduces cases of malaria from outbreak of 33 per cent to only 4 per cent.

Less fumigation required. Sanitary work at Colon more difficult than at other places in zone and vicinity. Progress made, however, toward converting the lowest, wettest, and dirtiest spot in the Republic of Panama into a safe habitation for American employees. **P-06, 29.**

Sanitation and hygiene of Panama route: Early history of the region, with respect to mortality, etc. Mortality among employees engaged in building the Panama R. R. in 1855 not 150,000 (equaling the number of cross-ties), as so often reported; chief engineer of the road asserted repeatedly that the total number of persons engaged on the road never exceeded 7,000 at any one time, and that the laborers and workmen who died in the 5 years of building did not exceed 1,200 in all. Prior to coming of Americans the sanitary methods employed were those known to be most efficacious among scientists. Vital statistics furnished by Col. Gorgas. The records show that it is not only possible but feasible to banish yellow fever from the Isthmus and to maintain the whole force of employees in a good state of health. Sickness on the Suez Canal conquered by killing the dangerous mosquitoes. **P-06*, 18.**

1907. Sanitation separated from department of government, in which it was a division, and created a new department, **P-07, 31.**

Success dependent on its ability to guard against the malarial mosquito; accomplished by draining and clearing the ground in neighborhoods, and proper quartering. 16,000,000 sq. y. brush cut; 1,000,000 sq. y. swamp lands filled and drained; 30,000,000 sq. y. grass burned; 217,000 linear feet ditches dug; 50,000' tile ditches laid; cemented, 50,000 linear feet. Miscellaneous work of every description. Considerable sanitation work done in cities of Panama and Colon. "Too much credit can not be given the department for the elimination of yellow fever." No cases originating in the zone; 1 case got in. Nearly 50 cases of smallpox developed; instant fumigation. 3,000 persons exposed to yellow fever or smallpox quarantined. Largest division of the department to do with the care of the sick, requiring for maintenance thereof more than half the sums appropriated for sanitation. Attention and medicine free to Isthmian Canal Commission and Panama R. R.

employees. To families of employees, a charge made. Average daily sick for year, 916. Statistics show marked improvement in health conditions. Lepers removed to colony at Palo Seco. Five new hospital buildings built in zone; additions made to others. Hospital beds increased from 1,252 to 1,845; increase of emergency cots by 587. Quarters provided for insane. Culebra and Naos Islands to be fitted for quarantine quarters. **P-07, 31-32.**

1908. Duties: General sanitary work of zone (as well as of cities of Colon and Panama); also the care of the sick and the maintenance of the hospitals.

Organization: Changes proposed for economy, removal of friction, and a more definite fixing of responsibility. In addition to the work of policing and grass cutting in vicinity of quarters, the Q. M.'s gangs to be charged with collection of garbage, removal of night soil, cutting of brush and grass for sanitary department. Proposed, also, that tiling and drainage be done by construction forces of engineering department. Proposed to make these transfers Sept. 1, 1908. Sanitary department to indicate what work shall be done so far as it relates to sanitation.

Health: Conditions improved. Average of 43,057 names on pay roll; death rate, 18.32 per thousand. Whites, death rate, 15.34. Blacks, death rate, 19.48; less than half that of the previous year. Better food the ascribed reason for the lowered death rate among the blacks.

Hospitals: 27,523 admitted; 29 deaths; 1,138 undergoing treatment at end of year. Two hospitals care for the sick (Ancon and Colon). 20 sick camps. Old buildings at Culebra converted into hospital for penitentiary patients. **P-08, 27, 28, 29.**

1909. Duties: Supervision of the sanitary department extends over the zone and the terminal cities.

City of Panama: Agreement with Republic of Panama, Sept. 1, 1907, by which street cleaning, etc., to be performed by the city, the U. S. assisting by paying \$10,000, or about one-fourth of the cost of the work.

City of Colon: Agreement with Republic of Panama, July 1, 1908, provided for the payment by the former of \$4,735.19 on account of street cleaning and garbage removal within period from July 1 to Dec. 31, 1908. Beginning Jan. 1, 1909, and continuing from year to year until the contract be canceled by either party upon notice of not less than 30 days before the expiration of an annual period, Panama agrees to pay one-half the cost of such work for the city of Colon.

Transfer of operations: Work in the zone for the first 2 months similar to that of the previous year. Under the general reorganization scheme, actual physical work, except oiling, transferred to the local engineering departments along the line, the sanitary

department exercising general supervision, etc.

Hospitals: Further consolidation of hospitals made; sick concentrated at Ancon; Colon Hospital reduced to 150 beds. Chronic ward established at Colon, for transferred men who by reason of disability must continue to be a charge on the Isthmian Canal Commission as long as they are on the Isthmus.

Health: Improvement over previous year. 46,194 admissions to hospitals and sick camps, and in quarters; being 23.49 out of every 1,000 on the rolls, as against 23.85 for the preceding year. Deaths, 530; rate, 11.97 per thousand, as against 18.32 for the preceding year.

Quarantine: No plague or yellow fever originated on the Isthmus; one case of the plague developed on a ship at Balboa; death ensued at quarantine station. Ship had been required number of days in quarantine from infected port. **P-09**, 29, 30.

1910. Work of department embraces sanitary work in cities of Colon and Panama and, except oiling, designates sanitary work to be done in zone to accomplish desired ends, exercising supervision necessary to see work satisfactorily performed; in addition, department has charge of hospitals and quarantine. In charge of Col. W. C. Gorgas, Medical Corps, U. S. Army, chief sanitary officer. Work in terminal cities consists of cutting grass and brush, oiling pools, and constructing and maintaining ditches for drainage purposes, removal of garbage and night soil, fumigation and street cleaning. On account of juxtaposition of Cristobal and Mount Hope to Colon, these included in Colon area, and for same reason Ancon incorporated with Panama.

In zone, Q. M. department expended under direction of sanitary department \$127,923.28 in grass and brush cutting in and about Isthmian Canal Commission settlements, and \$47,009.87 for removal of night soil and garbage. Expended for removal of garbage and night soil in native settlements, \$25,414.51. In maintenance of existing ditches and construction of new ones for drainage, construction division expended \$88,545.83; new work done in accordance with plans prepared by sanitary department. Total expended for oil, and labor in distribution, \$42,686.58.

Health conditions on Isthmus reported by chief sanitary officer as improvement over preceding year. Admissions to hospitals and sick camps, including sick in quarters, 26,539. Daily average of sick, 23.01 out of every 1,000 employed, as against 23.49 for preceding year. Deaths among employees, 548; equivalent to average of 10.84 per 1,000.

In addition to deaths among Americans, which aggregated 76, 39 deported as physically unfit, 10 recommended for extended leave without pay for same reasons, and 6 given extended

leave with pay in U. S. on account of injuries.

No case of plague or yellow fever originated on the Isthmus. One death from yellow fever, a young Englishman, at Ancon Hospital, Jan. 24, 1910. Deceased passed quarantine at Colon Jan. 6 and taken ill Jan. 8. Case diagnosed yellow fever Jan. 22. On Jan. 24 thorough fumigation undertaken of building in which deceased lived while in Panama, as well as factory in which he worked. **P-10**, 44, 45.

1911. In the zone the Q. M. department expended in and about Isthmian Canal Commission settlements \$114,725.98 for grass and brush cutting, and \$42,184.35 for removal of night soil and garbage. Expended for removal of garbage and night soil in native settlements, \$22,615.03. In maintenance of existing ditches and construction of new ones for drainage purposes construction divisions expended \$81,407.93; new work done in accordance with plans prepared by sanitary department. Sanitary department expended \$11,708.08 for oil and \$16,756.17 for distribution, \$16,711.85 for larvacide, and \$13,489.74 for distribution, or total of \$58,665.84; in addition, \$99,241.19 expended for sanitary work in terminal cities.

Admissions to hospitals and sick camps, including sick in quarters, 53,534; daily average of sick, 24.77 out of every 1,000 employed, as against 23.01 for 1909-10, and 23.49 for 1908-9, on the basis that total number employed during the years mentioned were 49,129, 50,535, and 44,261, respectively; total number of deaths among employees, 557, of which 33 were Americans, 96 white employees of other nationalities, and 428 blacks; deaths from violence among all employees, 178, as against 174 for preceding year; in addition to deaths reported, 134 deportations made—104 for disease and 30 for injuries. **P-11**, 56, 57.

1912. Work in Panama consisted in cleaning 398 miles of ditches, digging 2.5 miles of ditches, and clearing 118 acres of weeds and grass, in addition to oiling, disinfecting, and fumigating. In Colon district, from same source, 112.5 miles ditches maintained, 8 miles ditches constructed, and 217 acres cleared of vegetation, in addition to oiling, disinfecting, fumigating, etc.

Impression general elsewhere than on Isthmus that sanitary work, in the way of clearing land, extends over entire zone; of 278,848 acres comprised within zone limits less than 1,200 acres kept cleared for sanitary purposes and on sanitary requests, outside of military reservations, where work is done by troops. In addition, clearing done for construction purposes, but almost entire zone in original condition as regards brush and jungle.

Expense for sanitary work in zone and in Panama and Colon, \$596,608.73, of which

\$67,968.19 for sanitation proper in two cities, \$409,205.84 for sanitation in zone, \$18,672.50 for removal of garbage and street cleaning in two cities, and \$100,760.20 for removal of garbage and street cleaning in zone. Of amount expended for sanitation proper in zone, construction divisions expended \$89,725.17, principally in maintenance of existing ditches and construction of new ones for drainage purposes; Q. M. department, \$93,876.26 for grass and brush cutting; sanitary department used 719,835 gallons of oil, costing, \$18,862.81, and 124,718 gallons of larvacide, costing \$23,751.64; labor expense for distributing, \$18,820.05 and \$17,514.06, respectively. All work performed by construction divisions and Q. M. department done under direction of sanitary department, new ditching being done in accordance with plans prepared by that department after consultation with divisions interested. Removal of garbage and night soil in zone done by Q. M. department.

Admissions to hospitals and sick camps and sick in quarters, 48,307; daily average sick, 22.91 out of every 1,000 employees, as against 24.77 for 1910-11 and 23.01 for 1909-10 on basis that total numbers employed during years mentioned were 50,008, 49,129, and 50,535, respectively; deaths among employees, 508, of which 35 Americans, 79 white employees of other nationalities, and 394 blacks; deaths from violence among all employees, 154, as against 178 for preceding year. 193 deportations made—141 for disease and 52 for injuries. P-12, 64-65.

1913. Work in Panama consisted in cleaning 220 miles ditches, digging 1.2 miles ditches, and clearing 114 acres of weeds and grass, in addition to filling and cleaning cesspools and wells, oiling, disinfecting, and fumigating. In Colon district, from same source, 72 miles ditches maintained, 77 miles ditches constructed, and 29 acres cleared of vegetation, in addition to oiling, disinfecting, and fumigating.

Expense for sanitary work in zone and in cities of Panama and Colon, \$510,529.17, of which \$62,955.06 for sanitation proper in the two cities, \$371,844.90 for sanitation proper in zone, \$10,627.60 for removal of garbage and street cleaning in the two cities, and \$65,101.61 for removal of garbage and street cleaning in zone. Of amount expended for sanitation in zone, construction divisions expended \$91,877.98, principally in maintenance of existing ditches and construction of new ones for drainage purposes; Q. M. department, \$50,533.13 for grass and brush cutting. Sanitary department used in zone 674,662 gallons of oil, costing \$17,669.69, and 120,992 gallons of larvacide, costing \$21,759.96; labor expense for distributing, \$21,320.39 and \$19,567.39, respectively. All work by construction divisions and Q. M. department done under direction of sanitary department. Removal of garbage

and night soil in zone done by Q. M. department.

Admissions to hospitals and sick camps during year, including sick in quarters, 33,776; daily average number of employees sick, 19.04 out of every 1,000, as against 22.91 for 1911-12 and 24.77 for 1910-11—this on basis that total numbers employed during years mentioned were 54,000, 50,008, and 49,129, respectively. Deaths among employees, 483, of which 36 Americans, 58 white employees of other nationalities, and 389 blacks. Deaths from violence among all employees, 164, as against 154 for preceding year. 183 deportations made—134 for disease and 49 on account of injuries. P-13, 67, 68.

1914. Sanitation of zone placed in charge of health department, under Lt. Col. C. F. Mason, U. S. Army, as chief health officer, and department charged with care of sick and injured of zone, prevention of disease in zone and cities of Panama and Colon, street cleaning and garbage removal in latter cities, and all matters relating to quarantine. Matters relating to charity added. Administration divided into 3 divisions—hospitals and charities, sanitary division, and quarantine division.

Division of hospitals and charities: Maintains hospitals at Ancon and Colon and assists in maintaining Santo Tomas Hospital in city of Panama. Maintains institutions for care of insane and lepers of both zone and Republic of Panama and for employees permanently disabled through injury. Provides dispensary in each district into which zone divided. District physicians attend sick, send patients to hospital, perform vaccinations, make inspections of schools, hotels, restaurants, canal quarters, etc., and report births and deaths.

Sanitary division: Has 3 sections—health office of Panama, health office of Colon, and zone section. In zone section each district has sanitary inspector, with necessary foremen and laborers, all under direct charge of general inspector; inspectors keep close watch upon their districts, with view of preventing and controlling conditions which might give rise to disease, and especially endeavor to prevent breeding of disease-carrying mosquitoes and flies. They supervise construction and maintenance of drainage ditches, and cutting of grass and brush, oil pools and edges of large bodies of water, supervise removal of garbage and night soil, trap and catch mosquitoes in Panama Canal quarters, disinfect pit and other closets, and disinfect buildings for contagious diseases. Charged with enforcement of sanitary regulations, and have authority to personally make arrests when they have witnessed violation of regulations. Issue burial permits, make interments, and care for cemeteries. They keep charts of prevalence of malaria, and immediately investigate and take action upon any increase

therein. Work by health officers of Panama and Colon that by health officers everywhere. In addition, they have charge of street cleaning, garbage removal, grass and brush cutting, oiling of pools, fumigation, disinfection, etc. Duties in enforcing sanitary rules and regulations extensive, and include vaccinations, control of infectious and contagious diseases, special precautions against quarantinable diseases prevailing in Tropics, control of burials, inspection of slaughterhouses and of cattle for slaughter, inspection of markets, enforcement of pure-food regulations, inspection of bakeries and dairies, examination of milk, inspection of stables, bottling works, and barber shops. Large part of their time given up to enforcement of sanitary building regulations, especially with reference to rat-proofing as protection against plague.

Quarantine division: In direct charge of chief quarantine officer, and maintains large establishments at each end of canal—one for Panama and Balboa and the others for Colon and Cristobal. Maintains quarantine officer at Bocas del Toro. Division, already large, expected to increase greatly in proportions when canal is open to traffic; will include new features in arrangement for passage of ships through canal in quarantine. Ground on Balboa dump, fronting upon and adjoining Fort Amador on south and radio station on east, assigned as permanent site for Panama quarantine station. Board appointed to select site for permanent quarantine station at Cristobal. **P-14**, 64, 65.

San Juan River. (See Nos. 20, 22, p. 2361 of this Index.)

"Santa Clara."

Lockages, **P-14**, 118.

Saturation.

Curves of, experimental dam, Gatun, **P-08**, 196, pls. 120, 130.

Lines of, experimental dam, Gatun, **P-08**, 196, pls. 109-119, 121-129.

Slope of, Gatun Dam studies, **P-08**, 148, 196, pl. 136.

Saville, C. M.

Reports. (See Nos. 232, 244, pp. 2366, 2367 of this Index.)

Schlichter's Scale.

Estimation of transmission constant, sand and gravel, **P-08**, 196, pl. 171.

Schools, P-07, 169. (See Nos. 113, 122, pp. 2363, 2364 of this Index.)

Appropriations, **P-06**, 48.

Gardens, **P-11**, 433.

Schoolhouses, **P-07**, 80, pl. 100; **P-08**, 280, pls. 188, 189, 194; **P-14**, 320.

1905. Census of zone children taken. Plans made for 42 schools. **P-05**, 65.

1906. Although school system was authorized in 1904, but little done until Dec., 1905.

On Jan. 2, 1906, first free public school under the Canal Zone government opened at Corozal. At first 2 sets of schools, but on Feb. 1, 1906, municipal schools made a part of the zone system. Supervision of schools transferred to chief of bureau of municipalities, which was created May 1, 1906. This made for greater progress. May 1, 1906, 18 schools, 21 teachers, 840 pupils; June 1, 22 schools, 1,088 pupils; Sept. 30, term ended with 30 schools, 1,796 pupils. Sept. 30, 12 American teachers, 1 Panamanian, and 19 Jamaican (colored). Of the 30 schools, 4 were for white children; other mixed. Of the 1,800 pupils, about 10 per cent only American and white. Mar. 3, first convention of teachers held. School system essentially American, methods, books, songs, flag, etc. Schools welcomed by zone people. Expenses paid from funds of zone; not from canal-construction funds. **P-06**, 39.

1907-1914. (See Civil Administration; Zone.)

Schussler, H. (See No. 164, p. 2365 of this Index.)

Sea.

Temperatures. (See Meteorology.)

Scrap, P-11, 358; **P-12**, 380; **P-13**, 378; **P-14**, 284.

Sales. (See Sales.)

Shipments, **P-11**, 359.

Seagoing Dredges. (See Dredges.)

Sea-level Plans, etc. (See Canal; Excavation; see Nos. 174, 176, 180, 182, 183, 212, p. 2365 of this Index.)

Cross sections, **P-06***, 7, pl. III.

Comparative dangers of sea-level and lock-level canals, **P-06***, 142.

Line proposed, **P-06***, 7, pl. I.

Profile proposed, **P-06***, 7, pl. II.

Sea-level section, north of Gatun Locks, **P-13**, 138, pl. 24.

Seamen.

Deserters, **P-11**, 433.

Seasons, Dry.

Discharge during wet and dry seasons, various streams, Gamboa and Gatun, **P-12**, 244, 246, 247.

Seats, Cover.

Crank-gear machinery, lock gates, **P-12**, 92.

Sea Wall.

Cristobal, **P-10**, 130.

Second Division. (See No. 243, p. 2367 of this Index.)

Secretary.

Executive department. (See No. 271, p. 2368 of this Index.)

Secretary of the Treasury.

Accounting system established after consultation with, **P-04**, 53.

Secretary of War.

Orders return of Gen. Davis, **P-05**, 28.

Sections.

Gatun Dam, **P-13**, pl. 91, 92.

Maximum section, proposed Gatun Dam, **P-08**, 196, pl. 135.

Gatun Dam, embodying changes proposed by BE., **P-09**, 42, pl. 12.

Wachussetts Dike, Gatun Dam studies, **P-08**, 196, pl. 134.

Dumps, Juan Grande River, **P-11**, 106.

Showing fill, Gatun Dam, **P-09**, 66, pl. 20.

Upper lock, Gatun, **P-09**, 42, pl. 1.

Pedro Miguel Locks, **P-09**, 42, pl. 2.

Pier shells, concrete, **P-13**, pls. 105, 106.

Quay walls, **P-13**, 220.

River bed, study of underground flowage, **P-08**, 196, pl. 100.

Slides, Comacho, Culebra, etc., **P-11**, pls. 107, 108; **P-12**, pls. 84, 87.

Spillways, Miraflores and Gatun, **P-11**, pl. 86, 88.

Valves, gate and lock, **P-09**, 42, pls. 3, 4; **P-12**, pls. 70, 71.

Sediment. (See Basins.)

Gatun and Mount Hope Basins, **P-11**, 132, pl. 24; **P-14**, pl. 17.

Seepage.

Geological causes of, slides, **P-12**, 214, pl. 60.

Rate of, experimental dam, **P-08**, 120, 130, 196.

Gatun Dam tests, **P-08**, 134, 196, pls. 89-94, 95, 96, 97.

West emergency dam pit, Miraflores Lock, **P-14**, 158.

Seismography. (See Earthquakes.)

Isthmus, etc., **P-10**, 277; **P-11**, 251, 265; **P-12**, 227; **P-13**, 225; **P-14**, 144.

Records, **P-10**, 287, 288; **P-13**, 234; **P-14**, 150.

Room, seismograph, **P-10**, 303, pl. 62.

Service, Custom, P-08, 257. (See also Nos. 110, 225, pp. 2363, 2366 of this Index.)

Settlements.

Panama R. R. relocations, **P-11**, 194; **P-13**, 220.

Sewers, Etc. (See Nos. 39, 88, 129, 155, 156, pp. 2362, 2363, 2364 of this Index.)

Ancon, **P-07**, 65.

Atlantic division, **P-11**, 127; **P-12**, 137; **P-13**, 133.

Bas Obispo, **P-07**, 72.

Balboa, **P-14**, 224.

Caballa Viejo, **P-07**, 73.

Camacho and Empire, **P-07**, 72.

Central division, **P-09**, 85, 88.

Chagresito, **P-07**, 73.

Colon, **P-07**, 62; **P-11**, 129.

Construction progress, **P-05**, 41.

Corozal, **P-07**, 66.

Cristobal, **P-07**, 77; **P-09**, 65; **P-10**, 130.

Cucaracha, **P-07**, 68.

Culebra, **P-07**, 70.

Fifth division, **P-13**, 182.

Gatun, **P-07**, 73; **P-09**, 63; **P-10**, 128.

Gorgona machine shops, **P-07**, 73.

La Boca, **P-07**, 65.

Maimeí, **P-07**, 73.

Maintenance, etc., **P-07**, 168; **P-13**, 182.

Miraflores, **P-07**, 66.

New Gatun, **P-10**, 128.

Pacific division, **P-09**, 107, 111; **P-10**, 189, 190; **P-11**, 184; **P-12**, 194, 199.

Panama, **P-05**, 13; **P-07**, 166.

Panama and Colon, **P-07**, 150.

Paraiso, **P-07**, 67, 68.

Pedro Miguel, **P-07**, 67.

Plans, Panama, **P-04**, 46.

Purification plants, **P-14**, 136.

Santa Cruz, **P-07**, 73.

Status, **P-05**, 135, 142.

Storm sewers, **P-10**, 136, pls. 19, 20; **P-11**, 129.

Sumps, **P-07**, 62.

Water and sewer system, Tabernilla, **P-07**, 73.

Zone, **P-08**, 89.

Sewers, Municipal. (See Municipalities, Sanitation.)

1905. Work at Panama, Culebra, Empire, Corozal, etc., progressing rapidly, **P-05**, 111.

Sheet Piling. (See Piling, Sheet.)

Shells, Pier.

Making, Balboa Docks, **P-13**, pl. 107.

Section of concrete pier shells, **P-13**, pls. 105, 106.

Shipments.

Emergency dams, **P-13**, 102.

Ships. (See Nos. 71, 187, 195, pp. 2363, 2365 of this Index.)

Towing, design of locomotives, **P-13**, 9.

Unloading dynamite, Mount Hope, **P-10**, 322, pl. 66.

Shipways, P-07, pl. 41.

Balboa, **P-10**, 179; **P-11**, 166; **P-12**, 182, 186; **P-13**, 189.

Dredging, Balboa shops, **P-11**, 166.

Machine shops and, La Boca, **P-07**, 52, pl. 41.

Pacific division, **P-09**, 101.

Repairs, **P-11**, 170; **P-12**, 186.

Shops and, Balboa, **P-11**, 170.

Shooting. (See Orders, Executive.)

Shoals, Rock.

Location and working, **P-13**, 189.

Shonts, T. P. (See No. 64, p. 2363 of this Index.)

Shops, P-07, pls. 76, 77, 78, 79, 81, 82, 87, 88, 89, 92, 93.
Additions to, **P-11**, 223.
Balboa, **P-09**, 99, 101; **P-10**, 172, 179; **P-11**, 230; **P-12**, 182, 264; **P-13**, 189, 261; **P-14**, 243, pl. 113.
Canal and terminal shops, **P-13**, 186, pl. 54.
Closed and transferred, **P-11**, 222.
Committee of consultation, mechanical, **P-11**, 231.
Cristobal, **P-07**, 81; **P-12**, 261; **P-13**, 259; **P-14**, 244.
Delivery of work of, **P-11**, 226.
Dredging, Balboa, **P-11**, 166.
Dry docks, **P-11**, 229; **P-12**, 115, 262; **P-13**, 259.
Electrical work in, **P-14**, 89.
Empire, **P-07**, 80, pls. 92, 93; **P-08**, 75; **P-09**, 147; **P-10**, 266; **P-11**, 229; **P-12**, 264; **P-13**, 261.
Expense, **P-11**, 225; **P-12**, 261; **P-13**, 258, 265.
Expense, actual shop, mechanical division, **P-14**, 256.
Foundations, **P-13**, 200.
Gambos, **P-12**, 263; **P-13**, 260.
Gatun, **P-11**, 230; **P-12**, 262; **P-13**, 260.
Gold Hill, **P-12**, 263; **P-13**, 260.
Gorgona, **P-07**, 72, 79, 80, pls. 76, 77, 78, 79, 80, 87, 88, 89; **P-08**, 74; **P-09**, 144; **P-10**, 266; **P-11**, 226, 234; **P-12**, 264, 271; **P-13**, 261.
Inspections, **P-11**, 218. (See No. 251, p. 2368 of this Index.)
Installation, mechanical division, **P-14**, 171.
Las Cascadas, **P-12**, 263; **P-13**, 260.
Locomotive department, **P-09**, 144.
Motors, **P-13**, 207.
Office, **P-14**, 171, 319.
Overtime, **P-11**, 221; **P-12**, 260; **P-13**, 257.
Pacific terminals, **P-14**, 206.
Paraiso, **P-07**, 80, 82, pls. 81, 82, 83; **P-14**, 245.
Pay rolls, **P-11**, 221; **P-12**, 259; **P-13**, 257.
Pedro Miguel, **P-11**, 230; **P-12**, 263; **P-13**, 260.
Personnel, **P-13**, 255.
Porto Bello, **P-12**, 262; **P-13**, 259.
Proposed, central division, **P-13**, pl. 96.
Repairs, etc., **P-09**, 102; **P-10**, 270; **P-11**, 170; **P-12**, 186; **P-13**, 265.
Rules, **P-11**, 225.
Shipways and, **P-11**, 170; **P-12**, 186.
Sites, clearing, **P-13**, 199.
Spillway, **P-12**, 262; **P-13**, 259.
Supervisors and employees, **P-12**, 258.
Terminals, **P-14**, 37.
Tools, foundations for, **P-13**, 201.
Toro Point, **P-11**, 222; **P-12**, 262; **P-13**, 259.
Tunnels, **P-14**, 206.
Water and sewage system, Gorgona, **P-07**, 73.

Shops, Blacksmith.

Locomotive department, **P-10**, 266; **P-11**, 235.

Shops, Boiler, P-07, pl. 83; **P-10**, 267; **P-11**, 235; **P-14**, pl. 24.

Shops, Car, P-10, 267, 268; **P-11**, 236; **P-12**, 272.

Shops, Foundry and Pattern, P-10, 268.

Shops, Machine, P-07, pl. 41.

La Boca, **P-07**, 52, pl. 41.

Locomotive department, **P-10**, 266; **P-11**, 235.

Shops, Marine.

Dry dock and, **P-09**, 58; **P-10**, 116; **P-11**, 107.

Shops, Paint, P-12, 272.

Shops, Pattern, P-07, pl. 80.

Shops, Permanent.

Details, **P-13**, 206, 207.

Equipment from other shops, **P-12**, 267.

Fill, **P-13**, 199.

Foundations, **P-13**, 199.

Machine shops, **P-11**, 205.

Terminals, **P-13**, 199, 205; **P-14**, 166.

Views, **P-13**, 254, pls. 56, 57.

Shops, Tin and Pipe, P-10, 266; **P-11**, 235; **P-12**, 271.

Shovels, Steam.

Buried under rock fall, etc., **P-12**, pl. 43.

Central division, **P-09**, 71; **P-10**, 141; **P-11**, 137; **P-12**, 148; **P-13**, 143.

Channels, straightening, Chagres River, **P-11**, 156, pl. 37.

Culebra division, **P-07**, 41, pls. 22, 23; **P-08**, 38.

Efficiency of, **P-05**, 132.

Excavation, Gatun Locks, **P-09**, 46.

Excavation, Mindi, **P-08**, 47.

Meeting of, Culebra, **P-13**, 160, pl. 35.

Mindi, **P-08**, 47.

Number at work by months, etc., **P-05**, 132.

Output, **P-07**, 41; **P-12**, 130; **P-13**, 125.

Output, Panama R. R. work, **P-11**, 199.

Performances of, **P-08**, 45; **P-09**, 73; **P-10**, pl. 103; **P-11**, 138, pl. 105; **P-12**, 148, 181, 184, pl. 83; **P-13**, 143, 144, 175, 176, 197, pl. 94; **P-14**, 214.

Records, **P-09**, 72; **P-10**, 142; **P-11**, 138; **P-12**, 131, 148.

Repairs, **P-10**, 156; **P-11**, 152; **P-12**, 166.

Slides, caught in, **P-13**, 160, pls. 42, 44, 45.

Terminals, **P-14**, 210.

Tunnel excavation, **P-13**, 254, pl. 59.

Views, Culebra Cut, etc., **P-12**, 170, pl. 30.

Working, **P-07**, 48, pls. 22, 23; **P-10**, 160, pl. 30; **P-11**, 192, pl. 58; **P-12**, 170, pls. 33, 34, 35, 38; **P-14**, pls. 41, 54, 55, 59.

Sibert, Lt. Col. (See Nos. 217, 220, 240, pp. 2366, 2367 of this Index.)

Sick.

Camps, **P-09**, 302; **P-10**, 423; **P-11**, 517, 518; **P-12**, 543, 544.

Employees, **P-11**, 518, 519; **P-12**, 545, 546; **P-13**, 541, 552.

Leave for, **P-13**, 621.

Quarters, in, **P-09**, 302; **P-10**, 423, 424; **P-11**, 517, 518; **P-12**, 544.

Visitation, **P-13**, 558.

Sidewall Culverts. (See Culverts; Walls.)

Signals.

Automatic railroad signals, **P-13**, 270, 272, pls. 63, 64.

Light and fog, breakwaters, **P-12**, pl. 76.

Signs.

Prohibited, **P-12**, 608.

Sills.

Emergency dams, Gatun, **P-12**, 108, pl. 3.

Emergency dams, Pedro Miguel, **P-12**, 204, pl. 48.

Masonry, general drawing, **P-09**, 42, pl. 10; **P-12**, pl. 72.

Miraflores Locks, **P-11**, 192, pl. 56.

Siltage, P-13, 192.**Silver.**

Silver schedule for wages, **P-09**, 152.

Sites. (See Locks and Dams.)

Clearing, terminals, **P-13**, 195, 199.

Drilling, Gatun Dam, **P-08**, 196, pls. 72, 81.

Gatun Dam, **P-10**, 136, pl. 3.

Dam, west, Miraflores, **P-09**, 134, pl. 63.

Dam, Sosa-Corozal, **P-07**, 56.

Dredging, Miraflores Locks, **P-09**, 134, pl. 62.

Gatun Locks and Dams, **P-08**, 126, pl. 56;

P-09, 66, pl. 21; **P-10**, 136, pls. 3, 8, 9.

Heads of water under, Gatun, **P-08**, 126, pls. 57, 58, 59, 60, 61.

Locks, Miraflores, **P-08**, 70, pl. 40; **P-09**, 134, pl. 61; **P-11**, 192, pl. 57.

Pedro Miguel, **P-08**, 56, 70, pls. 1, 36-39; **P-09**, 134, pl. 60.

Towns, Balboa, **P-13**, 180.

Sixth Division. (See Pacific Division; see No. 256, p. 2368 of this Index.)

1913. On abolition of Pacific division, dredging and procuring of sand from Chame organized into separate district reporting to chief engineer. Decided, Feb., 1913, to flood Culebra Cut, Oct., 1913, by removal of dike at Gamboa. Estimated 350,000 c. y. had to be removed from lake section north of Gamboa, and that this could be done most economically by dredging; Cucaracha slide, largely clay and small spalls, could not be removed economically by steam shovels after heavy rains set in, but could be handled efficiently by suction dredges; conclusion reached that subsequent to admission of water into cut work remaining could be handled most expeditiously and economically by dredging fleet. To get fleet in condition to handle work by that time and to take care of what remained at entrances, it naturally followed that best results could be accomplished by concentrating dredging under one head; May 1 this was done, and division organized with W. G. Comber as resident engineer.

Fleet available on Atlantic side, seagoing dredge "Caribbean," 5-yard dipper dredges "Chargres" and "Mindi," French ladder dredges "No. 1" and "No. 5," and 5 pipe-line suction dredges. One of the pipe-line dredges, after finishing hydraulic fill in dam, overhauled and laid up in Gatun Lake until water in lake was of sufficient depth for it to begin operations north of Gamboa, other dredges operated within prism north of about milepost 6,

covering about 5 miles of channel, removing therefrom during year 5,730,379 c. y. earth and 753,029 c. y. rock. July 1, 1913, there remained to be removed from prism 1,837,000 c. y. earth and 99,600 c. y. rock. Of rock excavated from channel, 680,176 c. y. dumped in vicinity of west breakwater, making total to date furnished by dredges for this purpose 1,810,108 c. y. Of this, 651,000 c. y. dumped within breakwater section. In removal of rock from channel drill boat "Terrier" drilled 43,062 linear feet in prism, breaking 394,526 c. y. material. At end of fiscal year 40' of water could be carried through approximately first $1\frac{1}{2}$ miles of channel, 35' through next 5 miles, and between this and locks depth varied from 10' to 30'. Siltage in prism for year, 2,084,000 c. y.

In addition to work in channel and in excavation for wing walls and north center approach pier of locks already reported, dredges operated in vicinity of new docks at Cristobal, of dry dock at same locality, of mouth of Mindi in French canal, and of Margarita Island. In approach channel to new docks at Cristobal 665,018 c. y. earth removed, and from slip between Piers 16 and 17 on new terminals 155,693 c. y. earth and 189,284 c. y. coral rock dredged. "Terrier" drilled 4,511' at site of permanent bridge across French canal for railroad connection with coaling plant, and 34,448 c. y. material broken up by blasting. From dry dock basin, to provide mooring berth for suction dredge "Caribbean," 3,851 c. y. removed, from French canal at Mindi 295,535 c. y. earth excavated, and 100,957 c. y. dredged from Margarita Bay and used for parapet and swamp fill in that locality. Site cleared for proposed coaling station on Telfer Island.

At Pacific entrance there were employed seagoing suction dredge "Culebra," 5-yard dipper dredge "Cardenas," 4 French ladder dredges, seagoing ladder dredge "Corozal," and 1 pipe-line suction dredge. Pipe-line suction dredge transferred from Atlantic end when it had completed its work on hydraulic fill for Gatun Dam; dismantled, hull cut in sections and moved over by railroad to Balboa, and after reerection put in commission Nov. 16, 1912. For remainder of year employed principally in dredging from site of proposed inner harbor and terminal basin at Balboa.

Total removed from prism during year, 4,321,956 c. y., of which 1,047,929 c. y. rock. At close of fiscal year there remained to be removed from prism 1,847,774 c. y. earth and 1,600,000 c. y. rock. Of total rock removed from prism, 121,161 c. y. drilled and blasted by drill barge "Teredo" and 65,953 c. y. broken by rock breaker "Vulcan." Remainder includes rock broken by Star drill operations in previous years and material which could be handled by dredges without drilling and blasting.

Auxiliary dredging outside of prism, 1,457,342 c. y., of which 3,695 c. y. rock. Of this, 1,453,647 c. y. earth and 3,695 c. y. rock removed from inner harbor and terminal basin site. At close of year there remained to be removed from inner harbor and terminal basin 6,363,240 c. y. earth and 372,062 c. y. rock. Clearing of this site extended over area of 1,050,988 sq. feet and consisted of cutting brush and trees and blasting stumps. Orange-peel dredge excavated 7,800' of diversion channel, for draining swamp lands at Balboa to be reclaimed by hydraulic filling.

During year 445,658 c. y. sand procured from Chame by dredging and transferred to sand bins at Balboa. Of this, 435,758 c. y. transferred to stock piles for use in concrete construction for the fifth division. Sand bins had total length of 260' and were provided with 3 rapid unloading cranes until early in May, 1913, when, because site of bins encroached upon terminal work, 1 unloader removed and bins shortened to 175'. Proposed to erect crane at Gamboa for use in procuring gravel from Chagres River.

Arrangements made by which 2 suction dredges and "Corozal" will be moved into Culebra Cut soon as locks will permit and depth of water is sufficient, with view to attacking Cucaracha slide. Suction dredges will remove clay and, assisted by relay pumps located on 95' level on west bank, will discharge into Rio Grande Valley. "Corozal" will handle heavier material, depositing it in low areas of Gatun Lake. Anticipating necessity for completing cut by dredges, contract entered into Jan. 16, 1913, for construction and delivery at Colon of 2 dipper dredges of largest and most powerful type. To be equipped with 15-yard buckets or dippers for dredging soft material and 10-yard buckets for rock. Deliveries expected at tidewater in U. S., ready for shipment to Isthmus, Dec. 1, 1913, and Jan. 1, 1914. To serve these dredges 6 dump scows of 1,000 c. y. capacity contracted for June 13, 1913; 2 to be delivered on or before Dec. 12, 1913, 2 on or before Jan. 27, 1914, and 2 on or before Mar. 13, 1914. **P-13**, 35-38.

Sifter, H. J. (See No. 234, p. 2367 of this Index.)

Slides. (See Banks; Breaks; Central Division; Culebra Cut; see No. 223, p. 2366 of this Index.)

Amount excavated annually, **P-12**, pl. 86.

Blasting, effect of, **P-12**, 214; **P-14**, pl. 52.

Breaks and, **P-10**, 153; **P-12**, 160, 162; **P-13**, 153, 154.

Causes, **P-12**, 208, 214, pl. 61.

Central division, **P-09**, 83; **P-11**, 149.

Channels at, Culebra, **P-14**, pl. 56.

Cucaracha, **P-08**, 56, pl. 11; **P-09**, 90, pl. 34; **P-10**, 160, pls. 33, 34; **P-12**, 170, pl. 30; **P-14**, pls. 49-59, 132-135.

Culebra division, **P-08**, 41; **P-11**, 156, pl. 34; **P-13**, 160, pl. 43.

Deformative slides, Culebra, **P-12**, 207.

Dredges working at, **P-14**, pls. 54, 55, 59.

Due to weathering and corrosion, **P-12**, 211.

Estimates, **P-11**, 136.

Excavation, **P-12**, 161.

Fault zone, **P-12**, 210; **P-13**, 582, pls. 76, 77.

Gatun Locks, **P-09**, 66, pl. 19; **P-11**, 118; **P-12**, 128.

Geological studies, **P-13**, 580.

Las Cascadas, **P-08**, 56, pl. 14; **P-11**, 156, pl. 35.

Miraflores Locks, **P-12**, 204, pl. 53.

Natural slopes, slides to cease when reached **P-12**, 214.

New Culebra, **P-08**, 56, pl. 13; **P-10**, pl. 105.

Normal and gravity, Culebra, **P-12**, 210.

Old French dump, **P-09**, 90, pl. 35.

Panama R. R. relocation, **P-11**, 194.

Paraiso, **P-08**, 56, pl. 12.

Passing Cucaracha slide, dredge, **P-14**, pl. 51.

Remedies, Culebra, **P-12**, 209.

Rock slides, **P-12**, 156, 170, pls. 36, 42.

Section, geological, Culebra, **P-12**, 214, pl. 59; **P-13**, pl. 123.

Sections and maps, **P-10**, pl. 104; **P-11**, pls. 107, 108; **P-12**, 170, pls. 40, 84.

Section showing change in surfaces, **P-12**, pls. 85, 87.

Seepage, cause of, **P-12**, 214, pl. 60.

Steam shovel, burial, **P-12**, 170, pl. 43; **P-13**, 160, pls. 42, 44, 45.

Structural break, Culebra, **P-12**, 207.

Terracing to prevent, **P-13**, 160, pl. 38.

Toe of, **P-13**, 160, pl. 37.

Types of, Culebra, **P-12**, 207.

Views, **P-13**, 138, pl. 19.

Wachusets Dam (Gatun Dam studies), **P-08**, 196, pl. 134.

White House yard, **P-10**, 160, pl. 40.

Slopes.

Saturation slopes, Gatun Dam studies, **P-08**, 148.

Materials, dam studies, **P-08**, 196.

Different heads, experimental dams **P-08**, 196, pls. 139, 167.

Paving, Gatun Dam, **P-13**, 138, pl. 28.

Natural slopes, when reached, slides will stop, **P-12**, 214.

Sea slopes, Toro Point Breakwater **P-14**, pl. 35.

Surface slopes, Chagres River, **P-11**, pl. 126.

Slots.

Conductor-slot material, **P-14**, 108, 109.

Sluice Gates. (See Gates, Sluice.)

Sluicing.

Cheap method of material disposition, Juan Grande, **P-11**, 156, pl. 32.

North Gold Hill, **P-13**, 186, pl. 52.

Smith, H. A. A. (See Nos. 237, 269, pp. 2367, 2368 of this Index.)

- Smith, Jackson.** (See Nos. 217, 224, p. 2366 of this Index.)
- Snubbing.**
Posts, **P-14**, 124.
- Social Conditions.** (See No. 53, p. 2362 of this Index.)
- Soils.**
Apparatus for testing, **P-08**, 138.
Capacity to absorb water, experimental dams, **P-08**, 177.
Dam studies, **P-08**, 138, 139.
Frictional resistance, **P-08**, 138.
Resistance to water, **P-08**, pl. 63.
Seepage tests, **P-08**, 132, 134.
- Specifications.**
Standard form, **P-09**, 179.
- Spillways, P-07**, 4, 57; **P-09**, 41; **P-11**, 83.
Accessory parts, **P-10**, 64.
Bridges, Gatun, **P-10**, 126.
Concrete work, Camacho Reservoir Dam, **P-11**, 156, pl. 42.
Costs, Gatun, **P-11**, 122; **P-13**, 130.
Crest gates, Gatun, **P-13**, 138, pl. 29.
Dam and spillway, Camacho Reservoir, **P-07**, 8, pl. 4.
Dam and spillway, costs, Gatun, **P-12**, 133.
Discharge, mass curves, Chagres, **P-12**, pl. 103; **P-14**, 91.
Excavation, Gatun, **P-08**, 70, pl. 33; **P-13**, 129.
Excavation, Miraflores, **P-13**, 173.
Floor and wall, Gatun, **P-09**, 66, pls. 25, 26.
Foundations, Gatun, **P-10**, 136, pl. 15.
Gate machine and pump, **P-11**, 80; **P-12**, 89; **P-13**, 93.
Gate machines, tests, **P-13**, 94.
Gates, leakage of, Gatun, **P-14**, pls. 109, 110.
Gatun, **P-07**, 55; **P-08**, 60, 196, pl. 84; **P-09**, 41, 52; **P-10**, 61, 125; **P-11**, 119, 121, 132, pl. 22; **P-12**, 129, 131, 132, pl. 80; **P-13**, 122, 128; **P-14**, 7.
Gauging station, **P-11**, 288, pl. 72.
Hydraulic conditions of vicinity, Miraflores, **P-14**, 158.
Irons, fixed, **P-13**, 74.
Leakage, **P-14**, 92.
Levee, Mindi, **P-10**, 126; **P-11**, 122.
Machinery, **P-13**, 5; **P-14**, 74.
Machinery, gates, **P-10**, 55; **P-12**, 89.
Machinery, assembly of, **P-10**, pl. 92.
Machinery, installation, **P-12**, 306.
Machinery, Gatun and Miraflores, **P-12**, pl. 74.
Miraflores, **P-09**, 41; **P-10**, 64; **P-13**, 166, 172, pl. 51; **P-14**, 9.
Model, Gatun, **P-10**, 64, pl. 1.
Model, baffles to check rush, **P-10**, 64, pl. 2.
Operating gates, changes due to, Gatun, **P-14**, pl. 108.
Outflow of Gatun Lake, **P-10**, 136, pl. 16.
Pacific division, **P-13**, 162.
Plan, Gatun, **P-10**, pls. 93, 94; **P-11**, pl. 85.
Plan, Miraflores, **P-11**, pl. 87.
Profile, Chagres Valley, **P-08**, 196, pl. 166.
Section, longitudinal, Gatun, **P-11**, pl. 86.
Section, Gatun, **P-11**, pl. 88.
Shops, **P-12**, 262; **P-13**, 259.
Sosa Hill and San Juan Hill, **P-07**, 57.
Stoney gates, drawings, **P-10**, pl. 77.
Views, Gatun, **P-08**, 196, pl. 84; **P-11**, 132, pl. 8; **P-12**, 142, pls. 24, 26, 27.
- Spooner Act, P-04**, 23; **P-11**, 549, 550. (See Laws; Acts; Panama.)
- Approved June 28, 1902. Provides for purchase of rights, etc., of New Panama Canal Company at Isthmus of Panama, including certain shares of Panama Railroad Company. Arrangements with Colombia for perpetual control of strip not less than 6 miles wide. Right to waters involved, and to construction and operation of canal, and operation, etc., of Panama Railroad, including jurisdiction over ports at the ends. \$40,000,000 to be paid Panama Canal Company, and sum to be agreed upon to Colombia.
- Canal to be constructed of sufficient capacity and depth as shall afford convenient passage for vessels of the largest tonnage and greatest draft "now in use," and such as may be "reasonably anticipated." Necessary locks to be supplied, and terminal harbors. Measures for defense to be taken. President authorized to employ whoever necessary, etc.
- Failing negotiations with Panama Canal Company, etc., canal by Nicaragua route authorized. Details.
- \$10,000,000 appropriated. Contracts authorized. Additional appropriation may be made, not to exceed in aggregate \$135,000,000 additional by Panama route, or \$180,000,000 by Nicaragua route.
- Special arrangements may be made with Colombia, Nicaragua, and Costa Rica for use of canal and harbors for vessels owned by those states, etc.
- Creation of Isthmian Canal Commission of 7 members, appointed by the President, etc. One to be named as chairman. Four learned and skilled in engineering, 1 an officer of the U. S. Army, 1 an officer of the U. S. Navy. Compensation of the Commission to be named by the President until otherwise fixed by Congress. Employment of engineers, etc., through the Commission. Commission subject to the direction and control of the President, reporting to him.
- Secretary of the Treasury authorized to borrow on credit of the U. S. \$130,000,000.
- Springs, Mineral.**
Zone, **P-13**, 578.
- Stairways, Concrete.**
Range towers, **P-12**, 108, pl. 18.
- State, Secretary.** (See No. 1, p. 2361 of this Index.)
- Station.** (See Coaling; Filtration; Fire; Gauging; Hydrography; Meteorology; Panama R. R.; Police; Pumping; Radios; Triangulation.)
- Station, Power.**
Establishment of electric power station, **P-10**, 57; **P-11**, 82.

Gatun, **P-12**, 88.

Locks, operation by, from, **P-12**, 88.

Transmission line substations, **P-14**, 315, pl. 70.

Staff, Engineering.

List of, **P-04**, 37.

Maj. W. M. Black, head, after transfer, Panama, **P-04**, 36.

Statistics. (See Courts; Customs; Employees; Municipalities; Sanitation.)

Statistics, Vital. (See No. 211, p. 2365 of this Index.)

Status. (See No. 169, p. 2365 of this Index.)

Steamboats. (See Administration, Civil.)

Inspection service and licenses, **P-10**, 365; **P-11**, 416; **P-12**, 458; **P-13**, 462; **P-14**, 265.

Steam Shovels. (See Shovels, Steam.)

Steam Vessels. (See Steamboats.)

Stearns, F. P. (See No. 164, p. 2365 of this Index.)

Steelwork and Steel.

Balboa shop buildings, **P-14**, 172.

Castings of, cost, etc., **P-13**, 262; **P-14**, 258.

Fixed steelwork, Gatun Locks, **P-11**, 118; **P-12**, 128; **P-13**, 121.

Forms of steelwork. (See Forms.)

Pacific terminals, **P-14**, 213, 214.

Reinforcing steelwork, Pacific terminals, **P-14**, 213.

Terminal construction, **P-14**, 167.

Vanadium steel yoke, lock gates, tested, **P-11**, 100, pl. 3.

Stevens, Chief Engineer John F. (See Nos. 125, 201, pp. 2363, 2365 of this Index.)

Appointment, **P-05**, 5, 108.

Stock. (See Material.)

On hand, **P-11**, 359; **P-13**, 377, 394.

Stock, Rolling, P-12, 252; **P-13**, 250; **P-14**, 305.

Stockade.

For convicts engaged in road building, **P-12**, 514, pl. 68.

Stone. (See Costs; Quarries; Rock.)

Ancon quarry, **P-09**, 97.

Concrete, Gatun, **P-08**, 60.

Costs, Gatun, Pedro Miguel, and Miraflores, **P-11**, 295.

Costs, Porto Bello and Ancon quarries, **P-11**, 296.

Costs, **P-14**, 449.

Crusher plant, Rio Grande, **P-07**, 69.

Crushed stone, Porto Bello, **P-12**, 115.

Crusher plant, Porto Bello, **P-09**, 66, pl. 23.

Excavation, Ancon, **P-09**, 97, 98.

Production, costs, **P-11**, 294; **P-12**, 301; **P-13**, 281. (See above.)

Standard stone, procuring, Gatun Locks and Spillway, **P-09**, 48.

Service of, Gatun Locks and Spillway, **P-11**, 103; **P-12**, 111.

Source of, found, for concrete, **P-08**, 66.

Supply, **P-10**, 111.

Stoney Valves. (See Frames; Gates; Locks; Machinery; Valves.)

Storage Magazines. (See Magazines, Storage.)

Storage.

Foundry and pattern storage, **P-12**, 271.

Patterns, new shop, Balboa, **P-13**, 254, pl. 57.

Trestles, storage, Pedro Miguel and Miraflores, **P-10**, 162, 164.

Trestles, Pedro Miguel, **P-10**, 196, pl. 44.

Yard, east breakwater, **P-14**, pl. 33.

Storehouses.

Empire, **P-09**, 220, pl. 92.

Fire, Mount Hope, **P-07**, 103.

Interior, Empire, **P-09**, 220, pl. 93.

Material in, **P-13**, 394; **P-14**, 304.

Places of storage and, **P-08**, 227.

Q. M. department, **P-12**, 383.

Rebuilt storehouses, **P-07**, pls. 130, 131, 132, 133.

Section, Mount Hope storehouses, **P-09**, 220, pl. 90.

Storms.

Force of, Tropics, **P-05**, 294.

Storm Sewers.

Colon, **P-10**, 136, pls. 19, 20; **P-11**, 129.

Streams.

Discharge of various, dry seasons, **P-12**, 244.

Streets. (See Municipal Engineering.)

Cleaning, Panama and Colon, **P-07**, 151; **P-09**, 65.

Colon, **P-09**, 65.

Gatun, **P-09**, 63.

Improvements, Panama, **P-10**, 185; **P-11**, 178; **P-12**, 192.

Railroad construction on, bond to insure repairs, **P-07**, 149.

Railways, Panama, **P-07**, 149.

Stripping.

Cocoli Hill, **P-12**, 204, pl. 55.

Struts, Compression.

Miter gate moving machines, **P-14**, pls. 83, 84.

Studies.

Experimental dams, Gatun, **P-08**, 127-196.

Gatun Dam borings, **P-08**, 196, pls. 73, 74, 75, 78, 79, 80, 81.

Submarine Foundations. (See Foundations, Submarine.)

Subsidy.

Payment of Panama R. R. to U. S. not required by act, **P-11**, 577.

Subsistence. (See No. 224, p. 2366 of this Index.)

Articles, principal, **P-10**, 325.

Cost, **P-07**, 139.

Groceries, statistics, **P-13**, 397.

Hospitals, **P-10**, 425; **P-11**, 520; **P-12**, 547.

Profits, **P-13**, 399.

Subsistence Department. (See Nos. 224, 246, pp. 2366, 2367 of this Index.)

1908-9. Organization: Commissary of Panama R. R. transferred, July 16, 1908, to charge of subsistence officer of Isthmian Canal Commission, and managed in connection with hotels, messes, kitchens, etc.

Sales: \$4,841,647.09. Commissary of no expense to Isthmian Canal Commission; operated at a profit to Panama R. R., surcharges being added to stuffs handled sufficient to pay off expense incurred by railroad company for the erection of buildings and various plants, and to cover freight and handling charges along the line.

New buildings: New commissary buildings constructed by Isthmian Canal Commission at Gatun and Porto Bello.

Hotels, messes, etc.: In addition to Hotel Tivoli, there are 17 hotels, 19 messes, 21 kitchens, providing food for 7,700 people. Hotel Tivoli shows profit, line hotels a loss, messes and kitchens a profit. Subsistence feature of Isthmian Canal Commission self-supporting. **P-09, 24.**

1910. Department charged with operation of Hotel Tivoli, 18 Isthmian Canal Commission hotels, 19 European laborers' messes, and 20 common laborers' kitchens; under charge of Maj. E. T. Wilson, subsistence officer.

Hotel added and one kitchen dropped. Supplies procured from commissary, belonging to Panama R. R., operated by subsistence officer, who is also commissary for Panama R. R.

Hotel Tivoli operated at profit of \$4,574.23. Meals served at line hotels, 2,176,451; price per meal, 30 cents. Cost for supplies per meal, 24.87 cents, and expense in preparing and serving, 6.23 cents. Total increase of \$43,964.31 in cost of the food supplies to line hotels during the year, or of 1.33 cents per meal. Expense in preparation and serving decreased 0.69 cent over preceding year. Total rations furnished European messes, 1,092,487, at cost of 30.18 cents per ration for food and 6.60 cents per ration for expense. Rations served in laborers' kitchens, 781,746, at cost of 22.66 cents for food and 4.63 cents for expense. Total revenue from the line hotels, messes, and kitchens, \$1,350,658.05; decrease of \$168,620.08 over previous year. **P-10, 38, 39.**

1911. At end of fiscal year department operating Tivoli Hotel, 19 line hotels, 3 night restaurants, 16 European laborers' messes, and 14 common laborers' kitchens; an increase of 1 hotel and decrease of 3 messes and 4 kitchens. Total meals served by hotels, 2,216,740; increase of 40,289 over previous year. Cost of supplies per meal, 25.44 cents, or 0.57 cent more than during previous year; and expense preparing and serving meals 0.62 cent less, or 5.61 cents; resulting in decrease in total cost per meal of 0.05 cent. Total rations served European laborers' messes, 1,054,545, or \$7,942 less than last year. Cost of supplies per ration in-

creased 0.16 cent, but cost of service decreased 0.72 cent, making decrease in total cost of ration 0.56 cent, or cost for year of 36.22 cents. Total rations served in laborers' kitchens 444,503; falling off of 337,243 over previous year. Cost of supplies per ration decreased 0.63 cent and cost of service decreased 0.63 cent, making total cost of ration 26.06 cents. Revenue for the year from line hotels, restaurants, messes, and kitchens, \$1,254,216.55; decrease of \$96,395.65. Supplies consumed decreased \$57,660.17 and total cost of service decreased \$37,980.50, giving total cost of operations of \$1,221,469.29. As result of operations, line hotels and restaurants showed loss of \$20,905.44, European messes showed profit of \$39,236.63, and common laborers' kitchens showed profit of \$14,411.00. On Nov. 1, 1910, room rates at Tivoli Hotel reduced approximately 10 per cent; hotel operated at a profit of \$26,427.05. In addition to repairing equipment and replacing such minor dining room and kitchen equipment as necessary, new furniture and fixtures amounting to \$7,000 purchased to replace such as no longer serviceable. **P-11, 4.**

1912. June 30, 1912, department operating line hotels, 3 night restaurants, 18 European laborers' messes, and 18 common laborers' kitchens—increased of 2 messes and 4 kitchens. Hotel and kitchen at Nombre de Dios closed because of completion of work. One of two messes at Obispo closed. Hotels, messes, and kitchen opened at Naos Island and Margarita Island mess and kitchen at Cerro, and kitchen at Rio Grande and Paraiso. Revenue from line hotels, restaurants, messes, and kitchens \$1,263,869.81, an increase of \$9,607.41. Total cost, \$1,226,352.16; increase of \$4,887.65. Profit, \$37,517.65; increase of \$4,724.51. Total meals in line hotels, 2,075,335, 6.38 per cent less; total rations in European laborers' messes, 1,108,175, 5.09 per cent more; rations in common laborers' kitchens, 584,314.9 per cent more. Expenditures in salaries and wages for line hotels, restaurants, messes, and kitchens, \$162,006.78; saving of \$10,000. As result of year's operations, line hotels and restaurants showed loss of \$12,085.37, European laborers' messes showed profit of \$38,455.78, and common laborers' kitchens showed profit of \$11,147.24.

Accommodations of Tivoli Hotel increased. Building new wing, increasing number of rooms opening on private baths from 28 to 32. New furniture and other equipment to the value of \$10,000 purchased, greater part of equipment being for new rooms. Hotel operated at profit of \$53,652.36. **P-12, 53, 54.**

1913. June 30, 1913, department operating Tivoli Hotel, 17 line hotels, 3 night restaurants, 15 European laborers' messes, and 16 common laborers' kitchens—decrease of 2 hotels, 3 messes, and 2 kitchens. I

at Balboa closed and consolidated with one at East Balboa. Hotel near spillway at Gatun closed Mar. 31, and messes at Cerro, Haut Obispo, Gatun (No. 68), and Naos Island closed, and one at Bas Obispo opened. New kitchen opened at Bas Obispo, while those at Ancon, Cerro, and Haut Obispo closed. Revenue from line hotels, restaurants, messes, and kitchens, \$1,235,077.84, decrease of \$28,791.97; while cost of operations was \$1,205,800.76, decrease of \$20,551.40; making profit \$29,277.08, decrease of \$8,240.57. Meals served in line hotels, 2,340,644, an increase of 265,309. Rations served in European laborers' messes, 985,516, or 172,659 less. Rations served in common laborers' kitchens, 461,456; decrease of 123,001. Net expenses for salaries and wages, \$166,398.65; increase of \$4,391.88. As result of year's operations, line hotels and restaurants showed loss of \$3,837.71, increase of \$8,247.66; European laborers' messes showed profit of \$26,845.24, decrease of \$11,610.54; and common laborers' kitchens showed profit of \$6,269.55, decrease of \$4,877.69.

Laundry installed in Tivoli Hotel to handle guests' work opened Dec., 1912. Hotel operated at profit of \$76,256.55. P-13, 57, 58.

Substations.

Electric substations, P-14, 97-100.

Suction Dredge. (See Dredge, Suction.)

Suits, Law.

Disposal of claims without, P-14, 523.

Summits, Canal.

60' profile, P-06*, 7, pl. IV
85', map, P-06*, 7.

Sumps.

Chain fender sump pumps, P-14, 113.
Colon, P-07, 62.
Pumps and motors, P-14, 114.
Pumps, Cristobal and Balboa substations, P-14, 124.

Supervisors.

Number, and pay, P-11, 220.
Shops, P-12, 258.

Supplies. (See Nos. 43, 69, 222, 267, pp. 2362, 2363, 2366, 2368 of this Index.)

Act relating to deductions from pay for, P-11, 564.

Classes handled, P-08, 221.

Diversity, P-07, 105.

Equipment and, Executive order preventing unauthorized purchases from persons in Army or Navy, P-12, 612.

Furnished to canal by Panama R. R., act relating to bond, P-11, 581.

Receipt, inspection, and disposition, P-08, 223.

Requisition system, P-07, 106.

Supplies, Material and, P-04, 38; P-05, 15, 16; P-06, 11; P-07, 103; P-08, 221; P-09, 210; P-10, 309; P-11, 357; P-12, 381; P-13, 376; P-14, 277.

Accounting for, P-08, 226.

Care and custody, P-08, 224.

Issue and transfer of, P-08, 225.

Supplies, Material and (Department).

1914. Organized Apr. 1, 1914, by combining Q. M. and subsistence departments under old organization, in charge of Capt. R. E. Wood, U. S. Army, as chief Q. M. Has charge of recruitment of labor; construction and repair of buildings; care, furnishing, and assignment of quarters; distributing fuel, commissary supplies, and distilled water; operation of hotels, messes, and kitchens; requisitioning for supplies, together with receipt and distribution of them; cutting of grass and disposal of night soil and garbage, as prescribed by the health department.

During year work of department more arduous than that of any other on Isthmus, by reason of frequent changes in organization due to consolidation of the work, construction of new buildings, elimination of old towns and transfer to new localities.

Force employed on canal dropped steadily, being 29,673, June 30, 1914, as compared with 43,350 at close of previous year. Large emigration, and for first time since work started excess of departures over arrivals of about 15,000. Free transportation furnished 1,361 Americans, 1,173 West Indians, and 1,615 Europeans. Character of force radically changed, due to completion of dry excavation and large increase in building force for construction of quarters, offices, etc. Shop forces made two transfers, one from Gorgona to Empire and then from Empire to Balboa. Dredging forces shifted from terminals at Balboa and Cristobal to Paraiso. Transportation men transferred from Las Cascadas and Empire to Balboa. These changes made necessary by waters of lake drowning out Gorgona where shops were formerly located, by concentration of dredging fleet in Culebra Cut, and by abandonment of Las Cascadas that it might be available for the military. At close of fiscal year there were 17,938 men, women, and children in canal quarters, as compared with 23,184 previous year. Greatest percentage of decrease among American and European employees.

A new town, La Boca, erected on Balboa dumps south of Sosa Hill for silver employees that will eventually be required for permanent organization. Houses which had to be abandoned or moved transferred and reerected at La Boca and converted into family quarters, and apartments rented. Fifty-two buildings, taken from Gorgona, Bas Obispo, Las Cascadas, Diablo, Empire, Culebra, Porto Bello, Gatun, Pedro Miguel, and Ancon Hospital, moved and reerected at La Boca. Structures accommodate 413 families. Cost varied from \$111 to \$520 per apartment and rents range from \$3

to \$9 per month. Range closets, cook sheds, washhouses, and bathhouses for bachelor and married employees erected at La Boca. Besides settlement at La Boca, silver quarters at Paraiso, Cristobal, and Gatun thoroughly overhauled, repaired, and rented. At close of year 153 houses, with 736 apartments and rooms, rented to employees on silver roll, monthly amount realized being \$3,736.

On June 30, 1914, 2,535 buildings in canal settlement—117 belonged to Panama R. R., 19 to Army, Navy, and Marine Corps, leaving 2,399 belonging to Panama Canal. Of these, 567 French buildings, remaining of total of 2,148 turned over by French company 1904. 136 buildings demolished and 107 sold, practically all French buildings. Raising of lake necessitated removal, demolition, and sale of all buildings at Gorgona and Matachin and most of buildings in labor camps at Chagres and Miraflores, and slides caused demolition and removal of some buildings at Culebra. Of 175 buildings taken down, 153 reerected and 22 in course of erection. Work in connection with erection of buildings for Darien radio station for Navy done by supply department. Permanent buildings constructed consisted of hydroelectric station at Gatun, substations at Gatun, Cristobal, Miraflores, and Balboa, commissary warehouse at Cristobal, the administration building at Balboa, permanent family quarters of concrete blocks (28 four-family and 9 two-family), shops office building, commissary building at Balboa, and commissary building at Ancon. Total expended for these buildings, exclusive of those for commissary, to close of fiscal year, \$1,943,430.05.

Policy continued of limiting stock of material and supplies, which necessitated placing of frequent orders. Material received, \$11,116,395.10; local purchases, \$2,293,144.66. Of local purchases, coal aggregated \$929,176.57; oil, \$863,206.66; and tools from the McClintic-Marshall Construction Co., \$40,000. Decrease of 130,000 tons of cement, but large increase in lumber purchased. Changed conditions of work necessitated closing down of storehouses at various localities and concentration of material at terminals. Gorgona storehouse closed Aug. 15, 1913; Miraflores storehouse Nov. 1, 1913; Pedro Miguel storehouse Sept. 15, 1913; Toro Point storehouse May 1, 1914; Porto Bello storehouse May 15, 1914; and Ancon storehouse June 30, 1914. Storehouse opened at Paraiso Dec. 1, 1913; cement shed erected for storage at Corozal, and new buildings of Balboa storehouse opened Feb., 1914. Mount Hope depot invoiced material to value of \$7,093,963.28, as compared with \$10,580,628 during previous year. Stock on hand at Balboa, June 30, 1914, \$1,098,143.49. 30,000 tons of rail and scrap handled at scrap yard at Mount Hope. Exclusive of con-

tracts with Chicago House Wrecking Co., under which practically no shipments were made during year, approximately \$80,000 worth of scrap sold. In addition, scrap on hand at Mount Hope valued at about \$300,000 based on market prices. Expenses of scrap operations proper, \$25,000. Unloaders, steam shovels, locomotives, spreaders, pile drivers, and track shifters no longer needed for work prepared for storage, at cost of \$14,222.84; this expenditure necessary to secure highest possible prices for material. June 30, 1914, department operating Hotel Tivoli, Hotel Aspinwall, 12 line hotels, and 10 laborers' messes, decrease of 4 hotels and 5 messes. Hotels at Porto Bello, Gorgona, Dump No. 6, Bas Obispo, Las Cascadas, and Miraflores closed. Mess at Ancon for gold employees and Hotel Aspinwall at Taboga Island opened. Messes at Dump No. 6, Bas Obispo, Culebra, Gorgona, Miraflores, and Porto Bello closed, and common laborers' kitchen at Naos Island converted into laborers' mess. Revenue from line hotels, restaurants, and messes, \$1,032,189.51, decrease of \$202,888.33; while cost of operations was \$1,021,856.92, decrease of \$183,942.84; making profit \$10,332.59, decrease of \$18,944.49. Meals served in line hotels, 2,131,912; decrease of 208,732. Immediately after July 1, 1913, European laborers' messes and common laborers' kitchens combined and called laborers' messes. Rations served in these messes, 950,994; total rations served in both messes and kitchens during previous year, 1,396,972. Salaries and wages, \$133,638.81, as compared with \$166,398.65 for previous year. Line hotels and restaurants showed loss of \$18,366.18, as compared with loss of \$3,837.71 during previous year. Laborers' messes show a profit of \$28,698.77, against combined profit of \$33,114.79 on messes and kitchens during previous year. During last fiscal year demand for wagon transportation heavier than since 1904; necessary to purchase 100 new mules. As a result of necessary town-site work, hauling material for new buildings and those transferred, and collection of garbage in city of Panama, which was transferred to health department during year, all U. S. animals worked to limit. This overwork and the fact that all mules, except those purchased during last 15 months, averaged over 7 years' service on Isthmus, resulted in death of 50 animals, considerably heavier loss than during previous year. P-14, 46-50.

Surge.

On locking, Pedro Miguel, in Culebra Cut, P-14, pl. 112.

Surveys. (See Geology; see Nos. 20-22, 136, 244, pp. 2361, 2363, 2367 of this Index.)

Alternative line, Gatun to Bohio, P-04, 41.

Atlantic division, P-09, 59; P-10, 117; P-11, 108; P-12, 122.

Base, horizontal length of, **P-11**, 273.
 Borings and, terminals, **P-12**, 187.
 Chagres River, **P-09**, 196; **P-10**, 297.
 Dam across Chagres at Gatun, **P-04**, 41;
P-05, 12.
 Dam, Bohio, **P-04**, 41; **P-05**, 12.
 Dredging division, **P-14**, 241.
 Dredging division, La Boca, **P-07**, 51.
 General surveys, **P-10**, 297; **P-11**, 272; **P-12**,
 248; **P-13**, 190; **P-14**, 27, 92.
 Lands, zone, **P-10**, 299; **P-11**, 275; **P-12**, 247.
 Lands, zone, act relating to, **P-11**, 570, 576.
 Lock and dam construction, **P-08**, 67.
 Maps, etc., making, **P-08**, 55.
 Navigation, aids to, **P-13**, 108.
 Office work and, **P-08**, 47.
 Pacific division, **P-10**, 196; **P-11**, 190; **P-12**,
 204.
 Panama-Colon datum, geographic positions,
P-11, 282, 284.
 Property of, **P-11**, 277.
 Section on general surveys, reports, **P-13**, 244.
 Sixth division, **P-13**, 190, 192.
 Status, **P-05**, 144.
 Triangulation, **P-10**, 297; **P-11**, 272.
 Upper San Juan to headwaters of the Indio,
P-99, 349-351.

Surveys, Operations.

1905. Tiger Hill: Surveys for cut-off in route
 shows change to this location would not be
 advantageous, **P-05**, 12.
 Chagres River surveys: Topography taken of
 line of proposed Gatuncillo Tunnel and
 Dique open cut. 67 miles of transit and
 120 miles of compass and level lines run
 and much other engineering work of a re-
 lated character. **P-05**, 116.

1906. Chagres River division: Extends from
 Bas Obispo to Bohio. Surveys mainly
 during the year. " * * * It should be
 borne in mind that every foot of every line
 run has been cut out through a dense tropical
 jungle, and during the rainy season, which
 continues during the greater part of the year,
 these surveyors are working in water from
 ankle to waist deep and are subsisted and
 quartered in temporary camps. Undoubtedly
 the engineers * * * are laboring under
 more adverse and uncomfortable conditions
 than any other class of employees on the
 Isthmus." **P-06**, 86.

1907. Boundary lines: Boundary lines
 marked, aided by engineer of the Republic of
 Panama. Monuments of 4" wrought-iron
 pipe, 4' long, with a brass cap suitably marked.
 Survey in progress, relating to properties
 of the Isthmian Canal Commission, and
 lands claimed by private parties. **P-07**, 16.

1908. Sosa-Coroza Dam area: Survey made
 of this area which would have been flooded
 through project abandoned in favor of the
 dams at Pedro Miguel and Miraflores.

Monuments: Two original maps made of
 boundary monuments, etc., and submitted
 for action by Republic of Panama.

Duplicate precise level line: Mississippi River
 Commission lent 2 precise level men, etc.,
 for running line across the Isthmus. Bench-
 marks placed.

General maps: Projection of 3 general maps of
 the Isthmus from data of all surveys, under
 way. **P-08**, 19, 20.

1909-1914. (See Meteorology and River
 Hydraulics.)

1914. In addition to setting corner and grade
 stakes for building lots in Colon and Panama,
 setting grades for fill in Colon, making sur-
 veys and preparing maps of estates and
 parcels of land in dispute before joint land
 commission, making surveys and inspections
 for department of law, and performing
 considerable amount of miscellaneous work,
 general-surveys section repaired and removed
 certain zone triangulation stations, made
 surveys and maps for other departments of
 Panama Canal, made locations for radio
 stations constructed for Navy Department,
 took readings on settlement hubs in Gatun
 Dam, and performed necessary work in
 connection with precise level benchmarks
 and monuments for tide-gauge registers at
 Colon, Gatun, and Miraflores. **P-14**, 27.

Surveys, Geological. (See Geology*)

Geological surveys made during the year to
 secure character of sites for locks and dams,
 classification of material to be excavated,
 and to determine resources of the country
 in regard to building materials. Valuable
 data obtained. Material for best grades of
 cement found vicinity of Gatun. **P-07**, 15.

Report on geology of the Canal Zone, by
 Ernest Howe. June 26, 1907. **P-07**, 108-138.

Part I: Descriptive geology. Topography:
 Caribbean slope, central slope, Pacific slope.
 Geology—Introduction. Description of for-
 mations: Obispo, Bohio, marls of Pena
 Blanca, Gatun, Culebra, upper limits of
 older sediments, acid tufts and related rocks,
 intrusions of basic rocks. Development of
 the present topography; relation of the
 geology to the topography.

Part II: Applied geology. Excavation. Ge-
 ology of the dam and lock site. Gatun.
 Introduction. Geology of the lock site; of
 the dam site. Character of the material
 filling the Pleistocene valley. Trinidad
 spillways. Lock site at Pedro Miguel; dike.
 Sosa Lock site. Dams: La Boca, Sosa-Coroza,
 La Boca Spillway. Materials available for
 purposes of construction, rock for concrete,
 sand. Cement materials: Burning tests of
 cement materials from Panama; soundness;
 physical character of the raw materials;
 amount of raw material available; kinds of
 material to be used; fuel; costs; effects of
 climate; conclusion. Lignite. General sum-
 mary.

Culebra Cut: Report of geologist. "No difficulties are to be anticipated in continuing the excavation in the Culebra region except at Contractors Hill, where it is possible, but not probable, that landslides may take place when lower levels are reached. Should this danger present itself, it may be overcome by a reduction in the angle of slope." **P-07, 138.**

Dams and locks: Geology of sites. Geologist Howe reported: "The rocks at all points where locks are to be constructed are firm and hard and will make excellent foundations for the lock walls." The materials underlying the sites selected for the various dams will be competent to support the dams and will be impervious to water. **P-07, 138.**

Masonry construction materials: Geologist Howe reported: "There is an abundance of rock suitable for crushing near all points where such material will be needed."

Sand: Sand for building purposes has been found in large quantity on the Pacific coast at Chorrera, while that needed on the Atlantic side may be obtained in the vicinity of Porto Bello.

Cement materials: Raw material from which high-grade Portland cement can be cheaply manufactured on the Isthmus has been found in quantities sufficient to supply all of the cement needed.

Lignite: No coal has been found on the Isthmus, but small deposits of low-grade lignite have been found that are of no commercial value. **P-07, 138.**

Swamp.

Drainage ditch, east of Sosa-Corozal Dam, **P-07, 57.**

Open earth drains for, Mount Hope, **P-10, 434, pl. 70.**

Switchboards.

High-tension oil switch group, transformer room, Pedro Miguel, **P-13, 110, pl. 12.**

Lock-control, **P-14, 122.**

Low-tension, transformer room, Miraflores, **P-13, 110, pl. 13.**

Switch, Limit.

Motor and, cylindrical valve machines, locks, **P-12, 108, pl. 11.**

Operating machinery, locks, **P-10, 53; P-12, 85.**

T.

Tanks.

Experimental dam, Gatun, **P-08, 196, pl. 107.**

Tariff.

Duty on merchandise when entered into U. S. from zone, **P-11, 558.**

Tasking.

Task gang at work, Panama R. R., **P-09, pl. 75.**

Taxes, P-13, 466.

Executive order relating to, **P-11, 433; P-12, 618.**

Fees and, **P-08, 258; P-09, 260; P-10, 367; P-11, 419; P-12, 461.**

Telegraph. (See Nos. 62, 72, pp. 2362, 2363 of this Index.)

"All American" cable advocated, **P-07, 148.**

Permanent lines, Panama R. R., **P-11, 198; P-12, 284.**

Special rate of 25 cents obtained from Central & South American Telegraph Co., instead of 65 cents a word, **P-05, 18.**

Telephones. (See No. 62, p. 2362 of this Index.)

System and equipment, **P-14, 17, 120.**

Telephone system on the Isthmus under construction, **P-05, 18.**

Temperature. (See Meteorology.)

Absolute temperatures of record, **P-11, 248; P-12, 224; P-13, 223.**

Charts of, Gatun Locks, **P-10, pl. 98; P-11, 118.**

Means and extremes of, **P-13, 223.**

Ocean, **P-10, 289; P-11, 250, 262; P-12, 226, 230; P-13, 225, 233; P-14, 144.**

"Teredo."

Performance of, as drill barge, **P-11, 169.**

Terminals. (See Nos. 154, 263, pp. 2364, 2368 of this Index.)

Atlantic terminals. (See Atlantic division.)

Balboa terminals. (See Pacific division.)

Boiler shop, interior, **P-14, pl. 24.**

Buildings and floor areas, **P-13, 205.**

Caissons, **P-14, pl. 22.**

Cargo handling, **P-12, 218.**

Coaling, **P-12, 216; P-13, 196, 205, 209, 215, 217.**

Cofferdams, **P-13, 198.**

Concrete work, **P-13, 203.**

Construction, **P-13, 195, 205; P-14, 226.**

Contracts, **P-13, 204, 208.**

Cranes, **P-13, 209; P-14, pl. 27.**

Cristobal terminals. (See Atlantic division.)

Designing, **P-14, 166.**

Ditches, **P-13, 201.**

Docking, **P-12**, 218.
Dredging, **P-13**, 205.
Drilling, **P-13**, 201.
Entrances, dry docks, **P-13**, 196.
Dry docks, **P-13**, 196, 198, 209, 210; **P-14**,
pls. 25, 26.
Embankments, **P-13**, 202.
Equipment, floating, **P-12**, 220.
Excavation, **P-10**, 113; **P-12**, 112, 187; **P-13**,
196, 204.
Foundations, **P-13**, 200.
Fuel, **P-12**, 217; **P-13**, 218; **P-14**, pls. 121,
122.
Lands, for commercial uses, **P-12**, 221.
Lands, reclamation, **P-14**, 207.
Offices, **P-12**, 220.
Pacific terminals. (See Pacific division.)
Panama R. R. yards, **P-14**, 207.
Paving, **P-14**, pls. 21, 23.
Piers, **P-12**, 217; **P-13**, 198, 219; **P-14**, pl. 28.
Pier shells, **P-13**, pls. 105-107.
Plan, general, **P-12**, pl. 97.
Repairs, facilities for, **P-12**, 219.
Shops, **P-13**, 186, 205, 206, 207, pl. 54.
Sites, **P-12**, 204, pl. 56.
Superstructures, **P-12**, 217; **P-14**, pl. 22.
Tracks, **P-13**, 195.
Wharves, **P-12**, 217.

Terminals. Operation.

1906. Terminal yards and wharves: Two large wharves built at Atlantic terminus, and coal-hoisting plant reducing cost of handling from 23 cents to 6 cents a ton. Terminal railway yards at Cristobal finished and "a credit." Terminal railway yard at La Boca under way. New wharf provided at La Boca, providing berths for 3 additional ships. **P-06**, 8.

1911. Increase in ships touching at ports on either side of Isthmus made it necessary to extend existing docking facilities. As act June 28, 1902, contemplates construction of terminals for canal, any addition to docks should be such as to form part of final scheme, which should also include coaling facilities and dry dock as necessary adjuncts to the canal. Board appointed Apr. 24, 1911, to consider and report on facilities necessary in connection with use of completed canal, so that after general scope and characteristics of facilities adopted such work as may be needed may be undertaken. These facilities to include storing and furnishing of coal and other fuel for use both afloat and shore; furnishing of fresh water to shipping; furnishing of adequate and convenient facilities for repair of vessels, as well as of rolling stock, equipment, and machinery ashore; and question of storehouses and storing of material and supplies on the Isthmus (other than fuel) for all other purposes after the completion of canal.

Comprehensive scheme outlined having in view construction at Pacific terminus of dry dock, permanent shops, and storehouse for supplies. Coaling station contemplated at each end and

arrangement of docks which would permit subsequent additions. Dry dock is to conform in dimensions to locks, and wharves to be of sufficient dimensions to care for any shipping which can use canal; in other words, docks are to have lengths of 1,000' and depths of water equal to depths provided in channels of approach.

On Atlantic side decided that docks should be within limits of zone, located so as not to interfere with traffic through canal and at same time enable shipping to lie at them in safety during storms. To accomplish these objects, negotiations undertaken to secure part of waterway north of Cristobal Point, which under agreement with Republic of Panama under jurisdiction of latter. Designs prepared for construction of mole extending in a general westerly direction to prism from the intersection of shore by line separating zone from Colon and of dimensions sufficient to protect against storms both docks and basin to be excavated to south of them. During year necessary borings made to determine depths to rock; trestles built for mole and for first slip of new dock; tracks laid from Mount Hope, where material is to be secured from borrow pits, to mole; and material collected for permanent construction. This involved construction of 2,100' trestle and laying of 7,235' track. Work will be done by Panama R. R. with its own forces.

On Pacific side tentative location selected for dry dock and for permanent shops, and arrangement made for scheme of docks. As docking facilities of Panama R. R. at Balboa very much restricted, immediate necessity for additional wharves, and under allotment from Panama R. R. of \$428,700 reinforced concrete dock 706' long and 55' wide begun; at request of Panama R. R. work to be carried on by forces of Pacific division.

In construction of new dock at Balboa test pit and line of borings made along the outer edge of the proposed dock. Sand encountered for about 20', below which heavy bluish-gray clay upon layer of gravel and sand overlying rock. Latter at depths varying from 60' to 70' below mean sea level. In construction of pier, caissons made heavily reinforced concrete shells carried down to rock and filled with concrete. Bottom section of caissons has exterior diameter of 10' at base, tapering to 8' at top, from which piers rise with same thickness to the top; interior diameter 6' throughout and sections cast 6' in height. Caissons connected by tie-girders 3' 6" deep by 2' 6" wide extending transversely between piers, and longitudinally between outside piers at elevation of -10. Floor system consists of girders running perpendicular to axis of docks, with cross section of 4' 8" deep by 2' 6" wide. Girders support system of floor beams running longitudinally along dock 3' 9" deep by 1' 3" wide, on top of which placed slabs 6" thick. Work begun on caisson construction during

last week in Feb., and on July 1 five caissons sunk to rock and 16 in process of sinking; 55 caissons in all.

1914. Division of terminal construction organized Apr. 1, 1914, under H. H. Rousseau, U. S. Navy, as engineer of terminal construction. Division embraces forces of former second division, O. C. E. engaged in design, inspection, and construction of dry docks, shops, coal and fuel-oil plants, floating cranes, docks and other terminal facilities; construction transportation by rail; road, street, and sewer work under landscape architect; and breakwater construction at Atlantic terminal.

Dry docks: General description and principal dimensions of Dry Docks No. 1 and No. 2, Balboa, given in previous report. On account of funds, decided to defer construction of Dry Dock No. 2, but such of dock structure as serves as entrance pier for Dry Dock No. 1, and as will permit future completion of Dry Dock No. 2 in dry without especial increase in cost will be built "now." Cofferdam, begun Apr. 1, 1913, to protect entrance of Dry Dock No. 1, Dry Dock No. 2, entrance basin, and coal-pocket excavations, completed by placing 103,116 c. y. Difficulty experienced through portion of double-track trestle giving way and moving outward after dumping from it had commenced, but this overcome by reinforcing outer toe by dumping material from barges, and cofferdam completed. Leakage, relatively small, controllable by pumps. In excavating for Dry Dock No. 1 and Dry Dock No. 2, coal pockets and entrance basin, old Balboa machine shops forced work to be confined to center and south sides until Nov., when they were demolished and last obstacle to excavation removed. Total taken from site of Dry Dock No. 1, 358,282 c. y., 48,838 c. y. of which earth and balance rock, making 466,975 c. y. excavated from area up to close of year. From site of Dry Dock No. 2, located just north of entrance of Dry Dock No. 1, there were removed 41,548 c. y. earth and 52,129 c. y. rock. Steam-shovel operations deepened excavation from -13.5 to final grade for entire area of approach basin inside of cofferdam, and 351,333 c. y. removed. Area required for storage of coal and for travel of unloading towers measures 800' in length and about 400' in width, measured from outer edge of quay wall. Total excavation during year, 166,104 c. y., 79,837 c. y. of which earth and balance rock. Material excavated from site of dry docks, entrance basin, and coal pocket removed by steam shovels, 3 of which worked 8 hours a day until Feb., 1914, when, on Feb. 5, shovels placed on 12-hour basis and another shovel added. Shovels worked on split shifts, 12 hours a day, continuously to end of the year; 1 shovel removed in June. Contract entered into Oct. 12, 1912, for pair of steel miter-gate leaves and fixed irons, completed

during the year, and material stored on Isthmus awaiting erection. Moving machines for operating leaves, together with motors, controls, and covers, also delivered.

Balboa coaling station: Upon completion of excavation for coaling plant, work begun on masonry for crane runway supports, which extend east and west through center of storage pile, and will support old Pacific division berm cranes to be reerected to rehandle coal. Material mixed by ½-yard mixer and placed by locomotive crane. At close of year all but 3 of piers over deep coal pockets up to construction joint, where girders which carry rail are to be set. Retaining wall between high and low storage pockets up to elevation 12 for three-fourths of length. Rubble retaining wall on south side of low storage area completed, as well as part of small rubble retaining wall at east end of high area. During year 1,330 c. y. concrete and 808 c. y. rubble masonry placed. In foundations for berm cranes 2,620 c. y. concrete also placed.

Total excavation accomplished, including work for dry docks, entrance basin, coaling plant, shops, quay walls, and piers, 1,513,048 c. y., of which 1,477,843 c. y. placed in fills and embankments, remainder being hand excavation wasted in excavation of foundations for shops, and orange-peel excavation thrown to one side during excavation for foundations for wharves and piers. Material used to bring shops' yard up to elevation 18 to make fill behind quay wall, piers, and area to be occupied by Panama R. R. yards, which lie east of head wall of permanent piers, for Naos Island Breakwater, and part wasted on Balboa dumps.

Shops: Lt. Col. T. C. Dickson, U. S. Army, inspector of shops, in immediate charge of design and installation of machinery of new Balboa shops until Mar. 6, 1914. Steelwork carried on by contract and completed. Total material delivered, 11,657,429 pounds. Work completed. Buildings have cement tile roofing, tiles being manufactured on Isthmus and erected in place under contract; total standard red tile squares put on, 6,441.18; gutter-tile squares, 201.15; ridge roll, 7,351 linear feet; ribbed glass pieces, 11,188. Remaining work on foundations pushed to be prepared for contractor for steelwork, and 3,221 c. y. concrete placed. All shop area brought up to grade and surfaced with crushed stone, excepting space occupied by incline from dry-dock excavation and small area between roundhouse yard and foundry. Foundations of 2 buildings interfered with by sand dock and considerable trouble experienced in placing foundations, due to obstructions in mud below low tide, consisting of old barges and other French equipment and old metal which had been dumped into area and subsequently covered up.

Installation of machine foundations in various buildings progressed rapidly as soon as

it was possible to start work inside buildings. In this connection 4,944 c. y. concrete used. Shops' tunnel, which runs through building and yard parallel to axis of dry dock, completed. Proper drainage system provided over entire area.

Mechanical division abandoned Gorgona Aug., 1913, and, together with foundry and planing mill, moved direct to Balboa. Other shops transferred temporarily to Empire, and, commencing Mar. 1, 1914, gradually moved to Balboa. At close of year practically all machines erected in permanent locations and in operation. Total expended on shops, including cost of moving and installing machines, \$2,384,967.33. Shops office building last one under construction. At close of year steel framework and cement tile roofing completed and construction division of supply department putting in walls and floors, and engaged in completion of building.

Breakwaters: As stated in last report, decided to construct detached breakwater on east side of Colon Harbor to protect interior harbor against waves caused by trade winds, its general direction extending out from Coco Solo to point 2,000' east of outer extremity of west breakwater. Breakwater, as originally approved, to be 7,200' long, its inner end 3,893' from end of shore fill. Investigations made in various localities for purpose of securing suitable core and armor rock for use in construction, with view of doing away with necessity of further use of Porto Bello. Upon examination of comparative estimates of costs bearing on different sources of supply of rock to be used, decided to obtain rock from Sosa Hill quarry and transport it across Isthmus. Double-track trestle extended out from Coco Solo and about 11,093 linear feet completed at close of year. Railroad connection completed between root of breakwater and railroad extending from Mount Hope to Margarita Point. Auxiliary lines and sidings built in vicinity of Coco Solo Point and along Margarita Point railroad. In all, 5.2 miles new track laid. Dock 16' by 100', with trestle and track connections, built for unloading of materials, and small harbor for landing of launches and tugs towing piles excavated by dredge "Sandpiper," necessitating removal of 58,650 c. y. sand. A 6" water main laid from Margarita Point main at Coco Solo turnout, and 50,000-gallon storage tank erected for watering locomotives and for additional fire protection. Coco Solo yard filled in to elevation plus 3.3, and approach tracks for trestle raised to elevation plus 14.5. Practically all tracks ballasted to main line of Panama R. R., for which 64,506 c. y. fill used in addition to 11,512 c. y. gravel ballast, and 522 c. y. crushed-rock ballast.

With abolition of Atlantic division Feb. 1, west breakwater work in Colon Harbor and operation of Porto Bello quarry transferred

to division. Armor rock procured from Porto Bello on old crushed-rock quarry level above two lower levels referred to in last report. Dec. 1, 1913, working hours in quarry reduced to 8 hours a day, and on Apr. 30 operation of quarry ceased. 207,654 c. y. of armor rock produced and shipped. Auxiliary excavation by steam shovels, 302,893 c. y.; wasted on shore dump. In May, 1914, quarry closed down in such a manner that it can be reopened if necessary later in connection with east breakwater. Of 207,654 c. y. rock shipped from Porto Bello, 162,951 c. y. placed by 3 derrick barges, and 44,703 c. y. placed by 3 cranes. Rock removed by dredges to extent of 18,254 c. y. placed in breakwater. Work completed May, 1914. Contains 1,945,733 c. y. material, consisting of 669,254 c. y. dredged rock, 819,930 c. y. Toro Point rock, and 456,549 c. y. Porto Bello rock.

Work on Naos Island Breakwater continued. With closing down of dry excavation in Culebra Cut on Oct. 10, borrow pit opened in side of Sosa Hill, as from action of breakwater concluded that too much soft material had been used in its construction and that nothing but rock should be put in to secure completion. Work at Sosa Hill continued Oct. 10, 1913, to Mar., 1914, when output from dry dock, together with character of material, warranted use of spoil from this locality for breakwater. At beginning of year all trestle completed to elevation plus 14 and filled in with exception of 600'. At close of year average elevation of breakwater plus 18.5; finished to full width. Average settlement during last two weeks of year, 0.075', with exception of one stretch about 600' in length, which settled at rate of about $\frac{1}{4}$ " per day. During portion of last three months of year settlement of about 2' a day at south end of breakwater immediately north of Naos Island, whereas settlement at end of year only $\frac{3}{4}$ " per day. During fiscal year 652,587 c. y. placed.

Cristobal coaling plant: Drilling and blasting channel material in vicinity of Cristobal coaling plant started by dredging division July, 1913, and removal of material by pipe-line suction dredge continued. Material pumped ashore where most needed. Largely clean coral rock and sand has been used to bring area in which coal will be stored in dry, measuring about 300' by 1,200', up to elevation plus 2. Work pushed on construction of trestles for use in setting 6' caissons and on construction of two concrete walls supported on piles, about 700' in length, that carry tracks for stocking and reclaiming bridges. At end of year trestle construction about 25 per cent completed. Caissons of steel, 6' in diameter, and by end of year 78 cylinders had been set, and 6 of these driven to rock with steam hammer in advance of any excavation. Total concrete placed, 3,123 c. y.

Contract entered into for materials, necessary machinery, and erection in place of coal-handling plants. Coal-handling plants designed for storage of 485,000 tons at Cristobal and 215,000 tons at Balboa. Of the former, 100,000 tons to be wet storage, and latter 50,000 tons.

Fuel-oil plant: Contract entered into Oct. 1, 1912, for 4 fuel-oil storage tanks, 93' in diameter and 35' in height, each having capacity of 40,000 barrels; cost, \$62,800. Two located at Mount Hope and two on Balboa dump southeast of Sosa Hill. Plans prepared and advertisements issued for necessary pumping plants in connection with these tanks, one at Balboa and one at Mount Hope. Provision made for installation of 3 pumps in each plant, 2 of which will be purchased at present time. They will be able to handle oil from Balboa to Miraflores tank, and from Mount Hope to Gatun tank, at rate of about 400 barrels an hour. On Atlantic side as much of Docks 13 and 14 as necessary will be used as oil docks, and tank field will be located between east diversion and Mount Hope Road, where there are suitable locations for 40 or 50 tanks. Pumping plant will be located immediately east of Mount Hope filtration plant. At Pacific terminal there will be berth for oil vessels 75' wide by about 2,000' long immediately adjoining canal channel and south of old French pier. There will be 3 oil cribs, 2 of which will be constructed at once, consisting of steel and concrete deck supported by 6' concrete cylinders. Pumping plant will be located on lower level of Balboa dump, opposite oil cribs. Tank field laid out on higher level of Balboa dump. Area reserved for accommodation of 33 lots each 200' square. To end of fiscal year expended on fuel-oil plant at Pacific terminal, \$50,289.33, including cost of dredging berth for ships, for which removed 60,776 c. y., and on that at Atlantic terminal \$49,694.15.

Quay walls and pier: Work continued on quay walls and pier at Pacific end. These consist of reinforced concrete deck supported by cylinders sunk to rock. Total length of quay wall or wharf will be 2,662.65', averaging 60' wide. Of this, 648.78' built for Panama R. R. as lumber dock; remaining portions of wharf extend to north and south of this lumber dock. North portion supported upon cylindrical concrete caissons sunk to rock and filled with concrete, reinforced with steel rails. Cylinders themselves reinforced concrete 7' 6" in diameter, with 8' bottom section 5' in length. Of section north of lumber dock, 1,238.42', 16 caissons remained to be sunk, most of substructure having been completed during previous year. 136 caissons in this dock. Superstructure consists of reinforced girders, beams, and floor slab, with vitrified brick surface. Work begun July, 1913, and completed Feb. 1, 1914. Paving brick laid on

sand cushion. 75,683 sq. feet of brick laid on floor of this dock, and completed Apr. 1, 1914.

To counteract any outward pressure against cylinders, "dead men" placed in ground about 85' behind rear edge of wharf and opposite each transverse girder, each with effective bearing area of 48 sq. feet, constructed of reinforced concrete. They were connected to dock by steel rods 2½' in diameter, drawn tight by means of turnbuckles, and incased in concrete.

Wharf south of lumber dock 775.45' in length with return 290' long, and, as work had to be performed in water, reinforced concrete caissons used in other dock not suitable. Caissons for this portion of work steel cylinders 6' in diameter, in sections 5' long. To permit construction of portion of wharf, necessary to remove sand-unloading cranes formerly used by Pacific division, and sand operations transferred to Miraflores Locks. Ladder dredge cleared site and double trestle constructed longitudinally through site for handling of caissons. Excavation inside the cylinders performed by orange-peel buckets as much as possible, but material overlying hard rock so firm that greater part of excavation had to be done by hand, using Star well drills as hoisting engines. At close of year 23 caissons sunk to rock.

Bulkhead quay wall, extending between wharf and Pier No. 1, 300' long and built on concrete cylinders sunk to rock in manner similar to that at wharf north of lumber dock. Rock encountered very much higher than on greater part of other quay walls, and it was necessary to do considerable rock excavation in caissons to get them well below -45. Excavation done by orange-peel buckets operated by locomotive cranes, but removal of rock and cleaning out bottom of caissons required hand excavation. 65 piers required for this dock. All sunk to rock at end of Feb., 1914. Superstructure placed similar to that of other docks. Similar bulkhead, extending from Pier No. 1 to Pier No. 2, begun during year.

Construction of Pier No. 1, 1,000' in length and 201' wide, proceeded in manner similar to that of wharf construction, both as regards excavating in caissons and placing superstructure. Most of material excavated soft, alluvial mud, rock being encountered at upper end, which necessitated hand excavation in order to secure foundation for cylinders. During year 184 piers sunk to rock.

Dock completed during year; area of 77,403 sq. feet, and total division cost \$421,200.57.

At quay wall south of lumber dock, in dredging preparatory to construction of dock, 25,720 c. y. removed; 669 c. y. excavated for and in piers; in filling caissons, 1,487 c. y. concrete placed. To close of fiscal year expended in construction of this dock, \$107,956.85. In construction of bulkhead

quay wall, extending between wharf and Pier No. 1, 7,835 c. y. excavated in and for piers. In construction of caisson shells, 1,657 c. y. concrete used; 3,563 c. y. concrete placed within cylinders; 2,462 c. y. concrete placed in concrete floor; and 21 c. y. in concrete balustrade. Behind structure, 2,313 c. y. back fill placed. Total expended on quay wall to end of fiscal year, \$130,306.14. In construction of pier, 31,666 c. y. excavated for and in cylinders. In construction of caisson shells, 10,773 c. y. concrete used, and 13,346 c. y. concrete used in filling caissons. In connection with floor system there were excavated 7,373 c. y.; 10,222 c. y. concrete laid in floor, and 939 c. y. back fill placed. To end of fiscal year there were expended in construction of this pier \$511,749.14. Total expense in connection with these docks, including preliminary expenditures not located to any of docks, to end of fiscal year, \$1,212,917.01.

Ancon quarry: Ancon quarry continued—by fifth division, July 1, 1913, to Feb. 1, 1914; by fourth division, Feb. 1, 1914, to May 31, 1914; and from latter date to end of year under division of terminal construction. Greater part of work carried on on upper level, over 400' above crushers. Two shovels kept at work until May, 1914, since which time one shovel operated and other held in reserve. In July, 1913, bank under crusher building gave way and threatened to carry away lower part of crusher building and conveyor. Material in slide excavated by steam shovels, working day and night, and about 40,000 c. y. removed and hauled to Miraflores Locks for back filling and to Balboa town site. During this time crushers ran 12 hours a day until danger from slide stopped. Large crusher relined once, main shaft changed twice, and main eccentric changed twice in order to be rebabbitted. Larger output from quarry designated as rock No. 1 and smaller No. 2. Demand for latter size greater than formerly, and crusher arranged to crush the rock smaller. Total crushed rock, 502,798 c. y. In addition, 49,156 c. y. screenings produced, utilized in construction and repair of roads and in manufacture of concrete blocks for construction of buildings.

Sand service: Handling of sand from Chame to Balboa performed by dredging division, and unloading at Balboa continued under dredging division until Feb., 1914, when unloading cranes at Balboa closed down, owing to necessity of moving them off temporary dock on which they had been installed. Unloading operations transferred to Miraflores Apr. 28, and unloading performed by one of berm cranes still remaining. Locomotive crane subsequently added, and both machines worked during May and June. Total of 199,319 c. y. sand received and unloaded.

Panama R. R. freight yards: Panama R. R. freight yards, Diablo Hill to foot of Sosa Hill, practically completed at end of year. Filling and excavation for these performed by division of terminal construction. Material excavated from inner harbor by suction dredges deposited through pipe lines into swamp lying between site and old Panama R. R. line, and considerable amount of dry fill obtained from dry-dock excavation and from Diablo Hill added. Low, swampy area east of Balboa terminals and north of Ancon Hill raised to higher elevation by hydraulic fill dredged from inner harbor.

Colliers: Successful operation of coaling plants, as well as price at which coal can be sold, dependent in some degree upon the ability to control transportation of coal from U. S. During year cost of water transportation \$1.395 per ton. Coal brought down in foreign bottoms. Conclusion reached early in consideration of coal-supply problem that advantages would result from ownership by Panama Canal or Panama R. R. of colliers bringing coal to Isthmus. Estimate submitted in 1912 that would permit construction by Panama Canal of two colliers in accordance with latest type of naval design, and would give Panama Canal desired control over its coal supply. General plans prepared by Navy Department, and bids opened Feb. 2, 1914. Apr. 9, 1914, contract entered into at \$987,500 each; each to have coal-carrying capacity of 12,000 tons and speed of 14 knots per hour loaded to full capacity. June 30, 1914, Sec. of War decided these colliers will be operated by Panama R. R. Panama R. R. has submitted estimate of cost of transportation, 97 cents ton, not including depreciation or interest on capital invested.

Tugs: Estimate for 1913 included purchase of 4 harbor tugs of suitable design and sufficient power to handle largest vessel using canal. Plans and specifications approved Dec., 1913, and bids invited Jan. 6, 1914. When bids received, decided to reduce number from 4 to 2, and contract entered into May 8, 1914.

Floating cranes: Contract entered into Apr. 21, 1913, for 2 floating cranes of revolving type, and 250 tons capacity each, at cost of \$337,500, to be delivered and completed on Isthmus within 580 days, or by Dec. 2, 1914; named "Ajax" and "Hercules," respectively. Pontoons brought from Germany and arrived on Isthmus July.

Balboa town site: Planning of permanent town of Balboa, together with streets, water and sewer systems, placed under this division. Previous study had served to determine location of administration building, and formal mall of buildings on Balboa Plain as recommended by Commission of Fine Arts. Main roadways have width of 24'; roadways of secondary importance have

width of either 18' or 14'. Land which has been set aside for permanent gold site at Balboa includes 29 acres on north and north-westerly slopes of Sosa Hill, intended generally for quartering employees assigned to shops and terminals; area of 72½ acres on southwesterly slope of Ancon Hill, named "Balboa Heights." Employees working in administration building will be housed in this area. Third area, 55 acres, on low ground between two areas above mentioned, on which will be located buildings of public or semipublic character, as well as quarters. Construction started Aug., and progress governed to considerable extent by existing structures and tracks. Sewer and water systems installed and considerable grading and planting completed. Total expended on work, \$409,116.35.

Radio station: In addition to foregoing work, building of Darien radio station placed in charge of this division and \$74,756.88 expended. **P-14**, 35-46.

Terracing.

To prevent slides, Culebra, **P-13**, 160, pl. 38.

Test Pits.

Bracing, Gatun Dam studies, **P-08**, 196, pl. 71.
Gatun Dam studies, **P-08**, 153.

Gatun Island surface conditions, **P-08**, 196, pl. 70.

Tests. (See Compression; Dams.)

Anchorages, Gatun Locks, **P-09**, 46.

Clay, Gatun Dam studies, **P-08**, 196, pls. 105, 106.

Compression, Gatun Locks, **P-09**, 46.

Discharge, Gatun Locks, **P-11**, 117; **P-13**, 77.

Foundations, Gatun, **P-08**, 58.

Foundations, Pacific locks and dams, **P-09**, 62.

Gate forcing machines, miter, **P-14**, 108.

Gate machines, spillway, **P-13**, 94; **P-14**, 110.

Gate moving machines, miter, **P-14**, 106.

Locks, Gatun, **P-12**, 127.

Material from vicinity Gatun Dam, **P-08**, 136, 138.

Mechanical, engineering tests, **P-10**, 269.

Miter-forcing tests, **P-13**, 91.

Rock, Gatun Dam studies, **P-08**, 196, pls. 101-104.

Rock, permeability of, apparatus for testing, Gatun, **P-08**, 196, pl. 62.

Sand tests, apparatus, Gatun Dam studies, **P-08**, 196, pls. 105, 106.

Seepage, Gatun Dam studies, **P-08**, 196, pls. 89-97.

Soils and materials, Gatun Dam studies, **P-08**, 132, 134, 139.

Testing engineer, **P-11**, 239.

Towing tests, **P-13**, pl. 85.

Towing steamships, **P-13**, 92.

Valve machine, **P-13**, 89.

Valves, **P-13**, 88.

Valves, guard, **P-14**, 104.

Valves, locks, **P-11**, 67; **P-12**, 72; **P-13**, 77.

Valves, rising stem, **P-12**, 73.

Valves, Stoney, **P-11**, 100, 117, pl. 1.

Yoke for lock gates, steel, **P-11**, 100, pl. 3.

Thatcher, M. H. (See Nos. 217, 225, p. 2366 of this Index.)

Third Division, Office Chief Engineer. (See No. 244, p. 2367 of this Index.)

Tides. (See Meteorology.)

Balboa and Cristobal data, **P-10**, 289, 290.

Conditions, **P-11**, 282; **P-12**, 237; **P-13**, 225, 233; **P-14**, 144, 150.

Ranges of, **P-10**, 289.

Records, **P-12**, 226.

Tidal extremes, **P-11**, 250.

Special tide traces, **P-09**, 204, pls. 80, 81.

Tiger Hill Dam. (See No. 36, p. 2361 of this Index.)

Tile.

Shops, **P-14**, 173.

Vitrified tile ducts, lock machinery, **P-12**, 87.

Timber.

Possibilities of the zone, **P-13**, 567.

Clearing timber and brush from Lake Gatun, **P-09**, 80; **P-10**, 153; **P-11**, 148.

Timbering.

Timbering and lining tunnel, Miraflores, **P-09**, 142, pl. 70.

Timekeeping, P-14, 60, 405.

1913. Jurisdiction of Q. M. department extended from Porto Bello to Balboa, and timekeeping centralized in the chief Q. M. office. To this force later assigned timekeeping for various offices at headquarters. When first division undertook installation of machinery at locks the timekeeping of this division also turned over to timekeeping force of Q. M. department. Same done when fortifications division organized, and results obtained from consolidation so satisfactory as to lead to consolidating all timekeeping under one head. This done gradually under examiner of accounts, in order that it might be properly started, and when all work of this kind for all departments and divisions, except central division, combined, timekeeping force turned over as part of organization of fourth division of O. C. E. July 1, 1913. **P-13**, 1, 2.

Tincauzer, E. (See No. 164, p. 2365 of this Index.)

Tivoli Hotel, P-07, 80, pls. 96, 97. (See Hotels.)

Töes.

Fill at Gatun Dam, **P-08**, 61.

Tolls. (See Orders, Executive.)

1911. Tolls and opening of canal: Estimated date for completion of canal, based on report of Board of Consulting Engineers, 1906 (see No. 183, p. 2365 of this Index), fixed at Jan. 1, 1915. Meantime, work advanced rapidly, and apparent it would be possible to pass vessels at least a year earlier. Shipping

interests of world raised question of tolls in July, 1910, and urged early settlement. Attention called to fact that at least 18 months' notice of rates should be given that steps might be taken in time to change routings that would follow if canal were used. Inquiry developed fact that organization of new companies for use of canal contemplated, provided rates should be attractive. Developed, also, that two years' advance notice desired to permit building of necessary ships.

To determine date when canal would be ready, a board convened, composed of those charged with the work. Announcement made that all concrete in locks at Gatun would be laid by June 1, 1912, and in locks on Pacific side by Oct. 1, 1912; that, assuming gates completed by June 1, 1913, locks would be ready for use on this date if operating machinery installed; that work on spillway at Gatun would be completed to elevation 50' by Apr. 1, 1912, and entire dam finished by close of dry season of 1912-13; that excavation through Culebra Cut would be completed by July 1, 1913, if no more material due to slides had to be removed than was estimated; and that exterior channels would be sufficiently advanced to pass shipping.

Need for legislation to fix tolls urgent. Time can be saved in making public announcement of rates by compiling, in advance of legislative action, data of amount of traffic that will probably use canal and formulation of rules by which tonnage of ships to be determined. Steps to this end taken. P-11, 58-60.

1912. Division engineer of the central division reported at close of year that if no more material due to slides had to be removed than increase which revised estimates of July 1, 1912, contemplated, excavation through Culebra Cut would be completed July 1, 1913, or the same date fixed a year ago. Though additional slides have occurred since close of fiscal year, there has been no decrease in force, so that it is still possible to complete it as predicted, though date must depend upon slides. In Atlantic division concrete work at north end of locks remains to be completed. Excavation in area below by dredging not begun until Feb., 1912, and reported by division engineer that, due to slides, date for completing concrete will be June 30, 1913. On account of increase in additional quantity of dry fill to be added to dam, July 1, 1913, now date fixed for completing this work, and Aug. 1, 1913, fixed as date for completing Gatun spillway.

In the Pacific division the division engineer estimates locks will be completed by Jan. 1, 1913, by which date dams at Pedro Miguel and Miraflores will also be finished, and spillway at Miraflores Locks will be completed by June 30, 1913. Delay of 7 months in delivery of dredge "Corozal"

threatened delay in completing excavation in channel below Miraflores by the amount estimated dredge would remove in that time. A large portion of excavation will be done by steam shovels, thus reducing length of time sufficiently to permit completion of channel by June 30, 1913.

Contract for lock gates not been carried out as rapidly as expected, and contractor called upon to finish gates in one flight of locks first, so that, if rest of work is in condition, passage of ships can be permitted by use of one flight. Delays in delivery of lock machinery and accessories, but assistant chief engineer so organizing work as to have completed sufficient machinery to meet conditions that lock-gate contract will furnish. Probable that certain features of work will not be finished until some time after first vessel passes locks, such as power-generating station, transmission line, aids to navigation, etc., which, though important, not essential to preliminary trial of system. P-12, 66, 67.

1913. Concrete work of locks completed, and but for slides central division would also be finished. Contract for completion of gates extended and contemplates finishing up all work on one flight throughout by Oct. 1, 1913. Work on installation of operating machinery concentrated to meet this condition of lock gates, and believed that one flight of locks throughout will be ready for operation Oct. 1, 1913, except fender chains and control houses, but electrical current from existing power plants will be usable until completion of hydroelectric station. Assuming the lake level at elevation 50, July 1, with average rainy season, lake should reach elevation 85 by Dec. 1, 1913. Rainfall during May excessive and above average; rainfall during July below average, so that the lake has not reached elevation that it should have at this time by about 3½'.

Slides which occurred to prevent completion of cut as anticipated a year ago are at Cucaracha, east side opposite Culebra, two in vicinity of Empire suspension bridge, relatively small, and one opposite White House. With exception of Cucaracha slide, these could probably be removed in dry by Jan. 1, 1914, but removal of Cucaracha slide in dry would require until Apr., 1914. Material can not be handled expeditiously by steam shovels during wet season, but lends itself to economical removal by hydraulic dredges. Except at Cucaracha, existing channel by slides is to full depth and of a width of at least 200' at bottom. Assuming that all slides were removed by steam shovels in dry, water in lake could not be raised above elevation 60 and still be kept out of cut by dike at Gamboa, so that after advent of dry season it would not be possible, under normal conditions, to secure full lake level

until Oct. or Nov., 1914. Material in all slides can be handled advantageously by dredging fleet, augmented, as it will be later, by two 15-yard dipper dredges under contract. They will operate against banks in every case and will not be excavating for full depth of 45'. Sea-level sections by time dredges can be moved into cut will be in condition for passage of ships of heaviest draft.

General belief that effect of water in cut would retard slides and experience below Gatun Locks in sustaining power of water against slides fully justifies this belief; on the other hand, geologist of opinion that water may to some extent develop new slides. Again, much ado made in 1909 over seamy character of rock on Isthmus, through which water flows quite rapidly, in consequence of which question raised that lake might leak out through seams and crevices. If these things liable to occur, sooner the better, if official opening of canal is to occur Jan. 1, 1915; for if water were not admitted "this" fall, but were deferred until May 1, 1914, full height could not be reached until Oct., 1914, leaving little time for determination of these questions. These considerations led to conclusion that water should be turned into cut at earliest date practicable for getting dredges to work on slides. Dredges can be passed into cut as soon as gates of one flight completed, and tifts is reasonably certain to be the case by Oct. 1. With average rainfall, lake should reach elevation approximately 70 by Oct. 10, and greater height of water against dike which excludes lake from cut at present would not be safe. Present plans based upon blowing up of Gamboa Dike Oct. 10, its removal by dredges immediately thereafter, transfer of two suction dredges and ladder dredge "Corozal" to Cucaracha slide, smaller dipper dredges to work on other slides until full width of channel attained, and passage of vessels through canal as soon as channels of full depth and of sufficient width secured.

Erroneous impression caused by announcement that water will be turned into cut Oct. 10, as it seems to have been assumed that canal will be practically finished on that date. Before boats can be passed it will be necessary to remove Gamboa Dike by dredges and to remove slides as already outlined. Passage of commercial vessels dependent, therefore, upon the time when proper channels can be dredged through slides; should additional ones occur, they will necessarily advance the date when this will be accomplished. P-13, 69-71.

Executive order fixing tolls, P-13, 615.

Tools.

Foundations for, shops, P-13, 201.

List of, by classes and location, P-10, 210.

Topography.

Coastal plain type, P-13, 582, pl. 67.

Gatun Dam studies, P-08, 196, pl. 86.

Hill type, Zion Hill, P-13, 582, pls. 65, 66.

Rock contours, Gatun Dam, P-08, 196, pl. 165.

Sites, Gatun Locks, P-08, 126, pl. 56.

Torque.

Gate valve machines, Miraflores, P-14, pl. 76.

Towage.

Tests, various speeds, P-13, 9. (See Tests.)

Towers, Range. (See Ranges.)

Towing. (See Gates; Locks; Locomotives.)

Devices, P-10, 56; P-11, 79; P-12, 86.

Electric locomotives proposed, P-10, pl. 85; P-13, 92.

Locomotives, distribution of, P-14, 109.

Towing machinery, P-09, 39.

Tests, Panama R. R. ships, P-13, 92, pl. 85. (See Tests.)

Tracks, rack, P-12, 108, pl. 8.

Track material, P-13, 91; P-14, 13, 108.

Tracks, steel girders, P-12, 108, pl. 7.

Towns. (See Cities; Municipalities.)

Lots, Executive order, P-11, 433.

New towns, P-12, 292, pl. 66.

Site, Balboa, P-13, 180; P-14, 45, pl. 118.

Sites, permanent, P-13, pl. 96.

Subsurface structures, Balboa, P-14, 225.

Subdivision, Balboa, P-14, 223.

Tracks. (See Atlantic Division; Central Division; Dumps; Locks; Pacific Division; Panama R. R.)

Barbacoas, P-08, 205.

Bridges, track span, electric transmission, P-14, 101.

Causeway for, north of Gatun Locks, P-13, 138, pl. 24.

Central division, P-09, 90, pl. 28; P-10, 144; P-11, 141; P-12, 152; P-13, 144.

Construction, Pacific terminals, P-13, 204.

Construction, Miraflores, P-10, 170; P-11, 163; P-12, 176; P-13, 166.

Construction, Pedro Miguel, P-10, 166; P-11, 159; P-12, 172; P-13, 163.

Culebra division, P-08, 39, 56, 160, pl. 36.

Dumps and, Culebra, P-08, 56.

Erection tracks, emergency dams, P-13, pl. 86.

Girders, towing locomotive tracks, Gatun, P-12, 108, pl. 7.

Joining track, emergency traffic, P-10, 197.

Laid and removed, P-14, 212.

Location, etc., P-10, 145; P-11, 141; P-12, 152; P-13, 148.

Lock and dam work, P-09, 93, 95.

Material for, locks, P-14, 108.

Panama R. R., P-08, 203; P-11, 198; P-12, 282.

Quarry, Ancon, P-09, 98.

Rack track, P-12, 108, pl. 8; P-14, 108. (See Towing.)

Relocation, Pacific terminal, P-13, 195.

Reservoirs, to, P-08, 204.

Standard, Panama R. R., P-08, 202.

Terminals. (See Terminals.)

Tiger Hill, P-08, 205.

Towing-track material, P-13, 91.

Throwing, P-07, 31, 48, pls. 30, 31.

Traffic. (See Nos. 177, 185, 208, p. 2365 of this Index.)

Capacity of lock canals for, paper by Noble and Ripley. (See No. 208, p. 2365 of this Index.)

Emergency, joining track, **P-10**, 197.

Trains.

Labor trains, **P-07**, 96, pl. 127; **P-10**, 322, pl. 65.

Pontoons, crossing, **P-14**, pl. 65.

Train-making, **P-07**, 48, pl. 26.

Transfers, Zone. (See Nos. 32, 49, p. 2362 of this Index.)

Transformers.

Room and equipment, locks, **P-12**, 91; **P-13**, 94, 110, pls. 12, 13; **P-14**, 110.

Transformation.

Lock to sea-level canal. (See No. 212, p. 2365 of this Index.)

Transit, Time of. (See Nos. 19, 184, pp. 2361, 2365 of this Index.)

Transit, time of, through isthmian canals: Appendix G. Report, Isthmian Canal Commission No. 1. **P-99**, 255-272.

Time for passage of a ship through proposed isthmian canals depends upon the speed attainable and permissible in the various sections, and the delays occasioned by lockages and by meeting other ships, etc. Discussion embraces 4 types of ships: (a) 24' 6" by 50' by 400', 1,900 I. H. P.; (b) 32' by 50' by 400', 2,300 I. H. P.; (c) 32' by 60' by 540', 3,300 I. H. P.; (d) 32' by 70' by 650', 4,500 I. H. P. Fresh-water draft. Power gives 12½ miles in open sea. Statute miles used in discussion. Coefficients. Available data: Experiments in France and Germany summarized by Mr. Elmathan Sweet; analysis of problem by Herr R. Haack, who conducted experiments as to movements of boats in small canals, etc., suggestive and useful in the discussion; back current; approximate formula for backward current; correct formula for back current; tractive resistance; backward current past a ship in a canal; observations in St. Clair Flats Canal; table of observations at St. Clair Flats Canal during passage of ships (Tables I and II); increased head resistance; shoal-water deduction; calculation of attainable speeds; speeds plotted and curve drawn.

Table III: Calculated speeds through Isthmian Canal channels by ships having sufficient power for a speed of 2.5 miles per hour in open sea. **P-99**, 260.

Speed through St. Clair Flats Canal limited by regulations. Reduction of speed in St. Clair Flats Canal. Observations made on Lake Huron and in St. Clair Flats Canal. Calculated speeds may be too high. Observations in Suez Canal. Observations at Kiel Canal. Speed limit fixed by backward currents. Reduction of speed on curves.

Table IV: Schedule of speeds proposed as a basis for calculating the time of transit through the Panama and Nicaragua Canals, **P-99**, 265.

Table V: Time of transit through the Panama Canal without allowance for meetings or lockages, **P-99**, 265.

Table VI: Time of transit through the Nicaragua Canal without allowance for meetings or lockages, **P-99**, 265. Time consumed by lockage.

Table VII: Time required for filling and emptying locks, **P-99**, 266.

Table VIII: Time required to pass Bohio Locks, **P-99**, 267.

Table IX: Time lost by lockages on the Panama route, **P-99**, 267.

Table X: Time lost by lockages on the Nicaragua route, **P-99**, 267. Delays at meeting points. Meetings in channels. Meetings in narrow channel sections.

Table XI: Delay at meeting points in canal section 150' wide at bottom, **P-99**, 268.

Table XII: Number of meetings for each ship in the canal sections of the Panama route and delays therefrom, **P-99**, 269.

Table XIII: Number of meetings for each ship in the canal sections of the Nicaragua route and delays therefrom, **P-99**, 269.

Table XIV: Delay at a meeting point in the channel in San Juan River, Lake Nicaragua, or Panama Bay, **P-99**, 269.

Table XV: Number of meetings for each ship in the channel excavated in Panama Bay and delays therefrom, **P-99**, 269.

Table XVI: Number of meetings for each ship in the channel excavated in the San Juan River and Lake Nicaragua, **P-99**, 269. Meetings at locks, average delay to each ship.

Table XVII: Delay caused by a meeting at Bohio Locks, **P-99**, 270.

Table XVIII: Delays caused by meetings at each of the locks or flights of the Panama route, **P-99**, 270.

Table XIX: Delays at meetings of each of the locks of the Nicaragua route, **P-99**, 270.

Table XX: Number of delays while awaiting lockage on the Panama route, and delays therefrom, **P-99**, 271.

Table XXI: Number of delays while awaiting lockage on the Nicaragua route, and delays therefrom, **P-99**, 271.

Table XXII: Time of transit across Isthmus, **P-99**, 271.

Total time of transit, Panama route: (a) 11.23, (b) 11.89, (c) 12.79, (d) 14.27 hours. Nicaragua route: (a) 30.11, (b) 32.30, (c) 34.35, (d) 37.67 hours. Assumed that passing places where ships can tie up will be provided at intervals of 5 miles in all canal sections, and that navigation can be by night. **P-99**, 271.

Diagram showing depression of water surface caused by a ship moving in a restricted channel, **P-99**, 272.

Diagram showing speed curves for restricted channels, **P-99**, 272.

Transportation. (See Nos. 68, 266, pp. 2363, 2368 of this Index.)

Analysis, from Isthmus, **P-13**, 384; **P-14**, 295.

Atlantic division, **P-12**, 141; **P-13**, 136.

Central division, **P-10**, 144; **P-11**, 140; **P-12**, 151; **P-13**, 147.

Culebra division, **P-07**, 42; **P-08**, 39.

Deductions from pay for, **P-08**, 249.

Division of transportation. (See No. 266, p. 2368 of this Index.)

Equipment for, **P-09**, 74; **P-11**, 131.

Excavation, **P-09**, 74.

Laborers, **P-07**, 140; **P-08**, 249.

Livery, **P-07**, 105.

Local, **P-08**, 230.

Prisoners through zone, **P-07**, 149.

Transportation, Canal.

Accidents, **P-14**, 263.

Reports. (See No. 266, p. 2368 of this Index.)

Transportation, Water. (See above.)

Atlantic division, **P-10**, 119; **P-11**, 112; **P-12**, 120; **P-13**, 113.

Atlantic terminals, **P-14**, 226.

Transporting power of water, Gatun Dam studies, **P-08**, 176.

Traveling Expenses. (See Expenses.)

Treasurer.

Balance of, **P-08**, 350.

Treasurer of zone to be disbursing officer of Isthmian Canal Commission, **P-04**, 53; **P-05**, 72.

Treasury. (See Funds; see No. 47, p. 2362 of this Index.)

Canal Zone, and funds, **P-12**, 471; **P-13**, 475. Condition, **P-11**, 432.

Treaties, Etc. (See Nos. 23, 29, 253, pp. 2361, 2362, 2368 of this Index.) (See Acts; Panama Projects.)

Acts of Congress and, relating to the Isthmian Canal, **P-11**, 543.

Acts. "To incorporate the Maritime Canal Co. of Nicaragua." U. S. Congress. Incorporators: "Billings, Daly, Ammen, Stout, Hotchkiss, Beale, Hitchcock, Goodwin, Cheney, O'Shaughnessy, Taylor, Miller, Crowninshield, Menocal, Stebbins, Garrett, Aldige, Lancaster, Mills, Kissell, Fairbanks, Robinson, Darling, McDonald, Roosevelt, Devries, Thompson, Parr, etc." 1889. **P-99**, 401.

Colombia. Convention. "Of alienage, commerce, and navigation." Republic of Colombia and French Republic. 1892. Suárez-Mancini. **P-99**, 459.

Colombia. Concession. Wyse concession. 1878. Contract for the construction of an interoceanic canal across Colombian territory. Lucien N. B. Wyse, chief of the Isthmian Scientific Surveying Expedition in 1876, 1877, and 1878; member and delegate of the board of directors of the International Interoceanic Canal Association. **P-99**, 473. Additional contract modifying that of 1878, 1890. Mr. Wyse

as special representative of the receiver of the Compagnie Universelle du Canal de Panama. **P-99**, 479.

Colombia to New Company of the Panama Canal. Contract. Of extension. Extension of 6 years granted. 1900, 1904. **P-99**, 483.

Memorandum. Legal status of the New Panama Canal Co., including translations of French laws and judicial decrees affecting its organization, and the charter of the company. Extract from the judgment of the civil tribunal of the Seine, Feb. 4, 1889, pronouncing the dissolution of the Compagnie Universelle du Canal Interoceanique de Panama, and appointing a receiver. **P-99**, 485. Act of July 1, 1893, relative to liquidation of the Universal Company of the Panama Interoceanic Canal, **P-99**, 486. Charter of the New Panama Canal Co., 1894, **P-99**, 488. Ratification of charter of New Panama Canal Co., **P-99**, 497. Law authorizing the Compagnie Universelle du Canal Interoceanique de Panama to issue in France securities repayable with prizes, **P-99**, 502. Law of July 15, 1889, authorizing sale of lottery bonds at reduced rates, **P-99**, 502.

Colombia, with Francois Mange, engineer, director of the operations of the liquidation on the Isthmus, special representative of the receiver of the Compagnie Universelle du Canal de Panama. Contract. Of extension. 1893. To Panama Canal Co., in liquidation. **P-99**, 481.

Colombia and Panama R. R. Co. Contract. 1867, 1876, 1880. Contract reformative of that of Apr., 1850, concerning the construction of a railroad, from one ocean to the other, across the Isthmus of Panama. **P-99**, 465.

Colombia and Spain. Treaty. 1881. Of peace and friendship. **P-99**, 461.

Costa Rica to Nicaragua Canal Association of New York. Concession. 1888. A. G. Menocal acting in behalf of the association. " * * * Grants * * * the exclusive privilege to excavate and operate a maritime canal between the Atlantic and Pacific Oceans, running either wholly or in part through the territory of the said Republic or along the whole or a part of her border line with the Republic of Nicaragua." **P-99**, 431.

Costa Rica and other countries. Treaties. (France, 1848. Hanse Towns, 1848. Great Britain, 1849. Spain, 1850. U. S., 1851. Netherlands, 1852. Belgium, 1858. Italy, 1863. Nicaragua, 1868, 1869. Germany, 1875. Guatemala, 1895. Honduras, 1896.) **P-99**, 429.

Costa Rica and Spain. Treaty. Of recognition, peace, and friendship. 1850. Molina-Pidal. **P-99**, 421.

Costa Rica and U. S. Treaty. Of friendship, commerce, and navigation. 1851. Molina-Daniel Webster. **P-99**, 417.

Costa Rica and U. S. Protocol. "In regard to future negotiations for the construction

of an interoceanic canal by way of Lake Nicaragua." Calvo-Hay. 1900. **P-99**, 443.
England and U. S. Treaties. 1850. Clayton-Bulwer. Convention as to ship canal connecting Atlantic and Pacific Oceans. Articles: Declaration as to control of canal, occupation of territory, and commercial advantages. Neutrality of canal in case of war. Protection of construction. Mutual influence to facilitate construction. Guarantee of neutrality. Cooperation of other States. Mutual encouragement to speedy construction. Protection to other communications. Ratification. **P-99**, 385.

Great Britain, **P-11**, 545, 548.

New Granada and France. Treaty. 1856. Of amity, commerce, and navigation. Pombo-Roslan. **P-99**, 453.

New Granada or Colombia with other countries. Treaties. (Netherlands, 1829. Ecuador, 1856. Venezuela, 1842. Chile, 1844 (2). U. S., 1846, 1879. Sardinia, 1847. Hanse Towns, 1854. France, 1856, 1892. Portugal, 1857. Great Britain, 1866. Peru, 1870. Spain, 1881. Germany, 1892. Italy, 1892.) **P-99**, 463.

New Granada and U. S. Treaty. 1846. Treaty of peace, amity, navigation, and commerce. Mallarino-Bidlack. **P-99**, 445.

Nicaragua and American, Atlantic & Pacific Ship Canal Co. Contract. 1849. Company composed of Cornelius Vanderbilt, J. L. White, N. H. Wolfe, etc. "For facilitating the transit across the Isthmus of Nicaragua from the Atlantic to the Pacific Ocean, by means of a ship canal or railroad." **P-99**, 509.

Nicaragua and Costa Rica. Treaty. For the excavation of an interoceanic canal. 1869. Montealegre-Kiminez. **P-99**, 425.

Nicaragua and Edward Eyre and E. F. Cragin, for construction of the inter-oceanic canal. Contracts. 1898. **P-99**, 403.

Nicaragua and various foreign countries. Treaties. List. Spain, 1850. Belgium, 1858. France, 1859. Great Britain, 1860 (2). Italy, 1868. U. S., 1867, 1884. Costa Rica, 1869. Germany, 1896. **P-99**, 383.

Nicaragua and France. Treaty. 1859. "Treaty of amity, commerce, and navigation." Jerez-Sartiges. **P-99**, 375.

Nicaragua and Great Britain. Treaty. 1860. "Relative to the Mosquito Indians and to the rights and claims of British subjects." Zeledon-Wyke. **P-99**, 365.

Nicaragua and Great Britain. Treaty. 1860. "Of friendship, commerce, and navigation." Zeledon-Wyke. Denounced by Nicaragua, 1860. **P-99**, 369, 374.

Nicaragua and Atlas Steamship Co. (Ltd.). Contract. 1897. Translation. "With the object of expediting steam navigation on Lake Nicaragua and the River San Juan del Norte, * * * of facilitating communication with the Atlantic coast, * * * and in the hope of commercial and agricultural

development that shall improve the condition of the country." **P-99**, 413.

Nicaragua to Nicaragua Canal Association of New York. Concessions. 1887. Cárdenas-Menocal. "For a maritime interoceanic canal." **P-99**, 389.

Nicaragua and U. S. Convention. 1849. "Having in view the grand design of opening and establishing through the territories of (Nicaragua) a passage and communication between the Caribbean Sea and the Pacific Ocean," etc. Elijah Hise, chargé d'affaires of U. S. **P-99**, 503.

Nicaragua and U. S. Treaty. 1867. "Of friendship, commerce, and navigation, and as to isthmian transit." Ayon-Dickinson. **P-99**, 353.

Nicaragua and U. S. Treaty. 1884. "Providing for the construction of an interoceanic canal across the territory of Nicaragua." Frelinghuysen-Zavala. **P-99**, 359.

Panama, **P-04**, 25; **P-11**, 552.

Trees.

Grubbing and clearing, Gatun Lake, **P-09**, 80. (See Timber.)

Trespasses.

Executive order relating to, **P-11**, 433; **P-12**, 617.

Trestles. (See Dumps.)

Driven, central division, **P-10**, 147; **P-11**, 143; **P-12**, 155; **P-13**, 151.

Connecting with old French bridge, Gamboa, **P-08**, 216, pl. 178.

Naos Island dump, **P-12**, 170, pls. 44, 45.

Pacific terminals, **P-14**, 221.

Storage trestles, Miraflores, **P-10**, 164.

Storage trestles, Pedro Miguel, **P-10**, 162, 196, pl. 44.

Temporary trestles, Panama R. R. relocation, **P-09**, 142, pl. 74.

Toro Point, **P-11**, 132, pl. 4.

Toro Point breakwater, **P-11**, pl. 4.

Trials.

Executive order relating to trial by jury, **P-13**, 631.

Triangulation.

Map, progress, **P-10**, pl. 137.

System, **P-11**, pl. 127.

Station, **P-10**, 303, pl. 64.

Surveys, etc., **P-10**, 279; **P-11**, 272.

Trusts.

Trust funds, **P-08**, 350.

Tubby, W. G. (See No. 222, p. 2366 of this Index.)

Tugs.

Lockage, **P-14**, 115.

Details, **P-14**, 197, 199.

Deck plans and profiles, **P-14**, pl. 127.

Tunnels. (See Diversions; Ducts.)

Conduit tunnels, digging, **P-13**, 254, pl. 59.

Diversion tunnels, Camacho, **P-08**, 56, pls. 9, 10.

Tunnel doors, operating, **P-14**, 114.

Electric tunnel, Pedro Miguel Locks, **P-11**, 192, pls. 49, 50.
 Miraflores, **P-08**, 215, pl. 182; **P-12**, 204, pl. 52.
 Operating tunnels, Balboa shops, **P-13**, 254, pls. 56, 58.
 Operating tunnels, Pacific terminals, **P-13**, 200.
 Outlets, Camacho diversion, during flood, **P-09**, 90, pl. 50.

Outlet, near, Bas Obispo, **P-09**, 90, pl. 49.
 Panama R. R. work, Miraflores, **P-09**, 139.
 Section, showing timbering and lining, Miraflores, **P-09**, 142, pl. 70.
 Shops, **P-14**, 206.

Turnouts.

Crossovers and, locks, **P-14**, 109.

U.

Unit Prices. (See No. 3, p. 2361 of this Index.)

Unloaders.

Cement, **P-10**, 58.
 Sand, Balboa, **P-10**, pl. 116.

Upkeep. (See Nos. 11, 191, pp. 2361, 2365 of this Index.)

V.

Vaccination, P-08, 314.

Valleys, Alluvial.

And measured velocity of underground flowage, Gatun Dam studies, **P-08**, 196, pl. 173.

Valves. (See Gates; Locks.)

Appurtenances, **P-13**, 3.
 Auxiliary culvert valves, **P-13**, 88; **P-14**, 12.
 Contract for, **P-10**, 48.
 Cylindrical valves for all locks, **P-09**, 42, pl. 6.
 Cylindrical valve machinery for all locks, **P-10**, pl. 81.
 Cylindrical valves, Miraflores Locks, **P-12**, 204; **P-13**, 110, pl. 14.
 Cylindrical valve machines, **P-10**, 52; **P-11**, 77; **P-12**, 108; **P-13**, 88; **P-14**, 12, 103.
 Cylindrical valve machine, motor and limit switch, **P-12**, 108, pl. 11.
 Culverts, Pedro Miguel Locks, **P-14**, pls. 72, 73.
 Discharge of, **P-13**, 4.
 Efficiency, **P-13**, 4.
 Forms, cylindrical valve chamber, locks, **P-11**, pl. 112.
 Fixed irons and, designing, locks, **P-10**, 48.
 Fixed irons and, design and contract, **P-13**, 74.

Fixed irons and, installation, locks, **P-13**, 74.
 Fixed irons and, locks, **P-11**, 66; **P-12**, 70; **P-13**, 74.

Fixed irons for rising stem gate valves, **P-13**, 87.

Gates, etc., locks, **P-12**, 72.

Gate valve machines, torque, locks, **P-14**, pl. 76.

Gate valves, rising stem, horizontal sections through valve and valve chamber, and sectional details of seals and train, **P-12**, pl. 71.

Gate valves, rising stem, rear elevation and sections, **P-12**, pl. 70.

Guard valves, **P-14**, 12.

Guard valves, assembly, locks, **P-13**, pls. 83, 84.

Guard valve machines, **P-12**, 93; **P-13**, 89.

Guard valves, tests, **P-14**, 104.

Locks, **P-09**, 36.

Locks, contracts, **P-10**, 48.

Machinery, locks, **P-09**, 39; **P-11**, 79.

Miraflores Locks, **P-13**, 110, pl. 14.

Opening valves, Gamboa Diike, **P-14**, pl. 60.

Operation of rising stem gate valve, in the dry, **P-13**, 88.

Operation of rising stem gate valve machines under full head, **P-14**, 102.

Oscillations of water level after opening valves; locks, **P-14**, pls. 74, 75.
Rising stem gate valves, **P-14**, 12.
Rising stem and cylindrical valves, machinery, **P-11**, 77; **P-12**, 82; **P-13**, 87; **P-14**, 102.
Rising stem gate valves, front elevation and section, **P-12**, pls. 69, 70, 71.
Rising stem gate valves, tests, **P-12**, 73; **P-14**, 102.
Rising stem valves, machinery for, **P-11**, 77; **P-12**, 108, pl. 12; **P-13**, 87.
Rising stem gate valves, milling machine for correcting irons of, locks, **P-13**, 110, pl. 11.
Stoney gate valves, for all locks, **P-09**, 42, pls. 3-5.
Stoney gate valves, erecting, Gatun Locks, **P-11**, 132, pls. 17, 18.
Stoney gate valves, frames, Miraflores, **P-11**, 192, pl. 59; **P-12**, 108, pl. 9.
Stoney gate valves, locks, **P-10**, pls. 78-80.
Stoney valve machinery, **P-10**, 51.
Stoney gate valves, rear elevation and section of gates, **P-09**, 42, pls. 4, 5.
Stoney gate valves, tests, Gatun Locks, **P-11**, 100, 117, pl. 1.
Test and correction for leakage of cylindrical valves, **P-13**, 88.
Test of, locks, **P-11**, 67; **P-12**, 72; **P-13**, 4, 77.
Tests of cylindrical and auxiliary culvert valve machine, **P-13**, 89.
Torque, **P-14**, pl. 76.
Upper guard valves, machinery for all locks, assembly, **P-13**, pls. 83, 84.
View of valves, Pedro Miguel Locks, **P-14**, pl. 1.

Vanadium Steel. (See Steel, Vanadium.)

Vehicles. (See Quartermaster.)

Statement of details concerning, **P-08**, 234, 235.

Executive order, **P-12**, 617.

Velocities.

Average velocity of flow of water at different heads, Gatun Dam studies, **P-08**, 196, pl. 98.

Measured velocity of underground flowage, Gatun Dam studies, **P-08**, 196, pl. 173.

Winds, **P-11**, 250, 259; **P-12**, 224, 225.

Vessels.

Bills of, Executive order, **P-14**, 597.

Executive order relating to inspection, **P-12**, 605; **P-13**, 615.

Measurements, **P-14**, 564.

Movement of, St. Marys River Locks, U. S., **P-06***, 7, pls. 15-28.

Stoppage power of lock fender chains, **P-11**, 82.

Villages.

Balboa, **P-14**, pl. 69.

Gatun, New, **P-09**, 64.

Visitations.

Sick, **P-13**, 558.

Vital Statistics. (See No. 211, p. 2365 of this Index; see also Sanitation.)

Volcanoes. (See Agglomerate, Volcanic.)

"Vulcan." (See Breakers, Rock.)

W.

Wages. (See Employees; Laborers.)

Gold and silver schedules, **P-09**, 152.

Increasing, on basis of length of service, **P-07**, 47.

Scale for gold employees, **P-11**, 206.

Standard wage scale for employees on gold roll adopted and put into effect. After its adoption heads of departments and divisions fixed maximum limit of pay for various positions considered by them as necessary for proper conduct of work in their charge; and pay of positions now standardized, no variation being allowed except in cases where increased responsibilities and duties devolve upon its occupant. **P-10**, 1, 2.

Wagons.

Wagon bridge, reinforced concrete, Mandingo River, near Bas Obispo, **P-11**, pl. 41.

Wagon roads, near Obispo, **P-11**, 156, pl. 40.

Walker, Admiral J. G. (See Nos. 1, 26, p. 2361 of this Index.)

Wallace, John Findlay. (See Nos. 142, 206, pp. 2364, 2365 of this Index.)

Chief engineer, **P-04**, 37.

Resignation, **P-05**, 5.

Walls. (See Concrete; Locks; Quays; Terminals.)

Break in, Culebra, **P-10**, 160, pls. 35-37.

Coaling station, Cristobal, **P-14**, pl. 32.

Walls, Approach.

Designing, locks, **P-10**, 48.

Flaring approach, Gatun Locks, **P-12**, 142, pl. 21.

Forms for, Pedro Miguel Locks, **P-12**, pl. 90.

Gatun Locks, **P-10**, 123; **P-12**, 142, pl. 24.

Locks, **P-11**, 66; **P-12**, 70.

Pedro Miguel Locks, **P-12**, 108, 204, pls. 4, 47.

Placing iron girders on, Gatun Locks, **P-13**, 138, pl. 20.

Sinking caissons, Miraflores Locks, **P-12**, 204, pl. 54.

Views, Gatun Locks, **P-13**, 130, pls. 21, 22.

Walls, Concrete.

Setting temperatures of concrete, Gatun,
P-10, 122.

Walls, Dry Dock.

Condition of, after near-by excavation, Balboa
terminal, P-14, pls. 25, 26.

Walls, Foundation.

Caissons, sinking, Miraflores, P-13, pl. 98.

Walls, Gatun Spillway, P-09, 66, pls. 25, 26.**Walls, Guide.**

Miraflores Locks, P-13, 186, pl. 50.
Pedro Miguel Dam, P-13, 186, pl. 48.

Walls, Lock.

Forms, P-09, 66, pl. 18.
Forms, Pedro Miguel and Miraflores, P-10,
pl. 113.
Pedro Miguel, P-11, 192, pls. 47-50.

Walls, Sea. (See Walls.)**Walls, Quay.**

General description, P-13, 219.
Pacific terminals, P-13, 198, 219.
Pouring concrete, Balboa, P-14, pl. 21.
Sections, P-13, 220.

Walls, Side.

Pedro Miguel Locks, P-10, pl. 75.

War.

Usefulness of terminal plants, P-14, 187.

War Department. (See Auditor.)**Warehouses.**

Commissary, P-14, 318.
Material in, P-13, 393.
Shelving, P-07, pl. 132.

Ward, C. O. (See No. 199, p. 2365 of this Index.)**Warwick, W. W.**

Examiner of accounts, reports. (See No. 237,
p. 2367 of this Index.)

Washington Office. (See Nos. 144, 227, 274, pp. 2364, 2366, 2368 of this Index.)

1907. Until Mar., 1907, the main office of the Isthmian Canal Commission. Reorganized later. In charge of general purchasing officer. Considerable saving in expense. P-07, 34.

1908. Purchases: By Executive order Aug. 15, 1907, placed under the supervision of the Chief of Engineers, U. S. Army, who was authorized to maintain purchasing department in the office of the Isthmian Canal Commission in Washington.

Divisions: Under the direction of the general purchasing officer, who acts as chief of office. General office, general counsel, disbursing office, assistant examiner of accounts, appointment, correspondence, and record divisions, and purchasing department.

Inspections: Part of the inspecting engineer's office was transferred from New York to Washington.

Appointments: 2,160 persons tendered ap-

pointments; 1,947 accepted; 5,397 persons given transportation to Isthmus.

Claims: 10,956; value, \$13,728,288.51. Paid by the disbursing officer in the U. S.

Purchasing offices: Assistant purchasing and shipping agents in New York, New Orleans, and San Francisco. Tacoma office closed; its work undertaken by U. S. engineer offices of Seattle and Washington.

Bids: Circular invitations for bids prepared from requisitions received from the Isthmus, and distributed throughout the country. Practice of allowing bids to cover delivery of materials on the Isthmus has given all sections equal opportunities. P-08, 34.

1909. Duties: Same scope as in previous year.

General counsel: Maintained until Apr. 1, 1909, when he was continued in the position of counsel to the Panama R. R. only, and moved in that capacity to New York.

Employment: 1,466 tendered employment on the Isthmus; 1,033 accepted and were appointed, covering 158 different positions, of which number 754 reported on the Isthmus and were assigned to duty by the Q. M. department.

Disbursing division: Paid vouchers for material and services aggregating \$15,311,021.12. Duplicate set of the general books of the Isthmian Canal Commission kept.

Claims of employees injured: Assistant examiner of accounts assumed charge of such claims arising under act May 30, 1908. Since May 6, 1909, prepared all commission contracts and bonds.

Inspections: Total amount of purchase orders placed during the year, \$16,536,130.42. Preliminary inspections made. P-09, 32.

1910. Work of office continued in charge of Capt. F. C. Boggs, Corps of Engineers, U. S. Army. 2,022 persons within U. S. tendered employment on Isthmus in grades above that of laborer, of which 1,287 accepted and appointed, covering 125 different positions. Total purchase orders placed during year, \$16,107,350.34; most important of purchases castings, structural material, and valves for use in locks, amounting to \$847,000; 4 steel barges; 2 tugboats; 3 launches; one 20" pipe line suction dredge; 1 hydraulic and dredging plant; 13 dredging, discharge, and relay pumps; 449 dump and flat cars; 10 cantilever cranes; 2 rock crushers; 8,745 tons of steel rails; 655,842 cross-ties; 32,715 piles; 30,771,744' of lumber; 14,742,400 pounds of dynamite and blasting powder. Shipments of cement for use in the locks and dams, purchased under contract for 4,500,000 barrels, amounted to 904,727 barrels up to June 30. P-10, 46.

1911. During year 1,706 persons within U. S. tendered employment on the Isthmus in grades above that of laborer, and 1,083 accepted and appointed, covering 58 different

positions. Total purchase orders placed during year, \$6,976,066.59. Most important contracts for 6 emergency dams for locks, amounting to \$2,238,988.40, and for machinery and materials entering into construction and operation of locks, amounting to \$2,456,482.23. Other principal items purchased were: One twin-screw steel ladder dredge with hopper capacity of 1,200 tons of spoil, 2 locomotive cranes, 1 electric trolley crane, 12 concrete mixers, 2 narrow-gauge locomotives, 1 un-loader plow, 19,577,589' of lumber, 3,400 tons of steel rails, 2,775 piles, and 8,000 frames for concrete piles. During year 3 independent inspecting offices established for inspection of lock gates and materials which enter into locks and movable dams. **P-11, 58.**

1912. During year 1,296 persons within U. S. tendered employment for duty on Isthmus in grades above that of laborer; 632 accepted and appointed, covering 51 different positions. Total purchase orders placed for fiscal year, \$10,446,551.23. Most important contracts for permanent equipment in form of structural lock material, \$386,274.60; electric locomotives and tracks, \$249,258.44; spillway gates and materials, \$526,697.03; machinery for operation of locks and spillways, \$2,271,582.01; and hydroelectric station, \$156,586.58. Other important purchases included 10,105,000 pounds of dynamite, 34,424,500' of lumber, and 7,259 gross tons of steel rails. Under contract for 4,500,000 barrels of Portland cement entered into Jan. 7, 1909, 4,354,024 barrels shipped, of which 1,579,210 barrels delivered during past year. During year 3 independent inspecting offices continued for inspection of lock gates and material which enter into construction of locks and dams. **P-12, 66.**

1913. Work made more difficult and arduous by the fact that, in the desire to reduce the amount of stock on hand, the number of rush orders increased. 2,065 persons within U. S. tendered employment for duty on Isthmus in grades above that of laborer; 1,183 accepted and appointed, covering 59 different positions. Total orders placed for fiscal year, \$12,335,973.12. Most important contracts for permanent equipment: Structural material for locks and spillways, \$241,326.33; machinery for operation, \$740,302.02; electric locomotives and tracks, \$548,732.67; hydroelectric station, \$72,540.34; dock material, \$571,723.48; shop buildings and machinery, \$593,649.51; transmission line, \$688,503.38; and two 250-ton revolving floating cranes, \$837,500. Other principal items of purchase included two 15-yard dipper dredges, 6,310,000 pounds of dynamite, and 23,505,695' of lumber. Supplemental contract entered into Sept. 13, 1912, covering additional quantity of cement necessary to complete work. 1,803,762 barrels of cement purchased. **P-13, 68.**

1914. Apr. 1, 1914, under provisions of Executive order Mar. 2, 1914, office of assistant auditor created in place of office of assistant examiner of accounts. Under assistant auditor was placed disbursing clerk, and disbursing office abolished. Scope of work about same as previously reported, except that practically all of independent inspection forces located at points in U. S. outside of Washington abolished or greatly reduced. Due to continued effort to reduce material on Isthmus to minimum, work of purchasing department even greater than during previous fiscal year.

2,248 persons within U. S. tendered employment for duty on Isthmus in grades above that of laborer; 1,429 accepted and appointed, covering 71 different classes of employment.

Total orders placed, \$12,392,407.78. Many of largest contracts for permanent equipment: Chain fenders and chain, \$192,865.90; coal-handling plants, \$1,929,103.85; terminal facilities and docks, \$224,004.44; floating caisson, \$333,851.20; single-track movable span bridge, \$55,674; transmission line, \$505,511.84; filtration plants, \$150,576.79; material and equipment for buildings and quarters, \$53,824.02; Balboa shops, buildings, \$155,547.89; machinery, \$146,367.16; two 12,000-ton colliers, \$1,975,000; 2 tugboats, \$304,000; and 9 gasoline motor boats, \$54,392. Other principal items purchased included 2,490 pounds of explosives, 22,200,000' of lumber, 20,000 cross-ties, and 18,311 piles. During year 592,674 barrels of cement purchased. **P-14, 62, 63.**

Water.

Average velocity of flow at different heads, Gatun Dam studies, **P-08, 196, pl. 98.**

Capacity of rocks and soil to absorb, Gatun Dam study, **P-08, 177.**

Different densities, both sides of lock gates, Gatun, **P-11, 85-99.**

Expenditure of, effect of locks separate or scattered, **P-10, 108.**

Flow through sand and gravel, Gatun Dam studies, **P-08, 185-196.**

Flow under 10' head, table showing, **P-08, 196, pl. 99.**

Heads of, site of Gatun Lock, **P-08, 126, pls. 57-61.**

Pressure. (See Pressure, Water.)

Resistance to soils, **P-08, 196, pl. 63.**

Saved by intermediate lock gates, **P-10, 79.**

Transporting power of, **P-08, 176.**

Under foundations, Gatun Locks, **P-08, 124.**

Underground flowage, diagrams, **P-08, 196, pls. 168-170.**

Underground flowage, measured velocity of, **P-08, 196, pl. 173.**

Underground, Gatun Dam studies, **P-08, 162.**

Velocity checked by baffles, model of spillway dam, **P-10, 64, pl. 2.**

Velocity of underground flow, river bed sections, **P-08, 196, pl. 100.**

Water and Sewer Systems. (See No. 155, p. 2364 of this Index.)

Panama City, operation and maintenance, **P-07**, 166.

Street paving and, Colon, operation and maintenance, **P-07**, 168.

Water Commissioner. (See No. 120, p. 2363 of this Index.)**Water Service, Air and.** (See Air.)**Watershed.** (See Discharge.)

Chagres, map, **P-09**, 358, pl. 113; **P-12**, 96.

Gatun, yield curves, **P-14**, pl. 104.

Retention curves, Lake Gatun, **P-12**, pl. 106; **P-13**, pl. 122.

Rio Grande, **P-10**, 297.

Waters, Subterranean.

Gatun Dam studies, **P-08**, 183.

Water Supply. (See Municipalities; Waterworks; see Nos. 87, 156, pp. 2363, 2364 of this Index.)

Bacterial content, Panama and Colon, **P-08**, 115, 118.

Balboa, **P-14**, 224.

Bas Obispo, system, **P-07**, 72.

Brazos Brook, **P-07**, 75.

Caballa Viejo, municipal supply, **P-07**, 73.

Camacho and Empire, **P-07**, 72.

Central division, **P-11**, 152; **P-13**, 155.

Chagresito, **P-07**, 73.

Chemical and bacteriological report, **P-08**, 111.

Chemical data, **P-08**, 112.

Colon, **P-10**, 130, 135.

Condensed water, **P-09**, 61.

Consumption and rents, city of Panama, **P-07**, 172.

Consumption by districts, **P-10**, 184; **P-11**, 177; **P-12**, 190; **P-13**, 179.

Consumption per capita, **P-07**, 167.

Consumption, Rio Grande and Cocoli Reservoirs, **P-13**, 178.

Corozal, **P-07**, 66.

Cristobal, **P-07**, 77.

Crusher, for, Pedro Miguel, **P-07**, 67.

Cucaracha, **P-07**, 68.

Culebra, **P-07**, 70.

Distribution, Colon, **P-11**, 128.

Filtration, **P-08**, 117. (See Filtration.)

Gatun, **P-07**, 73; **P-09**, 62; **P-10**, 127.

Gorgona machine shops, **P-07**, 73.

Juan Grande, **P-07**, 73.

La Boca, **P-07**, 65.

Las Cascadas, **P-07**, 72.

Mamei, **P-07**, 73.

Meters installed, **P-07**, 76.

Mineral analysis, **P-08**, 118.

Miraflores, **P-07**, 66.

Mount Hope station, **P-10**, 135.

Municipal supply, Tropics, **P-05**, 39.

New Gatun, **P-10**, 128.

Paraiso, **P-07**, 67, 68.

Pedro Miguel, **P-07**, 67.

Plant, enlarging, Culebra, **P-07**, 70.

Plant, modern, **P-13**, 21.

Purification, Agua Clara, **P-14**, pl. 16.

Purification, chlorine chart, Miraflores Lakes, **P-14**, pl. 98.

Purification, Miraflores, **P-14**, pls. 19, 96, 97.

Purification, wash-water tank, Miraflores, **P-14**, pl. 19.

Rainfall, **P-08**, 112.

Reservoir dam for, Panama, **P-05**, pl. 38.

San Pablo, **P-07**, 73.

Santa Cruz, **P-07**, 73.

Service inspection, **P-07**, 78.

Station, Panama R. R., **P-12**, 284.

Systems, **P-07**, 66, 168.

Tabernilla, **P-07**, 73.

Toro Point, **P-10**, 132; **P-11**, 130.

Water supply. (Operation.)

1904. Waterworks and sewer system, Panama and Colon: Force for designing and constructing waterworks and sewer systems sailed from New York soon after organization, June, 1904. Various plans considered. Rio Grande Reservoir for city of Panama system; water tested and found satisfactory; best waterworks practice followed. No sewers or drainage system in Panama. City divided into 3 sewer districts, sewage discharged into sea water of Panama Bay; total estimated cost, \$258,450. Difficult to find wholesome water for Colon. On account of lowness of Colon, sewage system a problem also. **P-04**, 44.

1905. Water turned into pipe lines, for supply of Panama, Colon, etc., from the reservoir made by dam across Rio Grande, and Brazos Brook. Reservoirs, and distributing systems established. **P-05**, 13.

Establishment of modern reservoir systems in progress. When piped water was turned on for Panama City the Te Deum was sung in the cathedral, attended by the President of the Republic, etc. **P-05**, 39. View showing opening of the waterworks system, Panama, July 4, 1905, **P-05**, 40.

1906. Water and sewer systems, Panama: Water system complete; at the end of the dry season a year's supply of water remained in reservoirs; "the best paved, best watered, and best sewered city in Central America, or in the northern half of South America," **P-06**, 8.

Water and sewer systems, Colon and Cristobal: Abundant supply of pure and wholesome water from receiving reservoir 2 miles back from Mount Hope, with a capacity of 508,000,000 gallons. Installation of sewer system for Colon begun. Paving under way. **P-06**, 9.

Water commissioner: Plumbing regulations devised. Rates established for water service. Meter system being installed at Panama. **P-06**, 35.

Colon water supply: In dry season, 1906, necessary to supply water to Colon with a water train hauling daily 200,000 to 250,000 gallons; at no time did Colon or Cristobal suffer; more water per inhabitant than ever known

before; charges that salt water pumped through mains "absolutely and unqualifiedly false." **P-06**, 98.

Water Supply, Gatun. (See Discharge.)

Gatun Lake, **P-13**, 242.

Mass curves, Gatun Lake, **P-14**, pl. 102.

Water Transportation. (See Transportation, Water.)

Waterways. (See Discharge; Rivers; see No. 215, p. 2365 of this Index.)

Artificial waterways, their improvement and navigation. By Joseph Ripley. Appendix S. **P-06***, 421-423.

Improvement. Demand in U. S. insistent for deeper, wider, and straighter channels. Minimum channel width of 1,000 standard for ocean ports. Continuous growth in capacity of internal waterways, such as canals. Instance of waterways connecting the Great Lakes.

Navigation, needs of: Widths; curves. Curvature made by ships in turning the angle at head of Little Mud Lake.

Delays in channels: 1,698 hours in Weitzel Lock, St. Marys Falls, 1881-1905; 1,104 hours in Poe Lock, 1896-1905. **P-06***, 421-423.

Waterworks, P-08, 82. (See Sedimentation; see Nos. 39, 128, pp. 2362, 2364 of this Index.)

Accounts, **P-14**, 326.

Ancon, **P-07**, 64.

Central division, **P-09**, 85, 86; **P-10**, 158; **P-11**, 154; **P-12**, 168; **P-13**, 157.

Colon, **P-07**, 62; **P-11**, 127.

Colon-Cristobal, **P-09**, 64.

Condenser plant, **P-10**, 127.

Construction, **P-11**, 180; **P-12**, 195; **P-13**, 171.

Cost of maintenance and repair, **P-12**, 194; **P-13**, 182.

Cristobal and Colon, **P-12**, 137; **P-13**, 133.

Distribution system, Colon, **P-09**, 64.

Fifth division, **P-13**, 181.

Filter plant, Gatun, **P-11**, pl. 103.

Gatun, **P-09**, 61; **P-10**, 126; **P-11**, 125; **P-12**, 136.

Gatun, pump station, filter building, sedimentation basins, clear water basins, forming water-purification plant, **P-11**, 132, pl. 24.

Gatun, showing Agua Clara Reservoir, **P-11**, 132, pl. 23.

Maintenance, Atlantic division, **P-09**, 62; **P-11**, 180.

Mount Hope, **P-14**, 136, pls. 17, 18.

Pacific division, **P-09**, 106, 108; **P-10**, 187; **P-11**, 180; **P-12**, 194.

Panama, **P-07**, 60.

Plan, general, Agua Clara, **P-10**, pl. 101; **P-14**, pl. 16.

Plans, Panama, **P-04**, 45.

Pumping and filtration station, Ancon, **P-09**, 103.

Sewers, pavements, and, Panama and Colon, **P-07**, 150.

Sewers, roads, and, status, **P-05**, 135, 142.

Southern end of canal, **P-14**, 132.

Systems, zone, **P-07**, 64; **P-08**, 88.

Waves.

Action of, Tropics, **P-05**, 294.

Weather. (See Meteorology.)

Slides due to weather and corroding, **P-12**, 211.

Wedges.

Rise, of, Gatun Locks, **P-14**, pl. 92.

Weights. (See Irons, Fixed.)

Weirs, Waste. (See No. 17, p. 2361 of this Index.)

Well, Drill. (See Drills, Well.)

Well, Artesian.

Gatun Dam studies, **P-08**, 182.

Wells.

Conditions which produce, Gatun Dam studies, **P-08**, 184.

Wells, G. M. (See No. 261, p. 2368 of this Index.)

Wharves. (See Terminals; see No. 154, p. 2364 of this Index.)

Atlantic terminals, **P-13**, 205.

Balboa, **P-10**, pl. 116.

Construction, Pacific division, **P-11**, 170; **P-12**, 186.

Construction of piers and wharves, Pacific terminals, **P-14**, 195.

Construction, rate of progress, **P-11**, 173.

Construction material, for handling, Cristobal, **P-09**, 51.

Construction plant, Pacific division, **P-11**, 173.

Foundations, Pacific division, **P-11**, 171.

Location, Pacific division, **P-11**, 170.

Status, **P-05**, 143.

Superstructures, Pacific division, **P-11**, 172.

Terminals, **P-12**, 217.

Unloader and reloader wharves, **P-14**, 197.

Unloading wharves, Cristobal coaling station, **P-14**, pl. 32.

Whitlock, Lt. F. O. (See No. 246, p. 2367 of this Index.)

Wickets, Emergency Dam.

Girder hoists, **P-11**, 80.

Lowering of girders for, Gatun, **P-13**, 110, pl. 6.

Machinery for, **P-10**, 57.

Wilson, F. D. (See No. 262, p. 2368 of this Index.)

Wilson, Maj. E. T. (See No. 246, p. 2367 of this Index.)

Williams, Ed. J.

Disbursing officer, reports. (See No. 236, p. 2367 of this Index.)

Williamson, S. B. (See No. 242, p. 2367 of this Index.)

Wind, P-10, 277; **P-11**, 249; **P-12**, 224; **P-13**, 223; **P-14**, 143.

Direction and velocity, **P-11**, 259.

- Maximum velocity, **P-11**, 250; **P-12**, 225; **P-13**, 224.
 Comparative records, Ancon and Sosa, **P-13**, 232.
 Trade winds, shore waves, **P-13**, 21.
 Wind roses, **P-09**, 204, pl. 82; **P-10**, pls. 127, 128; **P-11**, pl. 122; **P-12**, 99; **P-13**, pl. 109; **P-14**, pl. 99.
- Wire, Electric.**
 Cables and, orders, **P-13**, 95.
- Wireless.**
 Radio station, **P-14**, 47.
- Women.**
 Club privileges, **P-11**, 535.
- Wood, Capt. R. E.** (See Nos. 224, 245, pp. 2366, 2367 of this Index.)
- Work.** (See Office Work.)
 Classes of, headings for cost compiling, **P-10**, 241.
 Date of delivery, shops, **P-11**, 226.
 Value of, mechanical division, **P-14**, 253.
- Works, Regulating.**
 Plan, Gatun, **P-06***, pls. 11-13.
- Wrecks.**
 Steam shovels in slides, Gold Hill, **P-11**, 156, pl. 36.
 Wrecking outfit working, Gorgona, **P-07**, 48, pl. 27.

Y.

- Yardage.** (See Excavation; Profile.)
 Canal profile and, estimates, **P-10**, pl. 106; **P-11**, pl. 109; **P-12**, pls. 82, 88; **P-13**, pl. 93.
- Yardage and Rainfall.** (See Meteorology.)
 Diagrams, **P-08**, 36; **P-09**, 69; **P-10**, pl. 102; **P-11**, pl. 104.
- Yards.** (See Nos. 153, 154, p. 2364 of this Index.)
 Balboa, **P-14**, pl. 113.
 Coal chute, Pedro Miguel, **P-08**, 120, pl. 53.
 Culebra division, **P-07**, 43; **P-08**, 39.
 Depot, Mount Hope, **P-09**, 220, pl. 89.
 Storage yards, east breakwater, Limon Bay, **P-14**, pl. 33.
 Terminals, Panama R. R. yards, **P-09**, 134; pl. 67; **P-14**, 207.
 Train-making, **P-07**, 48, pl. 26.
 White House, Comache diversion, **P-09**, 90, pl. 48.
- Yards, Receiving and Forwarding.**
 To act as clearing houses for dirt trains, practically completed at each end of the line. **P-06**, 8.
- Yellow Fever.** (See Fever; see No. 79, p. 2363 of this Index.)
 Preventive and fumigation measures, **P-05**, 29, 32.
- 1905.** Important to stamp out source of yellow fever in view of danger of transmitting it by canal traffic to other portions of the world. Elimination of the disease as difficult as the engineering problem of the canal. Epidemic during first 10 months of American occupation. Panic among Americans. Chief sanitary officer assured of entire resources of the Isthmian Canal Commission to stamp the disease out. Campaign adopted to prevent propagation of mosquitoes, to isolate all infected persons, and destruction of all mosquitoes capable of transmission. Stegomyia brigades formed. With apparatus, these brigades destroyed nineteen-twentieths of sources of propagation, open receptacles, pools, etc. Medical inspectors appointed. Houses fumigated by a special fumigating force. Cities of Colon and Panama fumigated. Gradual decrease in death rate. Finally wiped out. **P-05**, 29.
- 1906.** Bocas del Toro: Yellow fever reported here Feb., 1906. Upon urgent representations, the Panama authorities appointed representatives of the Isthmian Canal Commission sanitary department to clean up, part of the expense being paid by the U. S. **P-06**, 23.
- 1907-1914.** (See Sanitation.)
- Yoke, Vanadium Steel.**
 Lock gates, testing to destruction, **P-11**, 100, pl. 3.
- Y. M. C. A.** (See Nos. 238, 247, p. 2367 of this Index.)
 Chart showing rise and fall in membership, **P-12**, pl. 110.

Z.

Zone. (See Accounts; Audit; Civil Administration; Diplomacy; Geology; Governor; Meteorology; Municipal Engineering; Municipalities; Panama R. R.; Sanitation; Waterworks; see Nos. 32, 48, 49, 54, 77, 92, pp. 2362, 2363, of this Index.)

Accounts, **P-08**, 344; **P-09**, 235; **P-10**, 342; **P-11**, 390; **P-12**, 413; **P-13**, 414; **P-14**, 328.

Agricultural possibilities, **P-13**, 567.

Amber deposits, **P-13**, 577.

Boundaries, **P-11**, 280.

Boundary marks, **P-10**, 297.

Census, **P-06**, 79.

Chalcedony, deposits of, **P-13**, 578.

Clay, deposits of, **P-13**, 577.

Coal, deposits of, **P-13**, 578.

Delimitations of, **P-07**, 151.

Geology of, **P-12**, 205.

Government, acts, **P-11**, 558; **P-12**, 599.

Government had gained the respect and confidence of the people of the zone, **P-05**, 28.

Industry and commerce revived by U. S. occupation, **P-05**, 53.

Map of, and watershed of Rio Chagres, **P-12**, pl. 96.

Panama R. R., map showing relocated line, **P-11**, pl. 117.

Sanitation, statistics, **P-09**, 326. (See No. 226, p. 2366 of this Index.)

Treasurer to be disbursing officer of Isthmian Canal Commission, **P-04**, 53.

Waterworks systems, **P-08**, 88.

Zone, Operations.

1904. Government of zone: The Isthmian Canal Commission required by President Roosevelt under authority of act Apr. 28, 1904, "to make all needful rules and regulations for the government of the zone and for the correct administration of the military, civil, and judicial affairs of its possessions until the close of the 58th Congress." Governor appointed by the Isthmian Canal Commission. Organization of administration of government into three branches—legislative, judicial, and executive. Outlines of the duties of each branch. Zone divided into 5 municipalities; organization outline. List of various laws enacted. Penal and criminal codes enacted, being adaptations of those in force in Porto Rico and the Philippines. **P-04**, 65, 70.

Organization: Maj. Gen. Geo. W. Davis, selected by Isthmian Canal Commission No. 2 to represent the commission on the Isthmus May 8, 1904. Appointed by Presi-

dent Roosevelt; outline of his powers. Col F. J. Hecker appointed to cooperate with Gov. Davis. May 17, 1904, the Government of Panama publicly announced recognition of Gov. Davis's authority over the zone. **P-04**, 77.

Panama officials at transfer ceased holding office as such June 16, 1904. List of tax sources of Panama régime. **P-04**, 82, 83.

Industries and social conditions: Primitive conditions; 2 schools in each town, with poor attendance. No highways outside villages; no masonry buildings. Only industries, cane growing and manufacture of rum. Only exports, bananas and coconuts. **P-04**, 82.

Postal affairs: None before U. S. occupancy; U. S. domestic rate established, and stations, etc., June 24, 1904. Issue of counterfeit Panama stamps not traceable to zone government. **P-04**, 84.

Jails: Jail erection planned; primitive system in vogue, **P-04**, 86.

Lands and buildings: Area of zone estimated. Geographical details. Classification of ownership of lands. Lands which will be needed by the U. S. Old buildings of the Panama Canal Co. leased during cessation of work, and lease continued by U. S., with revenue of about \$30,000 annually. Boundary lines of plots throughout zone indefinite. **P-04**, 91.

Telegraphs and telephones: Old equipment meager. Modern system begun. **P-04**, 94.

Public works: No roads except one at or near city of Panama; to be improved and maintained by the U. S. No great necessity for immediate road work. **P-04**, 93.

Justice and judiciary: Transfer caused a lack of local judges. Zone judiciary created. Circuit court began sessions; judge in each municipality. One circuit judge, etc., held to be plenty. Recommended that appeals be taken out of zone. People not litigious. **P-04**, 85.

Municipalities: Zone divided into 6 municipalities. General description of buildings. **P-04**, 81.

Geography: Panama divided into Provinces, and these into municipalities. Canal route traverses two of these Provinces (Colon and Panama), embracing some 8 municipalities. System of straight dividing lines established, abolishing the existing tortuous ones, the straight lines being determined by the direction of the probable axis of the canal. **P-04**, 80.

Public order: Old Panama Co. property protected by a special force, for the payments of whose services the Republic was reimbursed by the company; continued after transfer; later men were paid directly by the U. S.; establishment of zone police under way. **P-04, 84.**

1905. Delimitation of zone: To settle disputes about tax paying, survey made of the boundary line of the zone. Permanent boundaries not fixable until center line of canal definitely fixed. **P-05, 47.**

Revenues: Organized into 7 divisions—customs and internal revenue, posts and correspondence, lands, records and personnel, accounts, administration of estates, schools, **P-05, 62.**

Taxation of old régime continued. License taxes for rum distillation collected from 8 distilleries. **P-05, 64.**

Zone government: Executive order embracing the duties of governor and general auditor, covering the revenues and expenditures of the government of the zone. Authorization dated Apr. 1, 1905, the White House. Subjects: The general auditor; the local auditor; the chief clerk; accounts of Treasury deposits and withdrawals; revenue accounts; money-order accounts; jurisdiction of the auditor; reports; depositary of Canal Zone; title to be observed in the rendition and certification of accounts; appeals from the action of the auditor. Approved for the President by Sec. of War Taft, Nov. 5, 1905. **P-05, 101.**

1906. American ideals being preserved. Rights of citizens being preserved. **P-06, 18.**

1907. Department of civil administration embraces affairs of government of zone, courts, office of prosecuting attorney, and division of revenues, posts, lands, administration of estates, police, education, fire protection, and public works, **P-07, 27.**

Governor Magoon left Isthmus Sept. 25, 1906.

Executive order Nov. 17, 1906, created department of law and government under the general counsel; governmental matters handled in Washington by general counsel subsequently.

Executive order Apr. 2, 1907, vested authority of chief executive of the zone in the chairman of Isthmian Canal Commission; duties assigned to one of the commissioners.

Five municipalities abolished; administrative districts created in their stead.

U. S. patent, trade-mark, and copyright laws extended to zone.

Provisions made for regulating insurance companies, for registration of land titles, and celebration of marriages.

Penal laws amended; new code of civil procedure effective.

Isthmian Canal Commission authorized, order Mar. 13, 1907, to enact, with the approval of the Secretary of War, ordinances relating to police, sanitation, and taxation, and matters formerly regulated by municipal ordinances. **P-07, 27.**

A commission, of U. S. and Panama representatives, unable to agree on value of certain property affected by canal operations, except the islands in Panama Bay. Payment by U. S. of \$54,037 recommended in case of claims connected with Malambo fire.

Question raised by Panama as to right of the Central & South American Telegraph Co. to land its cable through Manzanillo Bay; claim of Panama would make ends of canal under Panama control.

Contracts made July 1, 1907, with Panama concerning water rates in Panama and Colon, from which the U. S. will gain reimbursement for sanitary work, etc., done in the 2 cities.

37.31 miles of roads and trails built; expected to increase agricultural leases.

Questionable if extradition laws apply to zone; considered advisable to extend U. S. status to zone by Executive order.

56 undesirables deported exclusive of the chronically sick.

16 post offices; 90,928 pieces registered; money orders amounted to \$2,318,965.34, employees finding money-order system a safe depository for their money.

Customs service of zone confined to entering and clearing vessels arriving at ports of Ancon and Cristobal. Docks built, equipped with modern appliances.

Distillation licenses to total of \$5,198.95 collected.

479 leases for building lots; 83 for agricultural lands.

Collector of revenue administered 29 estates.

Funds of zone derived from rental of land, etc., postal service, court costs and fines, and taxes. Expenses of school system, cost of public improvements, etc., paid from these revenues, but postal returns applied solely to that service.

358 civil cases settled in courts. Cases of Coulson and Andrade, among other cases, settled by supreme court. Coulson was convicted in circuit court of murder and sentenced to death; court denied trial by jury; supreme court affirmed circuit court decision. Andrade was ejected from property he claimed; argued Government must prove its title to lands; supreme court held that statute of limitations does not run against the Government, and burden always upon a person claiming adversely to the Government to prove title.

181 officers and men June 30, 1907. 6,236 arrests; 5,193 convictions. As marshal of the courts, chief of police served 310 summonses, 663 subpoenas, and levied 4 executions; acted as coroner at 136 inquests.

Additional fire stations installed; paid firemen increased; volunteer companies organized.

Superintendent of public works operated Panama waterworks and sewer systems. Average daily consumption, 749,800 gallons. Progress made at Colon on such operations.

24 schools opened during year; 31 teachers on rolls; average enrollment, 1,643; attendance, 1,138. **P-07**, 27-31.

1908. Organization: Executive branch includes executive office; the division of posts, customs, and revenues; police and prisons, schools; fire protection; public works; and the office of the prosecuting attorney. Judicial branch includes the supreme, circuit, and district courts. Head of department represents the Isthmian Canal Commission in its relations with the Republic of Panama and foreign representatives accredited to Panama.

Beyond-zone relations: Satisfactory; questions arising on basis of treaty with Panama settled satisfactorily. "The officials of the Republic have manifested at all times a desire to aid the work of the Isthmian Canal Commission."

Legislation, etc.: By Congress, includes provision respecting the use of local revenues of the zone, employer's liability act, and the act providing for compensation of Government employees injured in the performance of duty. By Executive order, Chinese-exclusion law of Panama extended to zone; and trial by jury for criminal prosecutions involving death penalty or life imprisonment.

Ordinances prescribing building regulations, providing for the impounding of stray animals, and revising the liquor regulations and the schedule of general taxes and license fees collected in the Canal Zone enacted by the Isthmian Canal Commission and approved by Sec. of War.

Posts, customs, and revenues: Postage-stamp sales, \$72,708.67. 42,089 parcels registered (45 per cent official). Postal clerks placed on steamers between New York and zone. Money orders for \$4,686,684.98 issued. New post-office buildings erected at Cristobal, Culebra, and Ancon.

412 vessels entered at Ancon and Cristobal. No fees.

1,081 leases; revenue, \$17,436.76. Distillation, liquor, and bonding fees, \$44,743.96. General taxes, \$77,467.47

32 estates administered.

Total revenues, \$231,666.87.

Police and prisons: 232 men. 6,075 arrests; 4,731 convictions. At end of year 108 felony convicts. Prisoners employed on public improvements; did work to value of \$14,856.65.

1,540 writs served in civil cases. 140 deaths investigated. **P-08**, 25, 26.

Schools: 11 places for whites; 15 places for colored children. 721 pupils enrolled in former; 2,146 in latter. New schools completed at various points.

Fire protection: Paid companies organized at Gorgona, Empire, Culebra, and Ancon. Four men to a company. Paid fire company at Cristobal. 18 volunteer companies along the line. Electric-alarm systems installed. 2 tugs equipped for fire protection at Cristobal, Colon, and La Boca. 63 alarms; total loss, \$46,170.50. Cooperation with protection service of Colon and Panama.

Public works: Collections from private consumers of water in Panama, \$42,568.25; \$25,233.90 in Colon. 75 private connections to zone systems; collections, \$2,772.37.

Markets: New ones at various points; 8 in operation.

Prosecuting attorney: 366 persons filed against; 192 convicted.

Courts: 17 sessions of supreme court, acting on 11 decisions of the circuit court in 4 criminal and 7 civil cases. In the circuit courts 65 civil cases disposed of out of total of 111 on the docket. In the district courts criminal cases filed against 5,776 persons; all but 25 had been acted on at end of year. 14 civil cases pending at end of year of 433 cases filed.

Zone funds: Expended, \$183,601.95; balance, \$244,762.31. \$47,175.03 was for public works, etc.; \$35,749.47 for public schools; \$99,673.21 for posts. **P-08**, 26, 27.

1908-1913. (See Civil Administration.)

1914. (See Executive Department.)

Zone, Fault. (See Slides.)

Zone Waterways. (See Waterways, Zone.)

Zürcher, P. (See No. 194, p. 2365 of this Index.)
Geology, Culebra, and Emperador, **P-06***, 162.

PART VI.

TOPICAL INDEX

**TO ENGINEERING DATA IN THE REPORTS
OF THE CHIEF OF ENGINEERS,
U. S. ARMY.**

1866-1912.

Plates or Views of Typical Engineering Works, page 2625.

GUIDE TO THE USE OF PART VI.

What is contained in this part.—The various reports of the Chief of Engineers, and of officers of the Corps of Engineers, U. S. Army, embrace, at times, necessary and valuable details or descriptions of engineering work on fortifications, river and harbor works, public buildings, parks, roads, etc. Part VI of this Index is an alphabetical list of the subjects so described, with adequate references, by year and page, to the reports containing the details.

Nature of the details indexed.—Details which consist of but a few lines or words are not, as a rule, indexed in Part VI. The effort has been to list or index details of a more extended character, if especially informative from an engineering viewpoint.

Page and report references.—These are of the same general form as in other parts of the Index. Illustration—**99**, 776, means the annual reports of the Chief of Engineers for 1899, page 776; **03**, S., 309 means the annual reports of the Chief of Engineers for 1903, supplement, page 309. H. D. 479 (or S. D.), 56th, 1st, means House Document No. 479; 56th Congress, 1st session. Some earlier issues of Professional Papers of the Corps of Engineers are referred to as P. P.

Cross references.—In compiling the Topical Index the advantage of logical cross references to main headings has been kept in view; i. e., "Breakwater" refers to many related topics. It has not been felt necessary, however, to provide copious subcross-references to the subjects arranged under a main heading. It is assumed that any person wanting information on, say, breakwaters, would examine, as is customary, each item under that heading and its modifications, making subcross-references unnecessary.

Panama Canal.—Part V of this Index gives the engineering details pertaining to that work, and they are not repeated in Part VI. See page 2357 of this Index.

Timeliness of data.—As it may be difficult for everyone to get access to the earlier reports of the Chief of Engineers, it should be pointed out that references to reports of more recent date throughout Part VI are the more valuable, because, as engineering is a progressive science, the later references generally cover the matter up to date.

PLATES OF TYPICAL ENGINEERING WORKS.

REPORTS, CHIEF OF ENGINEERS, U. S. ARMY, 1866-1912.

| Plate and figures. | Construction. | Remarks. |
|--------------------|-----------------------|---|
| Plate 1: | | |
| A..... | Breakwater..... | Outer harbor, Los Angeles, Cal. |
| B..... | Breakwater..... | Extension, Ashtabula, Ohio. |
| C..... | Breakwater..... | Harbor wall, Sandy Bay. |
| D..... | Breakwater..... | Fayerweather Island. |
| E..... | Breakwater..... | View from rubble mound for light at end, Gloucester, showing surface. |
| F..... | Breakwater..... | Surface, Sandy Bay. |
| Plate 2: | | |
| A..... | Jetty..... | Sea side of; reconstruction; cars loaded with rock; rock crane shown. |
| B..... | Breakwater..... | Toro Point, Panama Canal. |
| C..... | Breakwater..... | West breakwater, New Haven, Conn. |
| Plate 3: | | |
| A..... | Breakwater..... | Toro Point, Panama Canal. |
| B..... | Breakwater..... | San Luis, Cal. |
| C..... | Breakwater..... | Unloading rock, Toro Point, Panama Canal. |
| D..... | Breakwater..... | Surface, sea face, and open end of superstructure under construction, Sandy Bay. |
| Plate 4: | | |
| A..... | Jetties..... | View of two, Newburyport. |
| B..... | Breakwaters..... | Harbor face, Gloucester. |
| C..... | Breakwater..... | Rubble mound for light at end, Gloucester. |
| D..... | Breakwater..... | Stonington Harbor, Conn. |
| Plate 5: | | |
| A..... | Jetty..... | South Pass, Mississippi River. |
| B..... | Jetty..... | Siusslaw River. |
| C..... | Jetty..... | Cowlitz River. |
| D..... | Dike..... | Pile dike, Flushing Bay, N. Y. |
| E..... | Dam..... | Wing dam, upper Mississippi River. |
| F..... | Harbor..... | Inner harbor, behind jetties, Grand Marias, Minn. |
| Plate 6: | | |
| A..... | Piers..... | Pier and breakwater construction, Ludington, Mich. |
| B..... | Pier..... | Molding tunnel section, Milwaukee, Wis. |
| C..... | Breakwater..... | Timber crib breakwater, with concrete superstructure. |
| D..... | Pier..... | Sinking caissons, Milwaukee. |
| E..... | Breakwater..... | Duluth-Superior, Minn. |
| Plate 7: | | |
| A..... | Breakwater..... | Crib ready for sinking, Manistee, Mich. |
| B..... | Breakwater..... | Ludington, Mich., sinking crib. |
| C..... | Breakwater..... | Ludington, Mich. |
| D..... | Breakwater..... | Stone breakwater, Buffalo, N. Y. |
| E..... | Pier..... | Winter scene at end of pier, Grand Haven, Mich. |
| Plate 8: | | |
| A..... | Pier and dredging... | Extending old pier; hydraulic dredging; South Haven, Mich. |
| B..... | Breakwater or pier... | Sinking first crib, Manistee, Mich. |
| C..... | Pier and harbor... | Pile revetment; breakwater in background; Keweenaw Waterway. |
| D..... | Pier..... | Driving piles for crib foundation, Ludington, Mich. |
| Plate 9: | | |
| A..... | Pier..... | Concrete superstructure, Milwaukee, Wis. |
| B..... | Breakwater..... | Looking from pier light, Marquette, Mich. |
| C..... | Pier and harbor... | East and west piers, Ontonagon, Mich. |
| D..... | Piers and harbor... | Looking toward Lake Superior, past aerial ferry, Duluth-Superior, Wis. |
| E..... | Breakwater..... | Agate Bay, Minn. |
| Plate 10: | | |
| A..... | Breakwater..... | End of main breakwater, timber post in view stands upon pier-head crib just below surface of water, Ashland, Wis. |
| B..... | Piers and harbor... | Entrance, Grand Marais, Minn. |
| C..... | Breakwater..... | Timber crib breakwater with timber and concrete superstructure, Buffalo, N. Y. |
| D..... | Breakwater..... | Looking toward shore, Marquette Bay (Presque Isle), Mich. |

| Plate and figures. | Construction. | Remarks. |
|--------------------|-----------------------------|---|
| Plate 11: | | |
| A..... | Pier..... | Concrete revetment, looking toward harbor, Superior entry, Duluth-Superior, Minn. |
| B..... | Breakwater..... | Junction of pile pier section and concrete caisson section, Racine, Wis. |
| C..... | Piers..... | Concrete piers, Lorain, Ohio. |
| D..... | Piers and breakwaters. | Completed form for reinforced concrete caisson; finished caisson in rear; Milwaukee, Wis. |
| Plate 12: | | |
| A..... | Jetty..... | Reconstruction; making and depositing concrete; Humboldt Bay, Cal. |
| B..... | Pier..... | Beam and floor reinforcement; superstructure; Balboa terminals, Panama Canal. |
| C..... | Jetty..... | Reconstruction; cars loaded with concrete material; railroad ties embedded in concrete; concrete top of jetty; Humboldt Bay, Cal. |
| D..... | Jetty..... | Reconstruction; concreting top; crest of old jetty at low water shown in background; Humboldt Bay, Cal. |
| Plate 13: | | |
| A..... | Piles..... | Concrete piles, casting and aging, Missouri River. |
| B..... | Piers..... | Concrete superstructure center pier, St. Marys Locks and Canal, Mich. |
| C..... | Jetty..... | Pile driver, mouth of Columbia River. |
| Plate 14: | | |
| A..... | Dike..... | Rubblestone dike, across flats; showing spall bed on which rubblestone was laid; Provincetown Harbor. |
| B..... | Dike..... | Concrete pile dike; building forms for concrete bracing work; Missouri River. |
| C..... | Jetty..... | Pile jetty; Cowlitz River. |
| Plate 15: | | |
| A..... | Dam or dike..... | Closing dam across chute, upper Mississippi River. |
| B..... | Dike..... | Building piling or hurdle dike, central rivers. |
| C..... | Dike..... | Wooden pile dike; plant and supervision furnished at private firm's expense. |
| D..... | Dike..... | Rubblestone dike, Provincetown Harbor. |
| E..... | Dike..... | 3-row standard dike under construction; land pile driver in operation; Missouri River. |
| Plate 16: | | |
| A..... | Dikes..... | Spur and longitudinal dikes, upper Tennessee River. |
| B..... | Dikes..... | Spur and longitudinal dikes, French Broad River. |
| C..... | Dike..... | Concrete pile dike; dike partly braced; workmen pouring concrete into the forms; Missouri River. |
| D..... | Dike..... | Concrete pile dike, before mattress and bracing in place, Missouri River. |
| Plate 17: | | |
| A..... | Barrier or dike..... | Yuba River, Cal. |
| B..... | Dam or hurdle..... | Closing slough, Mississippi River. |
| C..... | Dam..... | Back channel dam; characteristic of low dam of concrete, Ohio River, Browns Island. |
| Plate 18: | | |
| A..... | Dam..... | Reservoir dam, Winnibigoshish. |
| B..... | Dam..... | Pine River Reservoir Dam. |
| C..... | Dam..... | Leech Lake Reservoir Dam. |
| D..... | Dam..... | Pokegama Reservoir Dam. |
| E..... | Dam..... | Leech Lake Reservoir Dam. |
| Plate 19: | | |
| A..... | Dam..... | Gull Lake Reservoir Dam. |
| B..... | Dam..... | Winnibigoshish Reservoir Dam. |
| C..... | Dam..... | Gatun Spillway Dam, Panama Canal. |
| Plate 20: | | |
| A..... | Dam and water power. | Hales Bar Dam, Tennessee River. |
| B..... | Lock and dam..... | Construction, No. 15, Ohio River. |
| C..... | Lock and dam..... | Concrete on pile foundation, Dam No. 6, Green River, Ky. |
| Plate 21: | | |
| A..... | Lock and dam..... | No. 1, Osage River. |
| B..... | Lock and dam..... | No. 6, Cumberland River. |
| C..... | Lock and dam..... | No. 21, Cumberland River. |
| D..... | Lock and dam..... | No. 1, between Minneapolis and St. Paul, Minn.; construction. |
| Plate 22: | | |
| A..... | Dam and waste weir. | At Lock and Dam No. 4, Trinity River, Tex. |
| B..... | Dam..... | No. 3, Muskingum River. |
| C..... | Dam, lock, and reservation. | No. 3, Cumberland River. |
| Plate 23: | | |
| A..... | Lock and approach. | Black Rock, N. Y. |
| B..... | Lock chambers..... | Black Rock, N. Y.; chambers pumped out to level of sill. |
| C..... | Locks..... | Gatun Locks. Steamship Ancon leaving upper west chamber and entering Gatun Lake. |

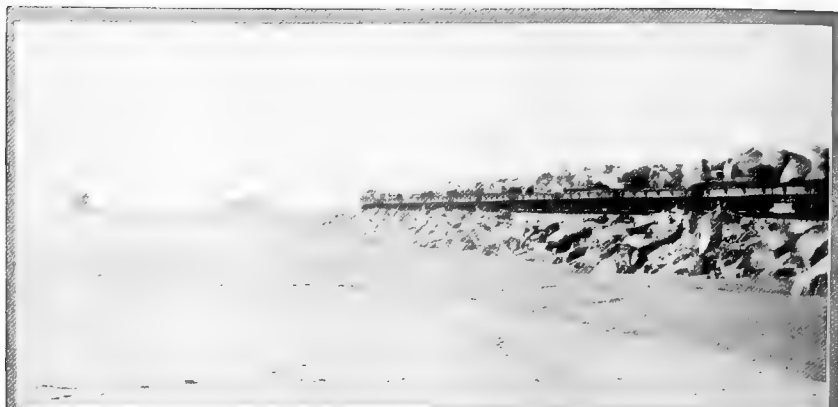
| Plate and figures. | Construction. | Remarks. |
|--------------------|---------------------------------|---|
| Plate 24: | | |
| A..... | Lock..... | No. 2, Cumberland River. |
| B..... | Lock..... | Model, St. Marys River Locks, Mich., showing culverts, gates open and shut, and form of concrete walls. |
| C..... | Lock..... | Boat passing through Moline Lock, upper Mississippi River. |
| D..... | Lock..... | No. 9, Muskingum River. |
| Plate 25: | | |
| A..... | Lock..... | No. 1, Cumberland River. |
| B..... | Lock..... | No. 5, Cumberland River. |
| C..... | Lock and dam..... | No. 8, Ouachita River. |
| D..... | Lock, dam, and reservation..... | Yamhill River. |
| Plate 26: | | |
| A..... | Lock..... | Concrete construction, St. Marys River, Mich. |
| B..... | Lock..... | Construction, forms in place for emptying culverts, St. Marys River. |
| Plate 27: | | |
| A..... | Lock..... | Colbert Shoals Canal, Tennessee River. |
| B..... | Lock and approach..... | Bayou Teche. |
| C..... | Dam..... | Sandy Lake Reservoir Dam, upper Mississippi River. |
| D..... | Lock and dam..... | Trinity River, Tex. |
| Plate 28: | | |
| A..... | Cofferdam and lock..... | Lock D, Cumberland River. |
| B..... | Lock and dam..... | No. 5, under construction, Ouachita River. |
| C..... | Lock and dam..... | No. 1, Trinity River, Tex. |
| Plate 29: | | |
| A..... | Concrete work..... | Pouring concrete, quay wall, Balboa Terminal, Panama Canal. |
| B..... | Concrete work..... | Placing, Lock No. 15, Ohio River. |
| C..... | Concrete work..... | Forms for concrete lining, upper chamber, tandem locks, Dalles-Celilo Canal, Columbia River. |
| Plate 30: | | |
| A..... | Locks and dams..... | Construction, Lock and Dam No. 17, Black Warrior River. |
| Plate 31: | | |
| A..... | Locks and cofferdam..... | Steel sheet pile cofferdam, lock, Black Rock, N. Y.; unwatered to 45-foot depth. |
| B..... | Locks..... | Construction, Gatun Locks, Panama Canal. |
| C..... | Locks..... | Construction, St. Marys River, Mich.; showing culvert forms. |
| Plate 32: | | |
| A..... | Locks..... | Guard wall, Lock No. 4, Cumberland River. |
| B..... | Locks..... | Gatun, Panama Canal; Gatun, the first boat through, entering locks, September 26, 1913. |
| C..... | Dam..... | Driving foundation piles for river wall, Dam No. 48, Ohio River. |
| Plate 33: | | |
| A..... | Lock gates..... | Moving wheel and machine, Gatun Locks, Panama Canal. |
| B..... | Lock gates..... | Constructing safety and lower gates, Pedro Miguel, Panama Canal. |
| C..... | Lock gates..... | Boat passing out of Moline Lock, upper Mississippi River. |
| D..... | Lock gates..... | Colbert Shoals Canal, Tennessee River. |
| Plate 34: | | |
| A..... | Locks and approach..... | Interior view, approach wall, Gatun Locks, Panama Canal. |
| B..... | Lock..... | Gates closed, Schooner Bayou, La. |
| C..... | Lock..... | Steamer about to enter lock, Cascades Canal Lock, Columbia River. |
| D..... | Locks and approach..... | Flaring approach wall under construction, Gatun, Panama Canal. |
| Plate 35: | | |
| A..... | Lock..... | Colbert Shoals Canal, Tennessee River. |
| B..... | Lock..... | No. 1, Ohio River; 10,000-ton coal fleet passing through under care of tow. |
| C..... | Lock..... | Steamer in lower chamber, Cascades Canal, Columbia River. |
| Plate 36: | | |
| A..... | Lock and dam..... | No. 2, Trinity River, Tex.; ready for erection of gates and Chanoine Dam. |
| B..... | Lock and dam..... | No. 17, Black Warrior River, Ala.; view of part of the construction. |
| C..... | Locks..... | Construction view, Pedro Miguel, Panama Canal. |
| D..... | Locks..... | Construction view, St. Marys River, Mich. |
| Plate 37: | | |
| A..... | Locks and culverts..... | Concrete work, Gatun Locks, Panama Canal. |
| B..... | Lock and cofferdam..... | Steel-pile cofferdam; lock building, Cape Fear River, N. C. |
| C..... | Lock..... | Upper end, No. 19, Ohio River. |
| D..... | Lock approach walls..... | Placing deck load on crib of center pier, St. Marys River, Mich. |
| Plate 38: | | |
| A..... | Lock..... | Third lock; construction, St. Marys River, Mich. |

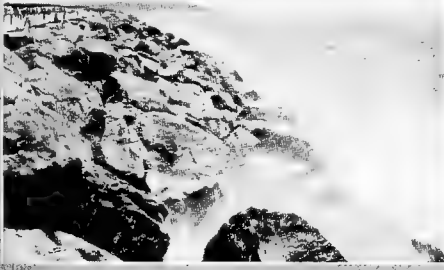
| Plate and figures. | Construction. | Remarks. |
|--------------------|----------------------------|--|
| Plate 39: | | |
| A..... | Locks..... | Monolithic center wall, with pipe, Gatun, Panama Canal. |
| B..... | Lock and cofferdam..... | No. 3, Ouachita River; cofferdam flooded. |
| C..... | Lock..... | No. 2, Monongahela River; double locks; construction. |
| D..... | Locks..... | Showing intermediate and lower chambers, Gatun, Panama Canal. |
| E..... | Dry dock..... | At Lock No. 6, Muscle Shoals Canal, Tennessee River. |
| Plate 40: | | |
| A..... | Lock gates..... | Upper guard gates, Gatun, Panama Canal, under erection. |
| B..... | Locks..... | Lower gates and temporary operating house, Black Rock, N. Y. |
| C..... | Lock gates..... | Various gates, Gatun, Panama Canal, under erection. |
| Plate 41: | | |
| A..... | Lock site..... | Beginning construction, Gatun, Panama Canal. |
| B..... | Locks..... | Construction, Pedro Miguel, Panama Canal. |
| C..... | Lock..... | Construction, No. 19, Ohio River. |
| Plate 42: | | |
| A..... | Dam, movable..... | No. 18, Ohio River. |
| B..... | Dam, movable..... | No. 1, Allegheny River; bear trap dam raised. |
| C..... | Dam, movable..... | No. 1, Allegheny River; bear traps lowered. |
| D..... | Dam, movable..... | No. 26, Ohio River; placing wickets, navigable pass. |
| Plate 43: | | |
| A..... | Dam, movable..... | No. 18, Ohio River; wickets up. |
| B..... | Dam, movable..... | No. 1, Ohio River; raising Chanoine wickets. |
| C..... | Dam, movable..... | No. 41, Ohio River; Boule section. |
| D..... | Dam, movable..... | No. 4, Ohio River; Chanoine wickets up. |
| Plate 44: | | |
| A..... | Dam, emergency..... | Gatun Locks, Panama Canal; ready to swing across lock. |
| B..... | Dam, emergency..... | Operating machinery, St. Marys River, Mich. |
| C..... | Dam, emergency..... | Gatun Locks, Panama Canal; dam lowered in lock. |
| D..... | Dam, emergency..... | Gatun Locks, Panama Canal; east emergency dam subjected to head of 50 feet of water, May 6, 1914. |
| E..... | Dam, emergency..... | Lowering wickets, St. Marys River, Mich. |
| Plate 45: | | |
| A..... | Canal..... | West Neebish rock cut, St. Marys River Canal, Mich. |
| B..... | Canal..... | Completed section, Dalles-Celilo, Columbia River. |
| C..... | Canal..... | Completed section, Dalles-Celilo, Columbia River. |
| D..... | Canal or waterway..... | Clearing right of way through swamp, inland waterway, Pamlico Sound to Beaufort Inlet, N. C. |
| E..... | Canal..... | Excavation, Panama Canal. |
| Plate 46: | | |
| A..... | Cranes..... | Unloading sand, Panama Canal. |
| B..... | Excavation..... | Rock excavated to natural slope, by steam shovels, Balboa Terminals, Panama Canal. |
| C..... | Quarrying..... | Loading rock on cars, Toro Point quarry, Panama Canal. |
| D..... | Excavation..... | Lock site, Gatun, Panama Canal. |
| E..... | Rockwork..... | Rock car used in construction of jetties, Columbia River mouth. |
| Plate 47: | | |
| A..... | Excavation..... | Culebra Cut, between Gold and Contractors Hills, Panama Canal, 1890, looking south. |
| B..... | Excavation..... | Culebra Cut, looking north from Contractors Hill, Dec. 28, 1907. |
| C..... | Excavation..... | Culebra Cut, looking south from Contractors Hill (excavation completed south of Cucaracha slide), July 19, 1913. |
| Plate 48: | | |
| A..... | Canal slides..... | Culebra Cut, Cucaracha, looking north from west bank, Dec. 9, 1913; dredges operating. |
| B..... | Canal slides..... | Culebra Cut, Culebra, Panama Canal; blasting channel through Cucaracha slide, looking north, Oct. 16, 1913. |
| C..... | Canal slides..... | Culebra Cut, Culebra, Panama Canal; looking south from top of Contractors Hill, Cucaracha slide to the left, Dec. 3, 1913. |
| D..... | Canal slide..... | Rock slide, Panama Canal; excavator smothered. |
| Plate 49: | | |
| A..... | Canal excavation..... | Canal trunk excavated in solid rock, Dalles-Celilo Canal, Columbia River; steam-shovel work. |
| B..... | Lock excavation..... | Rock excavation, by derricks, Dalles-Celilo Canal, Columbia River. |
| C..... | Canal excavation..... | Deepest cut, Panama Canal, Culebra Cut. |
| Plate 50: | | |
| A..... | Excavation, hydraulic..... | Stripping hill, Panama Canal. |
| B..... | Excavation..... | Steam shovel on skids, tunnel work, Panama Canal. |
| C..... | Rock blasting..... | Charge of dynamite fired from 25 holes, Willamette River. |
| Plate 51: | | |
| A..... | Excavation..... | Pipe line dredge working below Keokuk, Iowa, upper Mississippi River. |
| B..... | Excavation..... | Hydraulic dredging, suspended or fixed pipe line, San Pablo Bay, Cal. |
| C..... | Excavation rock..... | Drill rafter and tender, with drills at work, Tuscumbia Bar, Tennessee River. |
| D..... | Excavation..... | Floating pipe-line arrangement, hydraulic dredging, San Pablo Bay, Cal. |

| Plate and figures. | Construction. | Remarks. |
|--------------------|---------------------------|--|
| Plate 52: | | |
| A..... | Dredging..... | 20-inch suction dredge with ponton pipe or discharge line at work, Oakland Harbor, Cal. |
| B..... | Dredging..... | United States pump boat working, Savannah River, below Augusta, Ga. |
| C..... | Dredging..... | Dredging and disposal of material ashore, inland waterway, Pamlico Sound to Beaufort Inlet, N. C. |
| Plate 53: | | |
| A..... | Dredge..... | Burton. |
| B..... | Dredge..... | Pipe-line dredge Morgan, used to rehandle dumped material from sea goers in specially prepared pockets. |
| C..... | Dredge..... | Pump boat Augusta, showing cutter, and A frame. |
| D..... | Dredge..... | Savannah, running light. |
| E..... | Dredge..... | Atlantic. |
| F..... | Dredgings..... | Extension or Governors Island, New York Harbor, from dredgings, etc. |
| Plate 54: | | |
| A..... | Dredge..... | New Orleans. |
| B..... | Dredge..... | New Orleans. |
| C..... | Dredge..... | Tennessee working on Tuscumbia Bar, Tennessee River. |
| D..... | Snag boat..... | Dredging shoal, Yazoo River. |
| E..... | Dredge..... | Dipper dredge Ohio. |
| Plate 55: | | |
| A..... | Dredge..... | Savannah loaded. |
| B..... | Dredge..... | Dipper dredge Cheraw removing hard material, Winyah Bay, S. C. |
| C..... | Derrick boat..... | Removing rock shoals, Ocmulgee River, vicinity of Hawkinsville; rock is first blasted, then handled with orange-peel bucket; dump shown in background. |
| D..... | Dredge and pipe line..... | Dredge, floating pipe line, and trestle pipe line, Oakland Harbor, Cal. |
| E..... | Dredge..... | Clatsop. |
| Plate 56: | | |
| A..... | Dredge..... | Alabama working at head of canal, above Lock No. 1, Muscle Shoals Canal, Tennessee River. |
| B..... | Snag boat..... | Macomb, Mississippi River. |
| C..... | Snagging plant..... | Towboat Iroquois and derrick boat Mingot, Ohio River. |
| D..... | Snagging..... | Tree withdrawn from waterways, central rivers. |
| Plate 57: | | |
| A..... | Revetment and banks..... | Hydraulic bank grading, for revetment, Bates Island Bend, Missouri River. |
| B..... | Bank work..... | Protection, front of Augusta, Ga., showing pavement, sub and top. |
| C..... | River floating plant..... | Portion shown, Mississippi River. |
| D..... | Revetment and banks..... | Bank slopes, Mississippi River. |
| E..... | Banks..... | Paving, Savannah River at Augusta, Ga.; plant used to excavate trench at toe of slope; method of handling rock to fill same. |
| Plate 58: | | |
| A..... | Revetment and banks..... | Standard, 1899; Pelican Bend, Missouri River. |
| B..... | Barge..... | Material barge construction, United States engineer depot, Mississippi River. |
| C..... | Banks..... | Paving, Mississippi River. |
| D..... | Banks..... | Paving with stone, Mississippi River. |
| Plate 59: | | |
| A..... | Quarter boat..... | For employees, Mississippi River Commission, Mississippi River. |
| B..... | Banks..... | Rubble slope lining, gravel section, Dalles-Celilo Canal, Columbia River. |
| C..... | Banks..... | Placing concrete slope lining, gravel section, Dalles-Celilo Canal, Columbia River. |
| D..... | Banks..... | Paving; placing reinforced concrete, Arkansas River. |
| Plate 60: | | |
| A..... | Paving..... | Slope, Gatun Lake, Panama Canal, Gatun Dam. |
| B..... | Banks..... | Ice piled in bends, Mississippi River. |
| C..... | Bank and shore..... | Protection, upper Mississippi River. |
| D..... | Banks..... | Concrete bank paving, reinforced, Arkansas River. |
| E..... | Revetment..... | Finished revetment of concrete pavement and willow mattresses, Missouri River. |
| Plate 61: | | |
| A..... | Revetment..... | Mattress weaving, beginning stitch, Missouri River; hydraulic grading in background. |
| B..... | Revetment..... | Mattress weaving, near Sioux City, Iowa, Missouri River. |
| C..... | Revetment..... | Mattress weaving on ice, Missouri River, Williston, N. Dak. |
| D..... | Revetment..... | Mattress weaving; preparations for sinking mattresses, Mississippi River. |
| Plate 62: | | |
| A..... | Revetment..... | Framed mattress for river revetment ready to be sunk, Mississippi River. |
| B..... | Revetment..... | Sinking mattress, Mississippi River. |
| C..... | Revetment..... | Brush and pole mattress work, Trinity Bend, Arkansas River. |
| D..... | Revetment..... | Making mattress, Mississippi River. |
| E..... | Revetment..... | Brush and pole mattress work, Trinity Bend, Arkansas River. |

| Plate and figures. | Construction. | Remarks. |
|--------------------|-----------------------------------|---|
| Plate 63: | | |
| A..... | Dike breaking..... | Opening valves in Gamboa Diike, Panama Canal, to flood Culebra Cut; dike to be blasted later. |
| B..... | Cave-ins or crevasses..... | Crevasse narrowly averted; levees 16 feet high, Mississippi River. |
| C..... | Floods..... | Town flooded, Mississippi River. |
| Plate 64: | | |
| A and B..... | Floods and levees..... | Repairing, Mississippi River. |
| C..... | Floods and levees..... | Reinforcing, Mississippi River. |
| D..... | Floods and levees..... | Repairing, Mississippi River. |
| Plate 65: | | |
| A..... | Levees..... | Protection by sand bags, Mississippi River. |
| B..... | Flood and shoal..... | Sand and gravel after flood, Chagres River, Panama Canal; dredging. |
| C..... | Crevasse and flood..... | Cave-in narrowly averted, Mississippi River. |
| Plate 66: | | |
| A..... | Bridges..... | Concrete bridge, Yellowstone Park. |
| B..... | Bridges..... | Concrete bridge, Mandingo River, Panama Canal. |
| C..... | Bridges..... | Inlet bridge, Tidal Basin, District of Columbia. |
| D..... | Bridges..... | Concrete bridge, Yellowstone Park. |
| E..... | Bridge, ponton..... | Panama Canal, Paraiso. |
| Plate 67: | | |
| A..... | Roads..... | Tropical road, Philippines. |
| B..... | Roads..... | Mountain road and wall, Yellowstone Park. |
| C..... | Viaduct..... | Golden Gate Viaduct, Yellowstone Park. |
| Plate 68: | | |
| A..... | Monument erection..... | Stephenson Monument, Washington, D. C. |
| B..... | Municipal work..... | Ancon, P. C.; water reservoir in foreground. |
| C..... | Public grounds..... | Sherman Plaza and Washington Monument. |
| Plate 69: | | |
| A..... | Monument erection..... | Sheridan Statue, Washington, D. C. |
| B..... | Monument erection..... | Washington Memorial Arch, Valley Forge, Pa. |
| Plate 70: | | |
| A..... | Buildings..... | Lock houses, Cumberland River. |
| B..... | Buildings..... | Executive Office, White House, Washington, D. C. |
| C..... | Buildings..... | Lock keeper's dwelling, Cape Fear River. |
| D..... | Buildings..... | Dynamite storage magazines, Panama Canal. |
| E..... | Towers..... | Range towers, Panama Canal. |
| F..... | Steel buildings..... | Government Printing Office, Washington, D. C. |
| Plate 71: | | |
| A..... | Lighthouses or range towers..... | Panama Canal. |
| B..... | Power station..... | Gatehouse, Gatun, Panama Canal; hydroelectric station. |
| C..... | Beacons..... | Culebra Cut, Panama Canal. |
| D..... | Schoolhouses..... | Culebra, Panama Canal. |
| E..... | Buildings..... | Administration building, Balboa Heights, Panama Canal. |
| F..... | Power house..... | Reinforced-concrete power house, Miraflores, Panama Canal. |
| Plate 72: | | |
| A..... | Gauging and river hydraulics..... | Station and method, streams of Isthmian Canal Zone, Panama Canal. |
| B..... | Meteorology..... | Fluviograph station, Chagres River, Panama Canal. |
| C..... | Soundings..... | Catamaran, Great Lakes. |

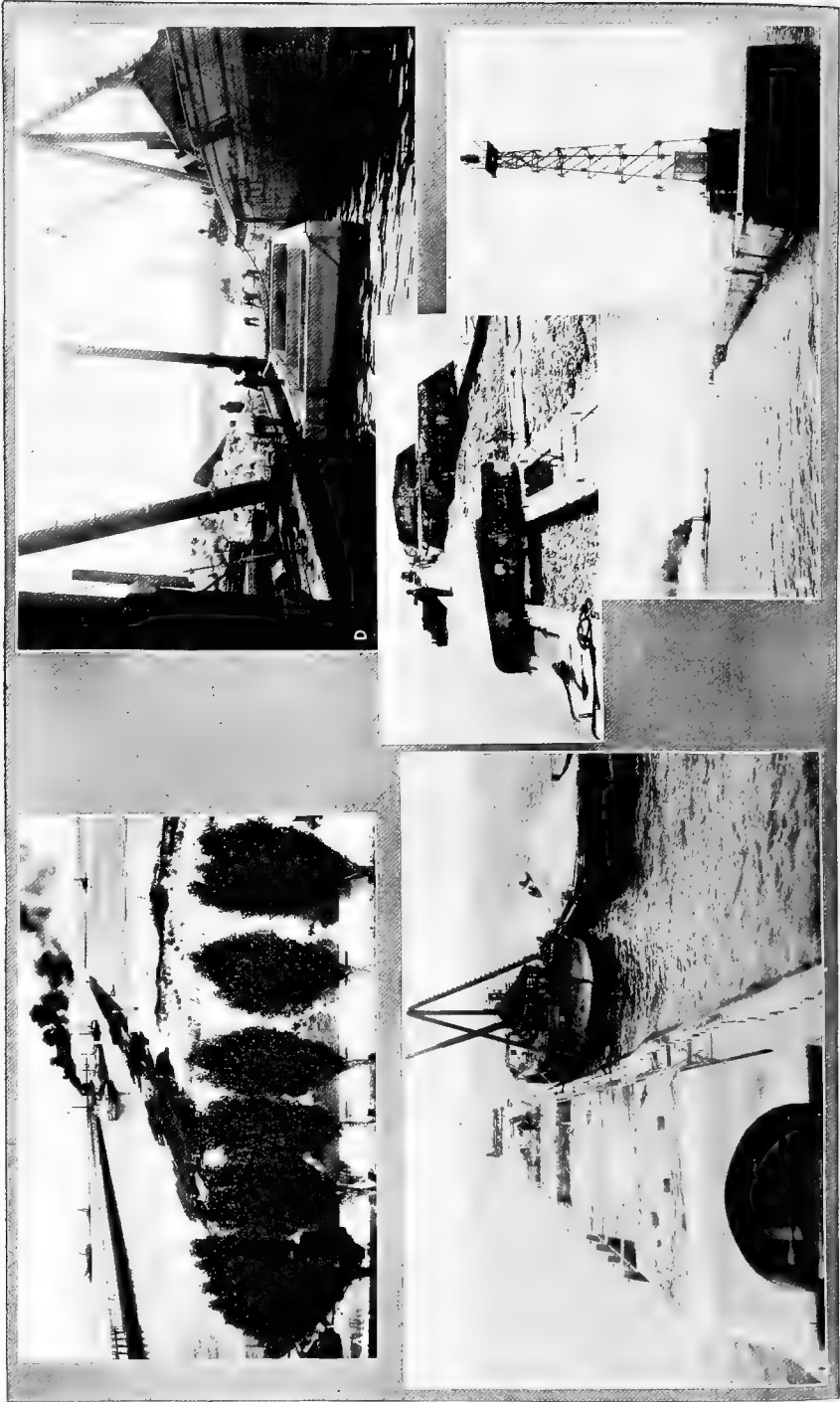


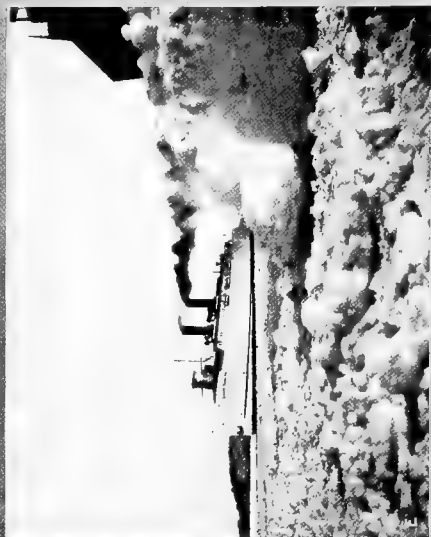




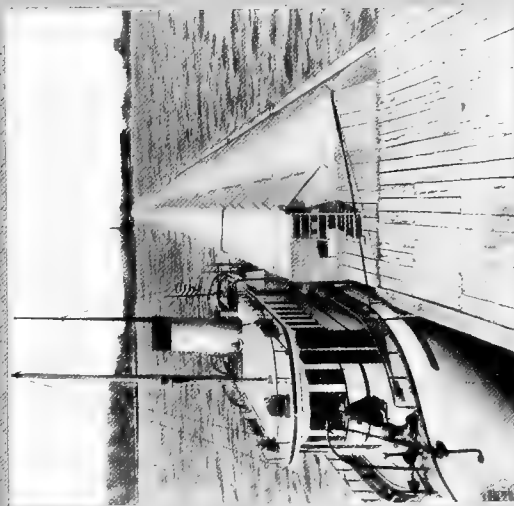








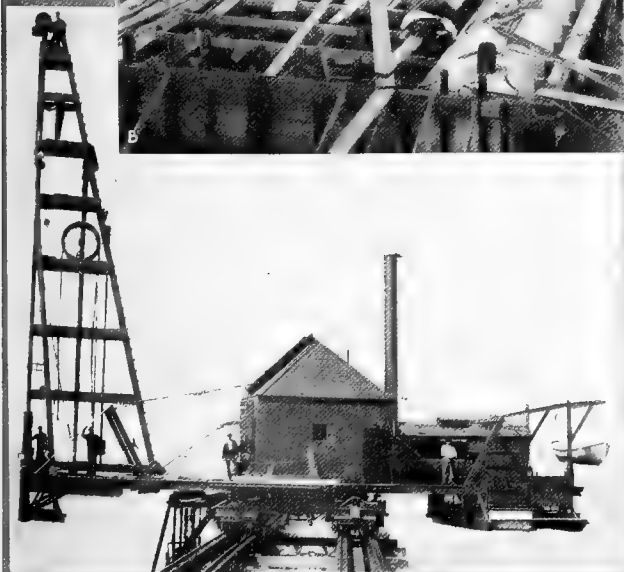




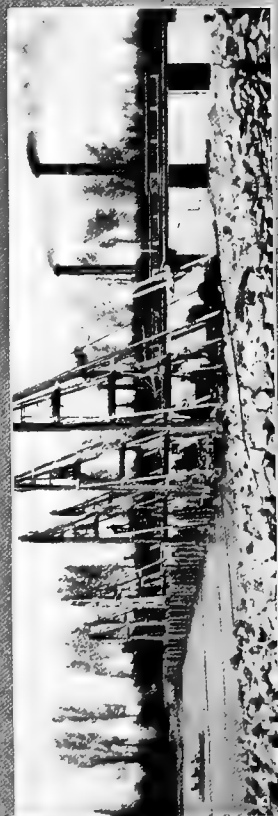
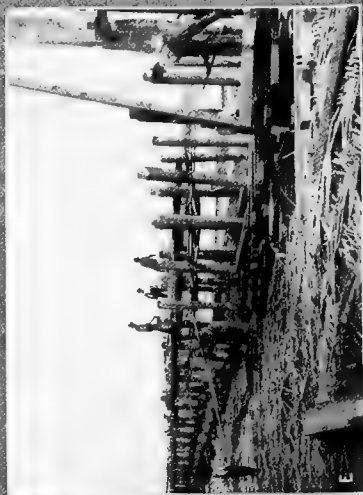






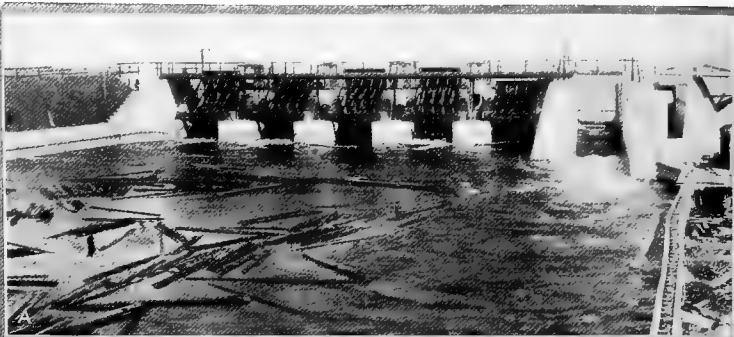


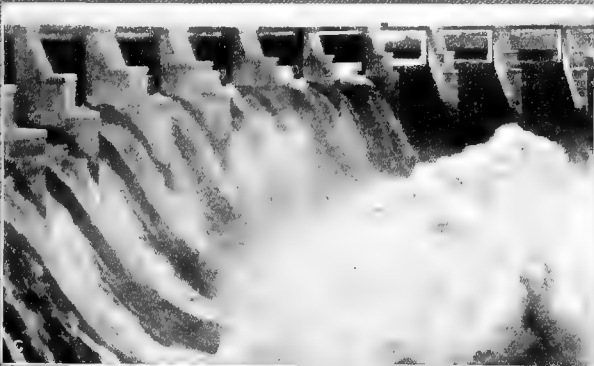
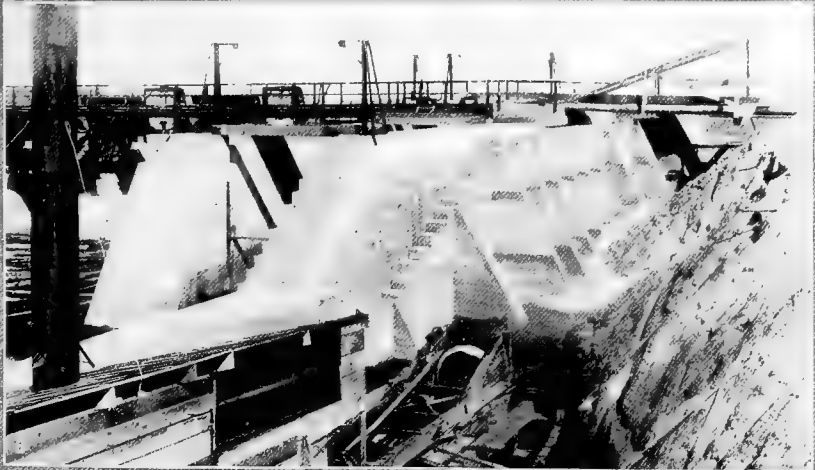




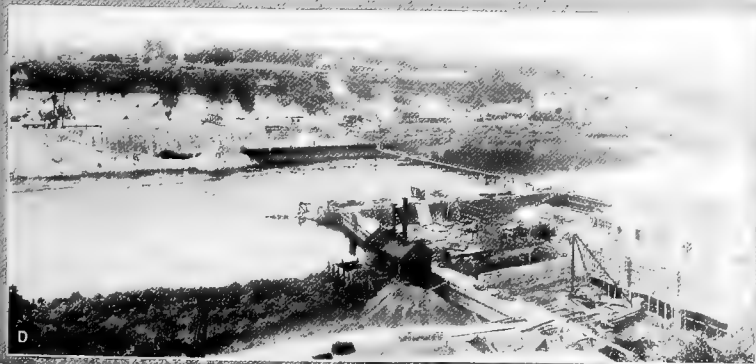






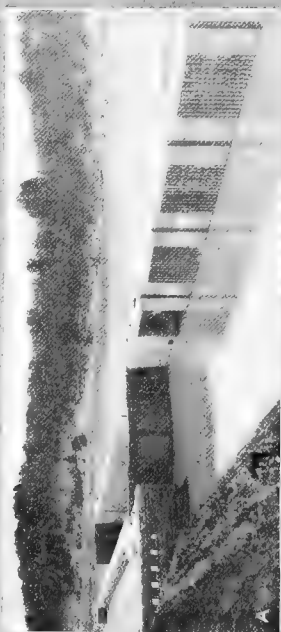


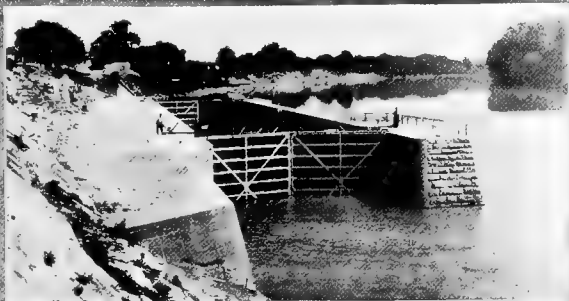


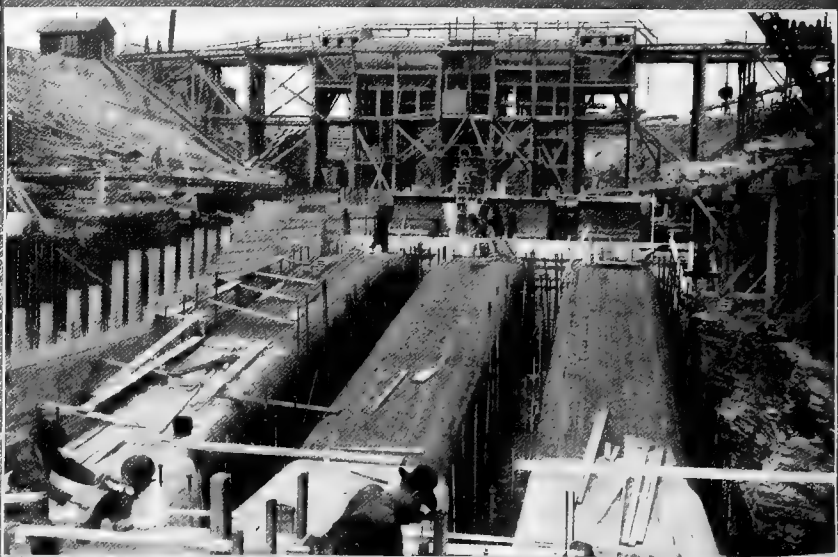








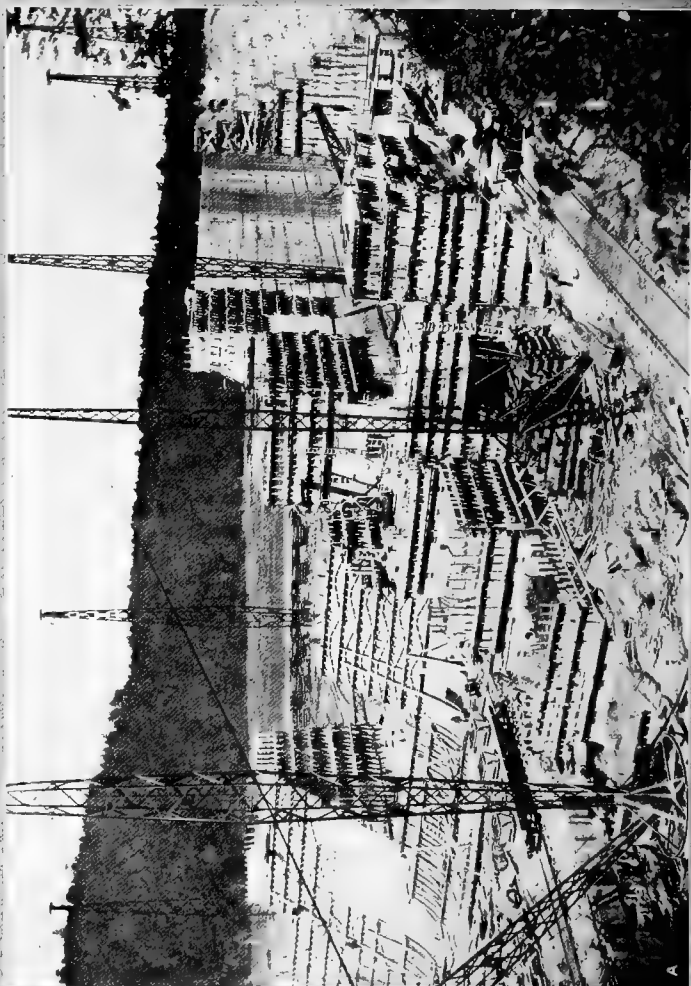


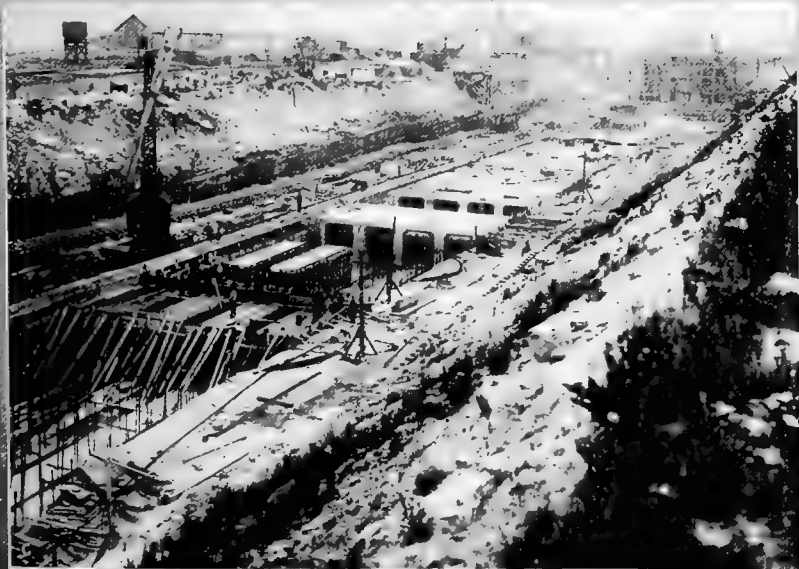




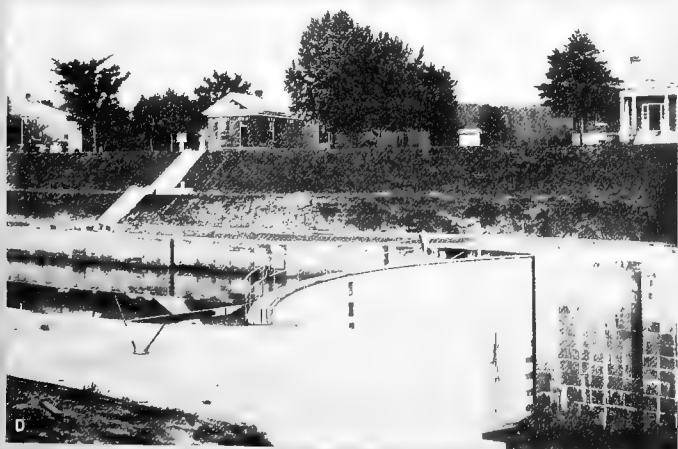


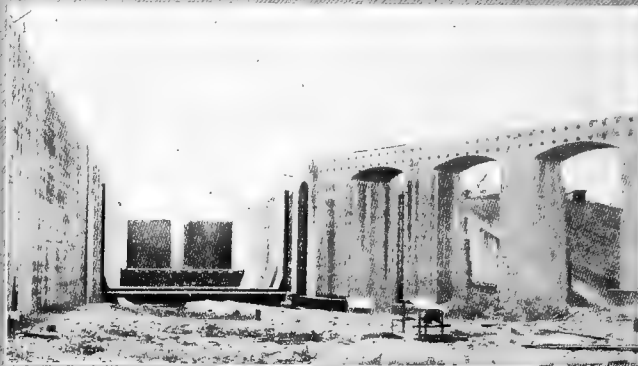




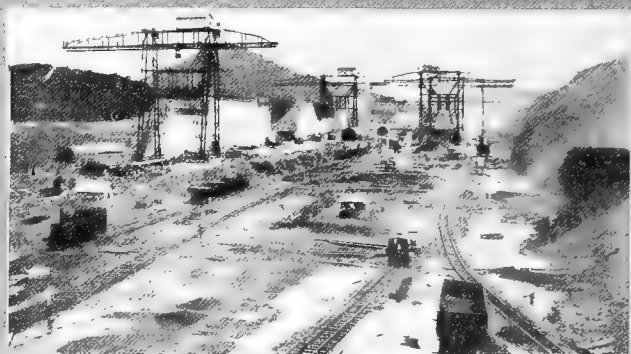


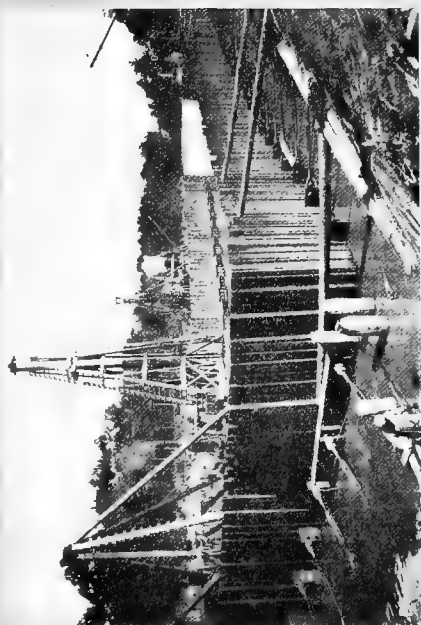
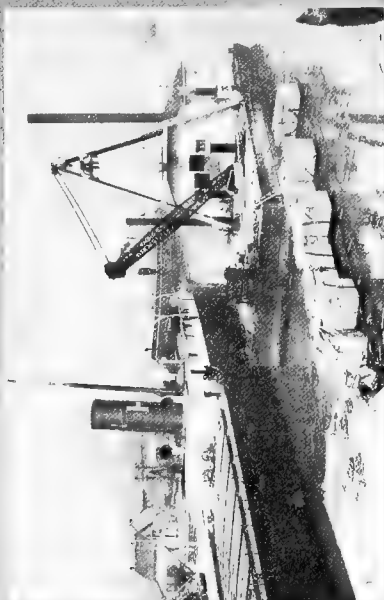


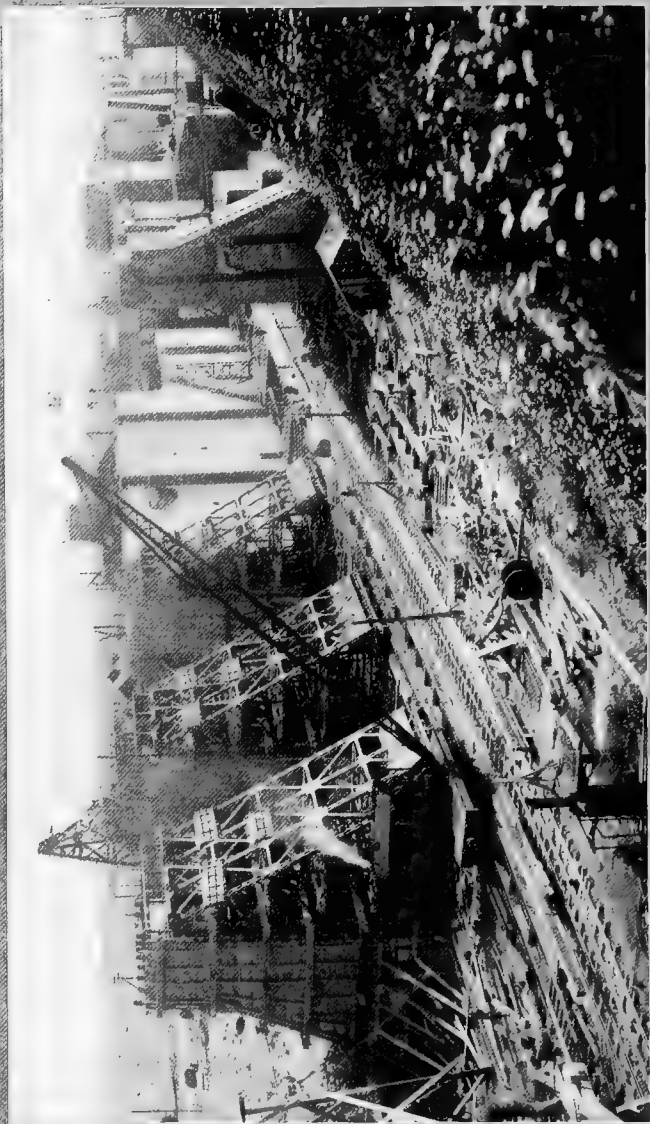


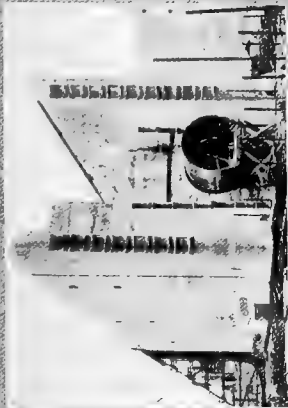
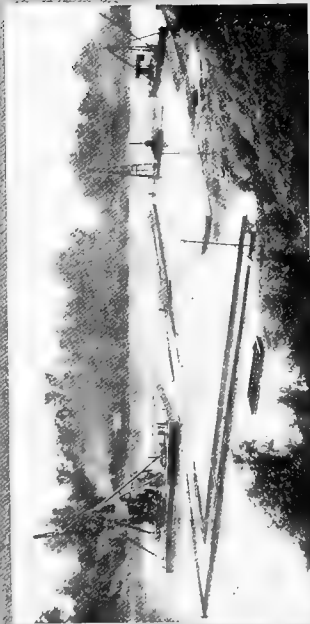


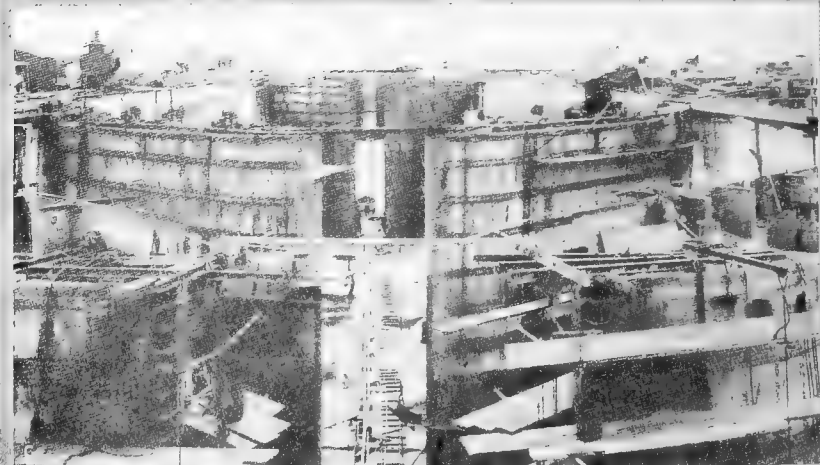


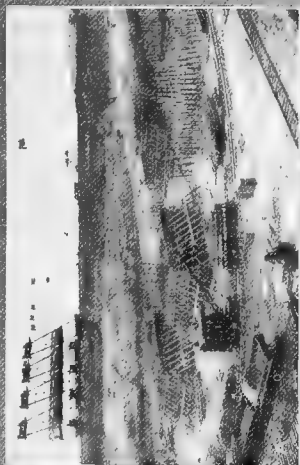
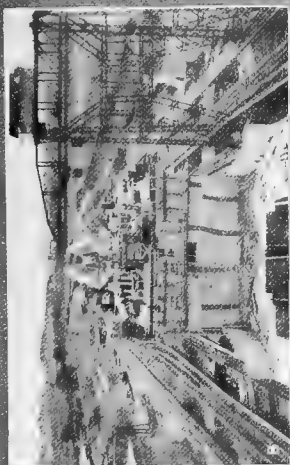


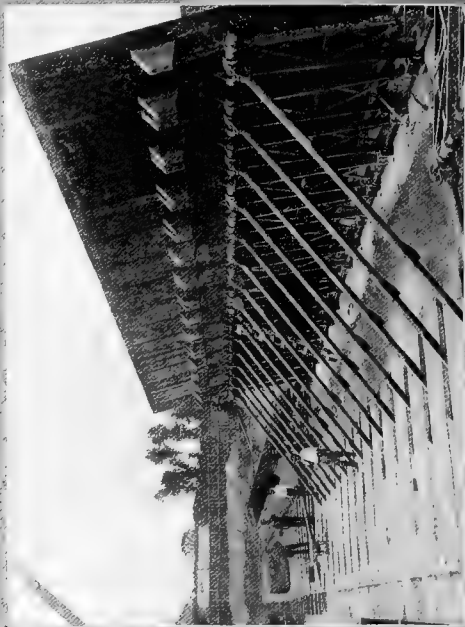




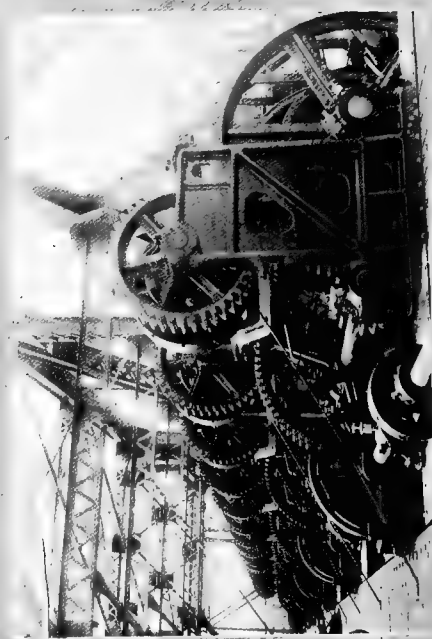
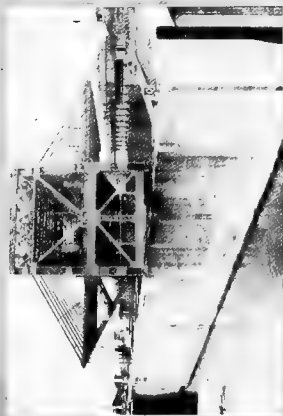
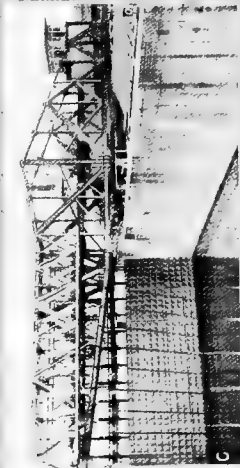




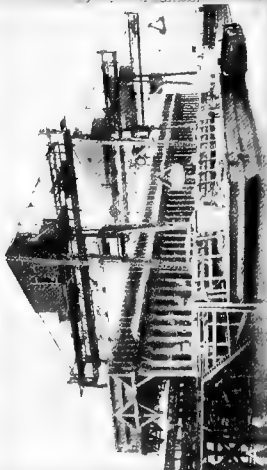






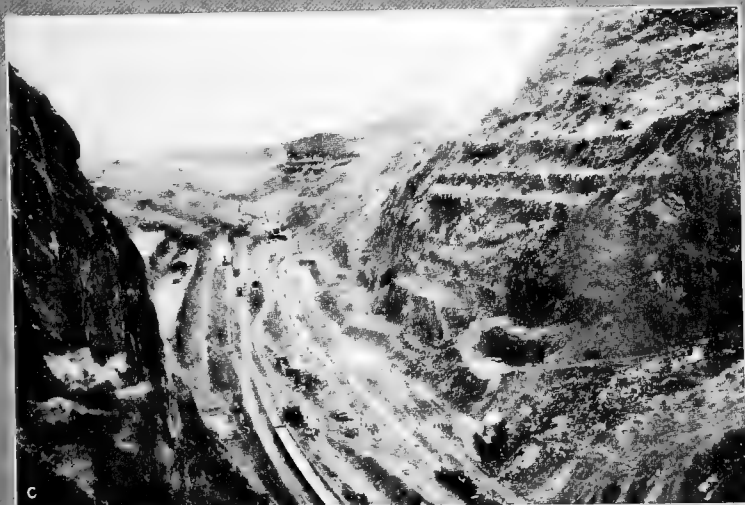










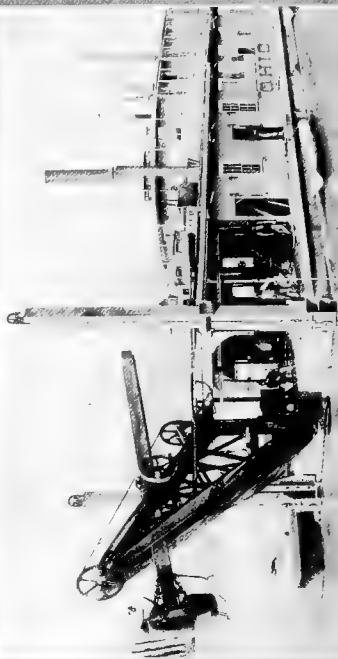
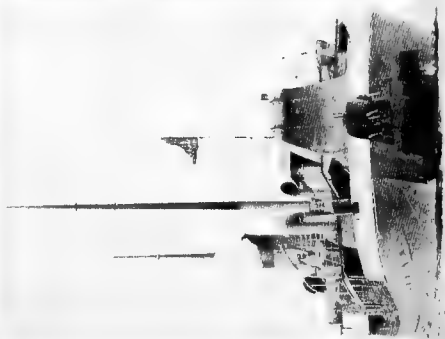
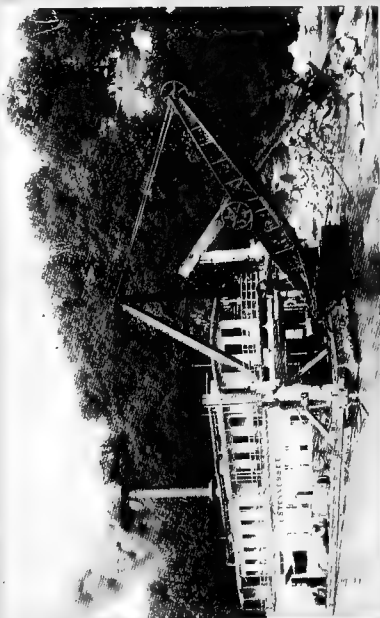




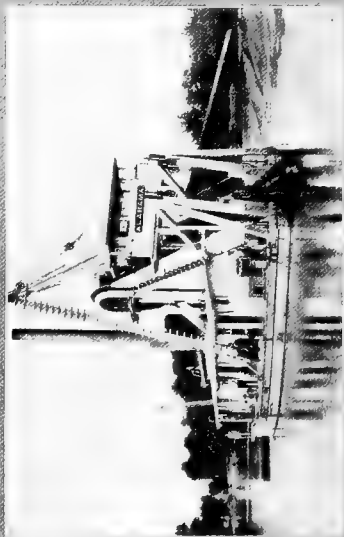
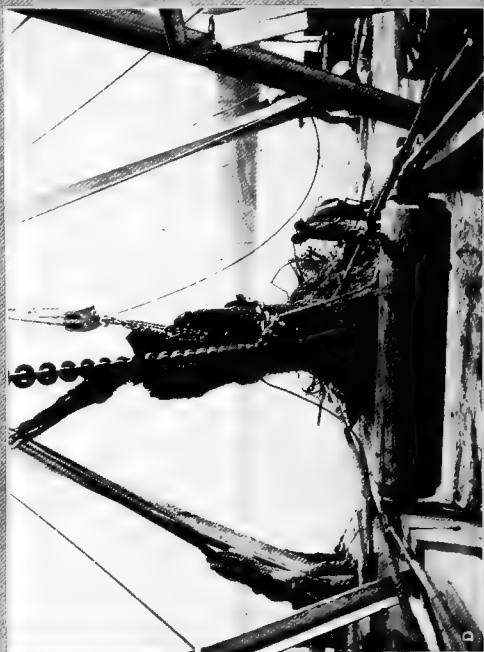
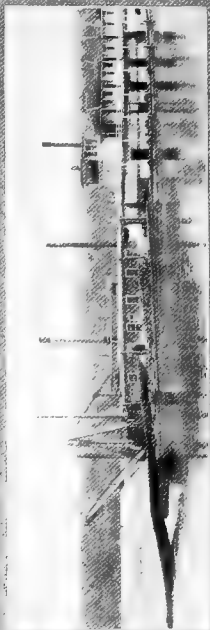




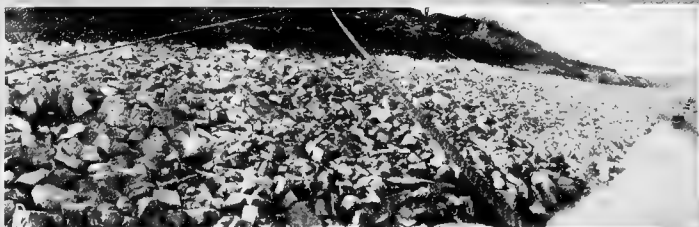
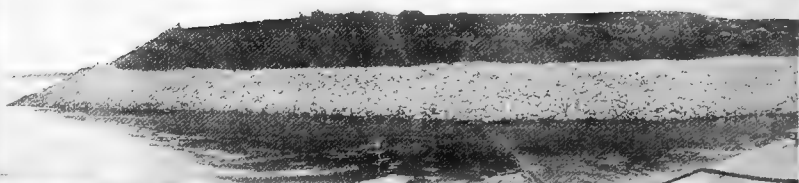


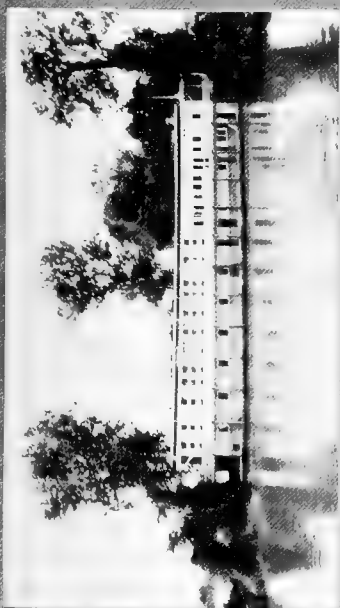


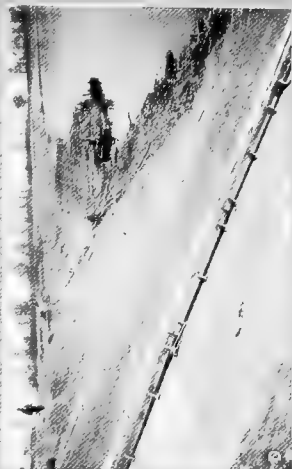


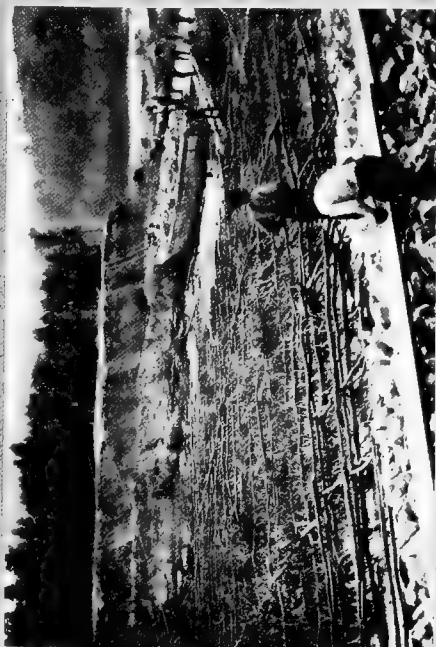










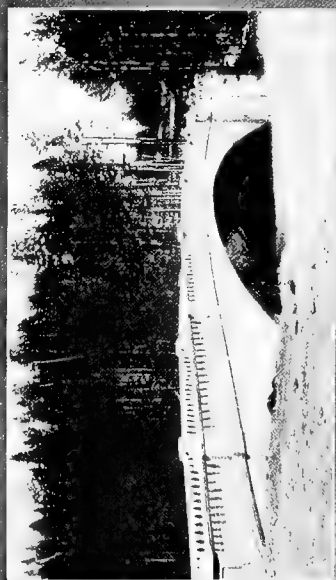
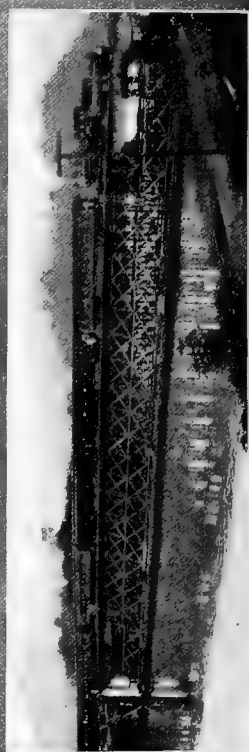








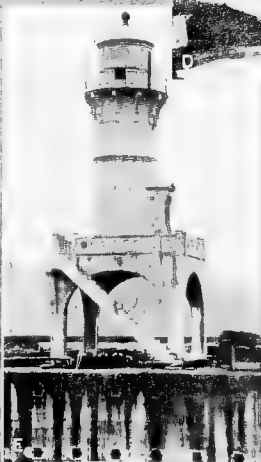


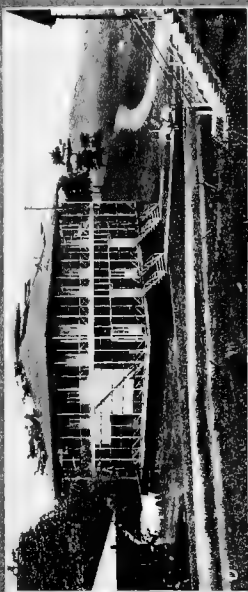














A.

Abatts.

Shore protection, Missouri River, **01**, S., 398, 401.

Abutments. (See Bridges; Dams; Gates; Locks.)

Building, dams, **97**, 2550.
Building, locks, **00**, 3507.
Building, movable dams, **97**, 2548.
Designing, dams, **00**, 2983.
Designing, lock gates, **00**, 2975.
Deterioration, locks, **93**, 2493.
Failure of, dams, **04**, 3767.
Floods, destroyed by, locks, **03**, 1421.
Grading, locks, **00**, 3511.
Locks, **98**, 2482; **04**, 3763.
Plans of, dams, H. D. 263, 59th, 1st.
Protecting, locks, **00**, 3511.
Quicksand flow, preventing, **98**, 2125.
Reconstruction, dams, **11**, 2106.
Repair, locks, **98**, 2143, 2149.
Sand and gravel for, bridges, **00**, 5444.

Abutments, Concrete.

Locks and dams, **01**, 2115; **04**, 2102.

Abutments, Crib.

Building, locks, **98**, 2125.

Accidents.

Blame difficult to fix, bridges, **07**, 1829.
Liability of vessel owners, **07**, 1825.
Locks, Great Lakes, **09**, 2069.

Accounts.

Rock; accounts, keeping, **93**, 1500.

Accretions. (See Banks; Canals; Rivers; Shores; Waterways.)

Bankheads, due to, **98**, 3530.
Breakwaters, vicinity of, **93**, 2743; **96**, 3140.
Dikes, due to, **93**, 427; **95**, 2217, 2218.
Jetties, vicinity of, **93**, 3141, 3494; **97**, 3372.
Phenomenal growth, H. D. 1506, 60th, 2d.
Piers, vicinity of, **97**, 2779.

Acids.

Lock gates affected by acids in waterways, **09**, 1761.
Locks and dams affected by acids in water, **11**, 2110.

Acts of Congress. (See Index of Laws.)

Mississippi River Commission, relating to, **95**, 3730.

Advertising.

Clear authority necessary, H. D. 641, 60th, 1st.
Objections to, wreck removing, **94**, 606.

Aeration.

Cement, effect on, **95**, 2924.

Agitator.

Hydraulic dredges, **98**, 3170, 3305.

Agreements.

Copy of, between wharf owners and public, H. D. 593, 61st, 2d.

Agriculture.

The only unprotected industry, discussion of, **74**, 608.

Air Bags.

Bear-trap gates, raising, **96**, 1840.
Weirs, raising, **93**, 2265.
Wrecks, raising, **98**, 1234.

Air, Compressed.

Power plant, **00**, 2769.
Power, transmitting, **98**, 1810.
Steam preferable to, rock drilling, **98**, 1952.

Air Compressor.

Turbine auxiliary plant, locks, **11**, 2109.

Air Exposure.

Dams, effect on, **87**, 2107.
Rock, softening of, **99**, 1426.

Air Spaces.

Concrete walls, **97**, 631; **99**, 786; **00**, 849, 978.
Not necessary, San Diego climate, **01**, 923.

Allotments. (See Appropriations.)

Points kept in view, fortifications, **96**, 9.

Amazon River.

Navigation of, Sen. D. 301, 61st, 2d.

Ammunition. (See Fortifications, p. 1793 of this Index.)

Handling, crane, **00**, 850.
Handling, hoists, etc., **93**, 610; **97**, 631; **99**, 795; **00**, 853, 857, 898.
Handling, hydraulic lifts, **05**, 3015.

Anchorage. (See Dredges; Vessels.)

Areas for, increasing, Portland, Me., H. D. 489, 62d, 2d.
Current, against; dredges, **93**, 2449.
Factors justifying construction, Fall R. H., H. D. 778, 61st, 2d.
Guns, **02**, 2466.
Harbor capacity for, determining, **84**, 579; **85**, 531.

Anchorage Area.

Determination of, **84**, 579; **85**, 531.
Various vessels, **84**, 585.

Anchorage Basin.

Hyannis, **95**, 656.

Anchor Bolts.

Grouting-in of, **00**, 2782.
Setting, **93**, 2826; **94**, 453.
Setting, without templets, gun platforms, **96**, 536.
Stripping of threads, lock gates, **11**, 2109.

Anchor, Disk.

Anchor piles substitute, **01**, 2195.
Hurdles, **01**, 2223.
Jetties, **01**, 2221.

Anchor Rods.

Concrete sea walls, **05**, 3026.

Anchors. (See Gates, Lock.)

Dredges, **01**, 2263; **02**, S. 44.
Holding power, **72**, 211.
Lock gates, **00**, 2982.
Mattresses, **03**, 2441.
Mooring buoys, attached to screws, **73**, 294.

Anemograph.

67, 595.

Records, Milwaukee, 67, 594, 755.

Angle Measuring.

Triangulation, 94, 3325; 95, 4167, 4216.

Angle Reading.

94, 3409.

Angles, Observed.

Errors, triangulation, 73, 1178.

Appropriations. (See p. 21 of this Index.)

Allotment of, points kept in view, fortifications, 96, 9.

Consolidated, advantages of, 01, 2049.

Division between Federal and State appropriations, waterways, Sen. D. 301, 61st, 2d.

Illogical, by States, waterways, 01, 1996.

Insufficient app. useless, wreck removal, "Maine," H. D. 919, 61st, 2d.

R. and H. app. should be in proportion to local enterprise, H. D. 1067, 61st, 3d.

Steps necessary before making, waterways, Sen. D. 301, 61st, 2d.

Appropriations, continuing; economy of, 01, S. 4.

Aprons. (See Blast; Concrete; Cribs; Weirs.)**Aqueduct Bridges.**

Design, 82, 2037; 86, 934, 942; 87, 902, 908.

Details, 96, 2670.

Potomac River, 76, 333.

Repairing, 97, 3988.

Aqueducts. (See Bridges; Washington Aqueduct, D. C., Miscellaneous Index.)

Capacity, study, H. D. 342, 61st, 2d.

Concrete, piers, 98, 2482.

Concrete, use of, 87, 2547.

Flow, gauging, 97, 4014.

Illinois and Mississippi Canal, 08, 2020.

Lining, 08, 2020.

Mammoth Hot Springs, 03, 2476.

Muscle Shoals Canal; cleaning, 01, 2446.

Sections, H. D. 342, 61st, 2d.

Sides, strengthening, 02, 1737.

System; Washington, D. C., 77, 1089; 01, 3651.

Tennessee River, 85, 1758.

Arches. (See Stone; Tunnels.)

Stability, P. P. No. 7, C. E.

Arid Regions.

Precipitation, reservoirs, effect, 98, 2865.

Reservoir sites, 98, 2819, 2821, 2842, 2869, 2872, 2878.

Reservoir systems, development of, 98, 2875.

Reservoirs, study of, 98, 2815.

Run-off, 98, 2875.

Watersheds, list of, 98, 2914.

Armor.

Coast defense, 87, 8.

Army.

Militia and, functions, seacoast defense, 81, 402.

Artillery.

Artillery officers added to Board of Engineers, 01, 5.

Arts, Commission of.

Formed to advise public officers, Washington, D. C., 12, 3517.

Asphaltic Concrete.

96, 534, 535.

Asphalting. (See Forts, p. 1793 of this Index.)**Assessments.**

Canal work, 09, 883; 10, 933; H. D. 953, 60th, 1st.

Astronomical Observations. (See Azimuth; Surveys.)

Data concerning, index to, Mississippi River, 95, 3703.

Field observatory, Willets Point, 81, 434.

Resurveys, 94, 332.

Surveys, 97, 4076.

Triangulation, 93, 4348; 96, 4025.

Willets Point, 80, 307; 81, 433; 82, 458; 84, 438; 85, 436.

Attacks.

Seacoast, plans, 80, 8; 81, 401.

Axles.

Lock gates, 11, 2138.

Azimuth Observations.

94, 3387.

B.**Backfilling.** (See Filling.)**Backing, Dry Rubble.**

Voids in tunnels, 99, 3803; 00, 5213.

Backwater.

Deposits, causes of, 97, 1967.

Determining, slack-watering, Mississippi River, H. D. 50, 61st, 1st.

Results of, rivers, 97, 1967.

Bacteria. (See Water Supply.)**Balance.**

Tapes, measuring, 93, 1926.

Ballast. (See Cribs; Filling; Gravel; Rock.)

Experiments, cribs, 02, 2546.

Mattresses, 03, 2442.

Space occupied, cribs, 99, 2639.

Weights for, piers, 04, 3802.

Ballast, Concrete.

Banks, 03, S., 309; 04, S., 278.

Cost, 02, S., 155; 04, S., 278.

Making, 01, S., 357; 02, S., 154.

Mattress work, 01, S., 410.

Ballasting. (See Filling; Mattresses.)

Brush and stone dam, 94, 2893.

Cribs, 99, 2634.

Mattresses, 00, 4921.

Ballasts. (See Vessels.)**Bankheads.** (See Missouri River.)

Accretions due to, 98, 3530.

Bank protection, efficiency in, 98, 3472; 99, 3709.

Building, 97, 3919; 98, 3514.

Experiments, 97, 3844.

Remodeling, 99, 3717.

Bankheads—Continued.Successful, **02**, S., 201.

Types, Missouri River, H. D. 1120, 60th, 2d.

Banks. (See Canals; Caving; Dams; Dikes; Embankments; Levees; Mississippi River, Vol. I; Revetment, and Mattresses. See plates.)Abrasions, **75**, II, 498.Angles, erosion, spurs to prevent, **97**, 3818.Building, hurdles for, **98**, 1698.Caving, **75**, II, 519; **00**, 4963; **05**, S., 196; H. D. 50, 60th, 1st.Caving, causes, sand stratas, **00**, 3189.Caving, checking, bayous, **96**, 1498.Caving, data, index to, Mississippi River, **95**, 3705.Caving, falling stages, **72**, 436; **78**, 615.Caving, Memphis, **80**, 1339.Caving, Mississippi River, **75**, 558, 608; **78**, 84; **79**, 976, 979.Caving, peculiar caving, **78**, 730.Caving, preventing, spur dikes for, low cost of, **98**, 3415.Changes in; cultivation, due to, **78**, 846.Concreting, dikes, **10**, 1842.Dams, **68**, 448; **73**, 232.Dams, effect of, **73**, 232.Dams, effect of, rivers, **76**, II, 408.Erosion, preventing, hurdles for, **98**, 1704.Erosion, preventing, spurs for, **97**, 3818.Erosion, preventing, rivers, **98**, 1777.Erosion, protection against, **94**, 2709.

Flood control, H. D. 81, 62d, 1st.

Floods, effect of, **79**, 1011.Garonne River, **72**, 839; **76**, II, 279.Graders, **92**, 3162.

Grading. (See Hydraulic grading.)

Grading, blasting abandoned for, **95**, 3831.Grading, handwork expensive, **95**, 3831.Grading, machines for, **92**, 3162; **05**, S., 213.Grading, Mississippi River, **93**, 3714.Grading, Missouri River, **03**, 2440.Grading, pile driver used for, **99**, 2156.Grading, scraper and floating derrick, **01**, 2225.Grading, water jet, **80**, 1444-1448; **81**, 1502,1611; **82**, 1504, 1576, 1685, 1688, 1691, 1701,1715; **83**, 1228, 1231, 1310, 1315, 1320, 1325,2296; **84**, 2765, 2780, 2799, 2801, 2836; **85**, 2775,2949; **87**, 2915.

Height, Altamaha system, H. D. 443, 62d, 2d.

Height, difference in, rivers, **79**, 1009.Hydraulic grading, **95**, 3774, 3825, 3830; **00**, 4913.Lines of, resurveys of, data, index to, Mississippi River, **95**, 3705.

Movement, canals; Delaware & Chesapeake, H. D. 391, 62d, 2d.

Movement of, checking, lock building, **99**, 3237.Pavements, **93**, 3729.Paving, methods of, **95**, 3774; **00**, 4913.Peculiar caving of, Red River of the North, **78**, 730.Points, holding, plan for, **97**, 3539.Preservation, Fort Riley, **11**, 2020.Protection, **93**, 2161; **00**, 4913.Protection, bankheads, **99**, 3709.Protection, bankheads, efficiency of, **98**, 3472.**Banks—Continued.**Protection, best methods, **97**, 3770.Protection, borings, **94**, 2881.Protection, checking, **01**, 2192.

Protection, costly, Missouri River, H. D. 862, 62d, 2d.

Protection, curtains, **99**, 3706.Protection, curtains, building, **94**, 1597.Protection, dams, above and below, **94**, 2108.Protection, dikes, **99**, 3505.Protection, dikes, building, **96**, 1879.Protection, fascine mats, **94**, 2904.Protection, framed mattresses for, advantages of, **97**, 3799.Protection, gabions, **99**, 3720.Protection, general plans for, Mississippi River, **97**, 3536.Protection, grading for, **94**, 2901, 2885.Protection, groins for, **99**, 3717, 3720.Protection, hydraulic grading, **96**, 3613.Protection, mattresses for, **94**, 1386; **01**, 2212.Protection, mattresses, building, **96**, 1879.Protection, Mississippi River, **96**, 3419, 3439.

Protection, Missouri River, H. D. 50, 61st, 1st.

Protection, paving, **94**, 2902; **93**, 3729; **02**, S., 154; **03**, 2443; **11**, 2003.Protection, pike and brush, rivers, **96**, 1400.Protection, regulation of private dredging, **12**, 2340.Protection, revetment, Mississippi and Missouri River types, **01**, S., 398; H. D. 638, 62d, 2d.

Protection, river and harbor improvements S. D. 301, 61st, 2d.

Protection, riprapping, Missouri River, **10**, 1826.Protection, spur, **99**, 3590.Protection, structures, Mississippi River, **94**, 1594.Protection, temporary expedients, **99**, 2079.Quicksands, effect of, **00**, 2845.Revetment, building, **96**, 3824; **00**, 2870, 3824, 4350.Revetment, mattresses, **97**, 2205.Rivers; dams, effect of, **76**, II, 408.Rivers, rectification, **72**, 839; **76**, II, 279, 285; **78**, 255.Sliding of, preventing difficult, **00**, 2846.Slopes, consistency with river improvements, **76**, 374; **76**, II, 284.

Sloughing, Altamaha system, H. D. 443, 62d, 2d.

Surfaces, protecting, grass and oats for, **98**, 1919.Width of, Mississippi River, **78**, 841, 844, 847.**Banks, Caving.**

Types, Altamaha system, H. D. 443, 62d, 2d.

Banks, Revetted. (See Banks.)Floods, effects, **98**, 1658.**Banks, Soft Sand.**Holding, **98**, 1702.**Banks, Stable.**

Types, Altamaha system, H. D. 443, 62d, 2d.

Banks, Yellow.Protecting, **95**, 2184.**Banquettes.**Levees, **99**, 3575.

Barge Loads.

- Weighing, displacement method, **94**, 2503.
- Weighing, displacement method not satisfactory, **94**, 1392.
- Weight, determining, **99**, 3265.

Barges. (See Boats; Mattresses; Scows; see plates.)

- Building, **96**, 1662.
- Building schooners and; cost, H. D. 391, 62d, 2d.
- Coal transportation, **97**, 3202.
- Commerce by, cheapest, **04**, 1390.
- Concrete ballast, making, **01**, S., 358; **02**, S., 154.
- Concrete, blocks, making, **01**, S., 358.
- Economical, freight, **01**, 1521-1540.
- Mooring, mattress work, **94**, 2899.
- Piping, supporting, dredging, **01**, 1883.
- Self-dumpers, **00**, 4192.
- Steel barges, special, Ohio River, H. D. 492, 60th, 1st.
- Stone, transfer of, **01**, S., 253.
- Tonnage leaving Duluth, H. D., 263, 59th, 1st.
- Towing system, Ohio River, **04**, 2434.
- Traffic of, Great Lakes, H. D. 263, 59th, 1st.

Barges, Stone. (See Barge Loads.)

- Displacement, measuring, **02**, 2511.

Barge Traffic.

- Canals, **96**, 3060.
- Rivers, **96**, 3060.

Barometers.

- Mercurial and aneroid, comparison of, **81**, 451.
- Surveys, use in, P. P. No. 15, C. E.
- Temperature, effect of, **75**, ii, 971.

Barriers. (See plates.)

- Ice, against, **73**, 874, 877.
- Building, mining stream, **05**, 2590.
- Details, river improvements, **04**, 3700; **05**, 2602.
- Inlet wall, rivers, **06**, 2078.
- System, river protection, **07**, 2265.

Bars. (See Channels; Dredging; Gravel; Harbors; Jetties; Piers; Rivers; Shoals.)

- Changes in river mouths, **93**, 3354.
- Channels through, changes in, **94**, 1006, 1271; **96**, 1307.
- Channels through, changes in, dimensions, Mississippi River, **12**, 3839.
- Channels through, changes in, Dohoy Bar, **97**, 1545.
- Channels through, changes in, Ocracoke Inlet, **94**, 1006.
- Channels through, changes in, Pensacola Harbor, **94**, 1271.
- Channels through, dredging, sand movement, obliteration by, **98**, 2891.
- Channels through, obtaining, **96**, 1293; H. D. 287, 62d, 2d.
- Channels through, opening of, desirable methods, **98**, 1391.
- Channels through, scraping of, rake for, **98**, 2877.
- Crest, movement of, Southwest Pass, **99**, 1895.
- Dikes effective, sand bars, **01**, 1661.
- Dredging, effect of, Mersey Bar, England, **00**, 2301.
- Dredging, economical, South Atlantic coast, **01**, 1662.

Bars—Continued.

- Dredging, over rough bars, **03**, 2296.
- Dynamite, effect of, Brunswick Outer Bar, **96**, 1280.
- Dynamite, efficacy of, with jetties and dredging, **01**, 1664.
- Experimental dredging, Mississippi River, **95**, 3623.
- Floods, effect of, **75**, ii, 477, 507; **79**, 1010.
- Floods, effect of, rivers, **79**, 1010.
- Formation, causes of; piers, faulty design of, **98**, 2246; **99**, 2709.
- Formation, causes of, freshets, rivers, **76**, ii, 541.
- Formation, causes of, storms, rivers, **68**, 111; **77**, 967.
- Formation, checking, pier ends, **95**, 3118; **96**, 2933.
- Formation, checking, relocation of, **96**, 2933.
- Formation, Connecticut River, **78**, 267.
- Formation, deltas, **74**, 804; **76**, 449, 458.
- Formation, deposits a cause, behind dams, **11**, 1581.
- Formation, jetties, effect of, **11**, 2611.
- Formation, jetty channels, **99**, 1595.
- Formation, jetty ends, **94**, 2578.
- Formation, Mississippi River, **74**, 804, 863, 865; **75**, 959, 967, 979; **76**, ii, 179; **78**, 842; **79**, 1010, 1892, 1967.
- Formation, Missouri River, H. D. 1287, 61st, 3d.
- Formation, opposing tides, rivers, **74**, ii, 35.
- Formation, retarding, triangular cribs at end of piers, **95**, 3118.
- Formation, rivers, **72**, 108, 132, 139, 142; **74**, 804, 863, 865; **75**, 959, ii, 457, 474, 476, 477, 484, 502, 504; **76**, 449.
- Formation, rivers, mouths of, **66**, iv, 236; **67**, 376; **68**, 111; **70**, 330; **72**, 242, 244; **73**, 335; **74**, 835, 855; **75**, 311, 959, 967, 979; **77**, 431, 967; **78**, 582, 585.
- Formation, Southwest Pass, **99**, 1869.
- Formation, theory of, Great Lakes, **03**, 2084.
- Formation, theory of, Jamaica Bay, H. D. 1506, 60th, 2d.
- Formation, theory of, Mississippi River, **05**, 1641.
- Formation, tidal rivers, **67**, 421.
- Growth of, Beaufort, **94**, 1032.
- Growth of, piers, vicinity of, **93**, 3098; **95**, 3139.
- Growth of, rivers, mouth of, **00**, 2290.
- Growth of, rivers, mouth of, Mississippi River; **68**, 483; **70**, 322; **74**, 835, 855; **75**, ii, 477, 484, **77**, 429, 430.
- Harbor entrances, **97**, 2779.
- High water, effect of, rivers, **72**, 132.
- Holding, willows for, **97**, 2095.
- Hydraulic dredging of, **96**, 1378.
- Improvement of, at intervals, from 1823, St. Johns Bar, Fla., H. D. 611, 61st, 2d.
- Jetties, channels, **95**, 1601. (See Dynamite, above.)
- Jetties, effect of, **93**, 3316; **95**, 1798; **97**, 2016; **00**, 4470; **05**, 802; H. D. 340, 59th, 2d; H. D. 29, 61st, 2d, H. D. 349, 62d, 2d.
- Jetties, not successful solely, South Atlantic coast, **01**, 1662.
- Length of, Mississippi River, **78**, 841.
- Lines of, and revetments, **05**, S., 196.

Bars—Continued.

- Motion wavelike, rivers, **75**, ii, 502, 504, 507; **76**, 449; **79**, 1751, 1757, 1759, 1892, 1967.
Movement of, controlling, river mouths, **96**, 1907.
Movement of, harbors, **96**, 1190.
Movement of, jetties, effect of, **94**, 2568.
Opposing tides, confluence of, **74**, ii, 35.
Origin, Mississippi River, **83**, 2373.
Portable jetties, effect of, **97**, 2016.
Principles of action of natural forces on, **01**, 1667.
Progressive motion, rivers, **75**, ii, 477, 484; **76**, ii, 179, 256, 402.
Rapid forming of; piers, vicinity of, **96**, 3100.
Removing, dredging, successful, Savannah, **09**, 1321.
Removing, fine methods, **01**, 1664.
Removing, Mississippi River, **05**, 1641.
Removing, water jet for, rivers, **68**, 671; **69**, 310; **79**, 383, 384.
Rivers, widths of, increasing, **78**, 842.
Sand spits, effect of, **93**, 3451.
Scraping, channels, **98**, 2977.
Scraping, rake for, **98**, 2977.
Sparring boat over, **68**, 628.
Surveying, **97**, 1638.
Tides, effect of, harbors, **96**, 1190.
Triangular cribs, effect of, **95**, 3118.
Unusual shape of; piers, vicinity of, **93**, 3082.
Vegetation on, starting of, experiments with willows, **98**, 1786.
Volumes of, computing, **95**, 1649.
Wave action, **81**, 676-685; **82**, 685.

Bars, Artificial. (See Rivers.)**Bars, Ocean.**

- Deepening difficult, **01**, 1709.
Dredging successful, **11**, 423.

Bars, Sand.

- Loose are packed natural, **02**, 2502.
Spur dams ineffective, **01**, 1661.

Base Lines. (See Surveys; Triangulation.)

- Coast surveys, **68**, 939.
Galveston, **00**, 2312.
Lakes, **70**, 549.
Lakes, agreement on, **70**, 549.
Lakes, length on, **70**, 544.
Measurements, **86**, 2952; **88**, 1109; **89**, 1592; **90**, 1830, 1836, 1839, 1844, 3403; **91**, 2871; **92**, 1331; **93**, 4360; **95**, 4230; **98**, 1500, 3748; **00**, 2312.
Measurements, apparatus, **98**, 1498; **93**, 1926.
Measurements, apparatus, lake survey, **68**, 939; **78**, 1406.
Measurements, careful measuring, **68**, 138.
Measurements, Chicago base, **78**, 1401.
Measurements, Crystal River, **00**, 2082.
Measurements, data, index to, Mississippi River, **95**, 3703.
Measurements, Galveston, **98**, 1497; **00**, 2312.
Measurements, Jacksonville, **87**, 1227.
Measurements, lake survey, **68**, 941; **71**, 982, 991; **74**, ii, 444; **75**, ii, 901; **77**, 1123.
Measurements, Mackinac, **97**, 4077; **98**, 3747.
Measurements, Mississippi River survey, **78**, 1381.
Measurements, Red River, **93**, 1926.

Base Lines—Continued.

- Measurements, Soo, **93**, 4360.
Steel tape, **87**, 2943, 2952, 3124; 500-f., **95**, 4230.
Tapes, **87**, 3124; **89**, 2759.
Tapes, correction of, **94**, 2729.
Remasuring, Mackinac, **97**, 4077.
Secondary triangulation, Missouri River, **94**, 3113.

Basements.

- Public buildings, **01**, 3806.

Base Rings.

- Leveling, gun carriages, **00**, 977.
Setting, gun carriages, **00**, 935.

Bases.

- Columns, building, **04**, 3860.

Bases, Secondary.

- Index to data, Mississippi River, **95**, 3703.

Basin, Artificial.

- Brownlow weed, rivers, **78**, 640, 654; **79**, 1014, 1054, 1058, 1061, 1070, 1077, 1080, 1088.

Basin, Expansion.

- Breakwater, right type, experiments, Great Lakes, **06**, 1821.
Helpful, Great Lakes, H. D. 62, 59th, 1st.

Basin, Filling.

- Locks, St. Marys, H. D. 716, 61st, 2d.

Basin, Harbor.

- Plans, new harborage, Jamaica Bay, H. D. 1506, 60th, 2d.

Basin, Interior.

- Enlarging, Grand Marais, H. D. 939, 60th, 1st.

Basin, Settling.

- Mining debris, **00**, 5059.

Basin, Ship.

- Details, Stamford, Conn., **08**, 1024.

Basin, Stilling.

- Breakwater, Duluth, H. D. 221, 60th, 1st.

Basin, Tidal.

- Enlarging, Keweenaw Waterway, H. D. 40, 62d, 1st.
Tides, velocity, **73**, 893; **74**, ii, 276, 279; **78**, 558.

Basin, Turning.

- Dimensions, openings, H. D. 317, 61st, 2d.
Practicability of, lieu of wider channels, Milwaukee, H. D. 667, 61st, 2d.

Basins.

- Drainage, California rivers, H. D. 262, 59th, 1st.

Battallon. (See Miscellaneous, p. 2035 of this Index.)**Batteries. (See p. 1793 of this Index.)****Batteries, Barbette.**

- Guns, cover for, **69**, 5.
Unreliable, 1878, **78**, 4.

Batteries, Storage.

- Electric lighting, forts, **98**, 679.

Battlefields.

- Surveys, **74**, ii, 476.

Bayous.

- Mouths of, bank caving, checking, **96**, 1498.

Bays.

- Bottom, ascertaining character, **01**, 2906.
Deposits in, checking, **93**, 3469.

Bays—Continued.

- Entrance channels, Jamaica Bay, H. D. 1506, 60th, 2d.
 Harbor location, Monterey Bay, Cal., H. D. 1084, 61st, 3d.

Beaches. (See Shores.)

- Erosion, effect of jetties on, Bridgeport, Conn. H. D. 89, 62d, 1st.
 Erosion, preventing, Sandy Hook, 82, 403; 95, 995.
 Erosion, progress of, Sandy Hook, 82, 404.
 Erosion, rate of, Cape Cod and vicinity, H. D. 821, 61st, 2d.
 Erosion, stone for preventing, 72, 897.
 Formation of, wave action on, 72, 107; 74, ii, 188.
 Outside lines, deterioration, H. D. 12, 61st, 1st.
 Protecting, 95, 510.
 Protecting, sea wall, effect of, 95, 995.
 Protecting, stone, effect of, 71, 884; 72, 896; 74, ii, 276.
 Sand movement, 02, 2505; H. D. 747, 61st, 2d.
 Storms, effect, H. D. 12, 61st, 1st.

Beach Grass.

- Shore protection, 67, 46; 73, 1098, 1101; 76, 179, 189; 78, 220; 79, 271, 936, 1746.

Beacons. (See plate 71.)**Beams.** (See Ceilings; I-beams. (See plate 12.)

- Ends of, best form, 83, 1486.
 Sand tightening, pile piers, 75, 243; 78, 1213; 79, 1659.
 Setting of, ceilings of batteries, 00, 898.

Beams, Wooden.

- Best form, 83, 1486.
 Revetments, sand tightening of, 75, 243; 78, 1213; 79, 1659.
 Tests, 83, 1486.

Bearings.

- Wear of, dredges; overcoming, 06, 1300.

Bear-trap Gates. (See Gates.)**Bed Rock.** (See Rock.)**Beds.** (See Rivers.)

- Character, bays, 01, 2906.
 River bed, Mississippi River. (See p. 1085 of this Index.)

Bench Marks.

- 02, 1467.
 Allegheny River, 99, 2446.
 Biloxi, Mississippi River, 99, 3486.
 Birmingham Canal, Ala., 99, 1761, 1770.
 Changes in, 00, 1353.
 Charlotte River to Detour, 97, 4119.
 Columbia River, 93, 3398; 95, 3542.
 Cypress Bayou, 93, 2079.
 Detroit River, 96, 2755.
 Great Lakes, list, 03, 2693.
 Kentucky River, 95, 2486.
 Lake Superior and Mississippi River Canal, 96, 2424, 2454.
 Mississippi River, 93, 2235, 3608, 3644; 94, 2758, 2768; 95, 3748; 96, 3522; 97, 3623; 98, 3218; 00, 4726, 4729, 4730, 4734.
 Mississippi River (mouth), 94, 2754.

Bench Marks—Continued.

- Mississippi River, upper, 99, 3393, 3408; 00, 4608.
 Missouri River, 93, 2306, 4089, 4210; 94, 1757, 3091, 3114.
 Monongahela River, 97, 2407; 00, 3231.
 Proper bench marks, necessity for, 71, 728.
 Red River, 93, 1951.
 Sault Ste. Marie and Waikua Bay, 94, 3426.
 Savannah Harbor, 96, 1224.
 Southwest Pass, 99, 1878.
 Stability, 93, 3621.
 Tennessee River, 93, 2366; 96, 1953.
 Warroad River, 01, 2360.
 Washington Monument, 98, 3670.
 West Fork River, 00, 3281.
 White River, 97, 2489.
 Yazoo River, 94, 1499.

Bench Marks, Permanent.

- Form, 98, 1606.
 Kalamazoo River, 98, 2540.
 Levees, 00, 4861.
 Making, 94, 2179.

Bends.

- Depth, effect on, rivers, 79, 1008.
 Protecting, H. D. 962, 60th, 1st.
 Regiment, effect on, 75, 575, ii, 488; 76, 296, ii, 265.
 Revetment, Mississippi River, 07, 2624.
 Rights across should be free to U. S., H. D. 523, 61st, 2d.
 Widths, proper, 05, 1496.

Beton Agglomerate. (See Cement; Concrete.)

- P. P. No. 19, C. E.

Bins. (See Dredges, Stone.)

- Leakage in, preventing, dredges, 93, 1498.

Blackboard.

- Recesses for, etc., forts, 05, 3032, 3033.

Black Powder.

- Composition of, 69, 429.
 Dynamite and explosions of, comparison, 68, 423; 77, 26.
 Nitroglycerin and, comparison, 68, 423, 738; 77, 27.
 Strength unimpaired under water, 73, 728.
 Wreck removing, 73, 728.

Blast Aprons.

- Batteries, 96, 534, 535.

Blasting. (See Channels; Drilling; Explosives;

- Rock; Stumps; Tunnels. See plates.)
 Ahnapee, 76, ii, 347, 357, 360.
 Ashtabula, 70, 179.
 Bank grading, abandoned in, 95, 3831.
 Bars, rivers, 70, 334.
 Batteries, firing, 68, 814; 69, 432.
 Batteries, firing, Hell Gate, 86, 687, 692.
 Batteries, firing, Waddington, 82, 2466.
 Below bottom, Rock Island Rapids, 69, 246, 247.
 Blast, amount of rock removed at, 69, 19.
 Blossom Rock, 68, 883; 69, 485; 70, 510; 71, 927, 933.
 Boston Harbor, 69, 430.

Blasting—Continued.

- Channels, **95**, 1501, 1621; **96**, 2065.
 Channels, examination of, **93**, 1586.
 Chiseling, drilling and, comparison, **79**, 1134.
 Columbia River, **69**, 475.
 Concrete structures, **94**, 477; **02**, 2471.
 Crater blasting, disadvantages of, **79**, 383.
 Crater explosions, preventing, **79**, 1507.
 Definite plane, difficulty of blasting to, **69**, 246.
 Depth of hole, rockwork, **01**, 1433.
 Dredging, aid to, **94**, 1407, 2473.
 Dredging and, hardpan, **95**, 3201.
 Dynamite from submarine mines used, **99**, 1329.
 Eagle Harbor, **76**, ii, 325, 327; **78**, 1134.
 Effect of, record of, **00**, 1731.
 Explosions, deep, **96**, 1932.
 Explosives, **91**, 2796.
 Explosives, arrangement of, **75**, ii, 200.
 Explosives, rock broken and, ratio, **68**, 423, 425; **69**, 19, 248; **71**, 733; **72**, 877; **73**, 935; **74**, ii, 39, 160; **75**, ii, 82; **76**, ii, 326, 545; **77**, 352; **79**, 61, 62, 379, 533, 535, 1135, 1508.
 Fuses for, Hell Gate, **86**, 687.
 Hallets Point, **77**, 228, 235.
 Hardpan, **95**, 3201.
 Harlem River, **76**, 244.
 Hell Gate, **68**, 737, 739; **71**, 724; **74**, ii, 162; **75**, ii, 209; **76**, 241; **86**, 680, 686.
 Holes for, proper depth, **68**, 425; **00**, 1731.
 Jetties and, channel forming, **98**, 1539.
 Lime Point, **69**, 19.
 Loading tube, **93**, 3164.
 Meters, blast, forts, **04**, 3739.
 Mica powder, nitroglycerin and, comparison, **91**, 2796.
 Middle Rock, New Haven, **67**, 451.
 Mud lumps, **70**, 330, 334.
 Powders, trials of, **69**, 424.
 Physical effect of, **77**, 238.
 Rock, **88**, 1120; **93**, 2378, 3164; **95**, 2911; **97**, 1094; **00**, 1731, 3678, 4216.
 Rock Island Rapids, **68**, 423; **76**, 670; **79**, 1135.
 Rock pinnacles under water, **01**, 3483.
 Stumps, **96**, 1622.
 Surface blasts, effect of, **66**, iv, 334; **67**, 451; **68**, 91, 94, 728, 732, 735, 745, 750, 751, 883, 884; **69**, 77; **71**, 924; **72**, 876.
 Surface blasts, inefficiency of, **68**, 728, 751; **69**, 77, 424, 430; **71**, 772, 776; **72**, 864.
 Surface blasts, successful, **79**, 383.
 Tower rock, **68**, 813; **69**, 423, 433.
 Tunnels, **76**, ii, 124.
 Water column displaced by, height of, **79**, 1508.

Blasting, Rock.

- 88**, 1120; **93**, 2378, 3164; **94**, 1846, 2572; **95**, 2911; **96**, 2065; **97**, 3721; **00**, 1731, 3678, 4216; **01**, 1427.
 Blast, amount removed at a, **69**, 19.
 Bottom below, Rock Island Rapids, **69**, 246, 257.
 Bronx River, **97**, 1094.
 Crater blasting, disadvantages of, **79**, 383.
 Explosions, crater, preventing, **79**, 1507.
 Dynamite, **75**, ii, 695.

Blasting, Rock—Continued.

- Dynamite, from submarine mines, Philadelphia Harbor, **99**, 1329.
 Dynamite, small charges, **96**, 471.
 Effect of, record of, **00**, 1731.
 Electric batteries, formula for, **77**, 236, 239.
 Electric batteries, use of, **68**, 814; **69**, 432; **75**, ii, 695.
 Explosions, deep, **96**, 1932.
 Explosives, ratio of, **80**, 500; **81**, 864; **83**, 541; **86**, 685.
 Explosives, small charges, **95**, 925.
 Firing, method, batteries, **68**, 814; **69**, 432.
 Holes, depths, proper, **00**, 1731.
 Loading tube, **93**, 3164.
 Plane, definite, difficulty of blasting to, **69**, 246.
 Powder and depth of hole, relation of, **68**, 425.
 Powders, various, trials of, **69**, 424.
 Rock, broken, explosives and, ratio, **68**, 423, 425; **69**, 19, 248; **71**, 733; **72**, 877; **73**, 935; **74**, ii, 39, 160; **75**, ii, 82; **76**, ii, 326, 545; **77**, 352; **79**, 61, 62, 379, 533, 1135, 1508; **80**, 500; **81**, 864; **83**, 541; **86**, 685.
 Surface blasts, effect of, **66**, iv, 334; **67**, 451; **68**, 91, 94, 728, 732, 735, 745, 750, 751, 883, 884; **69**, 77; **71**, 924; **72**, 876.
 Surface blasts, inefficiency of, **68**, 728, 751; **69**, 77, 424, 430; **71**, 772, 776; **72**, 864.
 Surface blasts, successful, Hallets Point, **79**, 383.
 Tamping, **69**, 433.
 Tower Rock, results, **69**, 423.

Blasts, Surface.

- Effect of, rock blasting, **71**, 924.
 Rock, effect on, **66**, iv, 334; **67**, 451; **68**, 91, 94, 728, 732, 735, 745, 750, 751, 883, 884; **69**, 77; **71**, 924; **72**, 876.
 Rock, insufficient effect on, **68**, 728, 751; **69**, 77, 424, 430; **71**, 776; **72**, 864.
 Rock, removing, **79**, 383.

Blocks, Concrete.

- Alternate monolithic blocks, piers, **01**, 2832.
 Arrangement, piers, **04**, 3802.
 Breakwaters, **11**, 2260.
 Cutwaters, piers, **01**, 2832.
 Revetment of, **02**, 1106.
 Stone, replacing, revetments, **02**, 1107.

Blocks, Cubical.

- Overturning difficult, rockworks, **01**, 2884.

Blocks, Facing.

- Displacing of, by storms, **01**, 3318.

Blocks, Footing.

- Piers, **98**, 2226, 01, 2832.

Blue-Print Paper.

- Willetts Point paper best in Philippines, **00**, 5446.

Bluffs.

- Course of Missouri River between, H. D. 1120, 60th, 2d.

Boat Railway.

- Appliances, **94**, 2675.

Boat Railway—Continued.

Columbia River, 94, 2668.

Defects, 01, 3524.

Planning, 95, 3590.

Boat Yard.

Plan of, Missouri River, 93, 4259.

Boats. (See Canals; Dredges; Dry Docks; Ice Boats; Quarter Boats; Snag Boats; Steamboats; Towboats; Vessels. See plate 59.)

Building plants, U. S. Engineer Department 12, 2883.

Canal tunnel sections, effect on, 76, ii, 80.

Dimensions of, canal and, relation, 74, 534, 535; ii, 118.

Grounding of, overloading a cause, 99, 3037.

Hyacinth crushing, 01, 341, 395.

Ohio River types, 79, 1369.

Those of Great Lakes not adapted to river traffic, H. D. 50, 61st, 1st.

Types for river traffic, 10, 2976, H. D. 443, 62d, 2d.

Velocity of, canal tunnels, 77, 685, 689, 700.

Board of Engineers. (See p. 2039 of this Index.)**Boards.**

Local boards for levees, 06, 2569.

Boats, Gasoline.

Snag removal made necessary by, 11, 34.

Boats, Maneuvering.

Bridge better than, weirs, or needle dams, 05, 539.

Boats, Moving.

Resistance to, 74, 534; 77, 689, 692.

Resistance to, formula, 78, 383, 532.

Boats, Overloaded. (See Boats.)**Boats, Quarter.**

Survey parties, 97, 2338.

Boats, Steam Canal.

97, 3204.

Boats, Torpedo.

Seacoast defense, 81, 410.

Bolts. (See Driftbolts.)

Advantages of, cribs, 96, 2578.

Cribs, 76, ii, 538.

Cribs, direction in, 69, 154.

Cribs, size in, 68, 210, 239.

Fastenings, cribs, 94, 2411.

Holding power of, concrete mortar, 95, 2940.

Holding power of, cribs, 76, ii, 538.

Miter sills, locks, 00, 2926.

Setting, concrete, 94, 453.

Bolts, Anchor.

Setting, concrete, 02, 2479.

Bolts, Patch.

Piers, 01, 2850.

Bolts, Screw.

Best form, 84, 1643; 85, 1758.

Bonding.

Rockwork, 04, 3830.

Booms. (See Rafting.)

Rafting, 00, 3346.

Rapids, lining over, 96, 3381.

Booms, Rafting.

Maintenance, rules, 00, 3346.

Booms, Sheer.

Bridge piers, 75, ii, 683; 77, 817; 78, 710, 972, 982, 986, 990, 1002, 1005, 1009, 1018.

Bridge piers, protecting, Rock Island Bridge, 78, 710; 79, 1144.

Bridges, 75, ii, 683; 77, 817; 78, 710, 972, 982, 986, 990, 1002, 1005, 1009, 1018.

Efficiency of, 79, 1145.

Operation, difficulties of, 79, 1146.

Plan and section, 78, 710.

Vessels, protecting, from ice, 78, 828; 79, 1363.

Booths. (See Forts, etc., p. 1797 of this Index.)**Booths, Telephone.** (See Telephones.)**Booths, Telautograph.**

03, 2424.

Borings. (See Ice; Locks; Rock.)

69, 254; 72, 218; 78, 546; 88, 1145; 89, 1410; 90, 765, 1416, 3379; 92, 2379; 93, 2075; 97, 1544; 98, 2540; 00, 1759, 2559.

Bank protection, 94, 2881.

Bridge sites, 96, 3901; 98, 3576, 3601.

Cleveland Harbor, 75, 304, 309.

Connecticut River, 74, ii, 256; 78, 303.

Dams, details, 01, 2758.

Data relating to, index to, Mississippi River, 95, 3705.

Drill borings, water jet and, 99, 1709.

Force pumps used, 75, 235; 01, 1719.

Foundations, batteries, 96, 503.

Illinois and Mississippi Canal, 94, 2179.

Illinois River, 69, 254.

Kalamazoo River, 98, 2540.

Lakes, 72, 175, 218; 74, 233; 75, 304, 309.

Locks, 00, 2179.

Locks and canals, 11, 2217.

Methods, rivers, H. D. 50, 60th, 1st.

Methods, Presler, Crawler Co., solid cores, 03, 1713.

Mississippi survey, 77, 1198; 78, 856; 79, 1924.

Missouri Valley, 90, 3376, 3390.

Peculiarities of, 00, 1760.

Pipes used, 94, 1493.

Ranges, locating, H. D. 50, 61st, 1st.

Rapid currents, 93, 3162.

Recovering lost piping, 01, 1834.

Red River, 95, 1872.

Steam piping used, 99, 1709.

Strata passed, artesian wells, S. C., 96, 504.

Tennessee River, 99, 2276.

Water jet for, 81, 2049; 84, 617; 00, 2769; 01, 1102, 1304, 1828, 1833.

Yazoo River mouth, 94, 1503.

Yuba River, 00, 5037.

Borings, Test.

Locks and dams, H. D. 231, 58th, 3d.

Machine for, 04, 2938.

Methods, H. D. 263, 59th, 1st.

Borrow Pits.

Draining, simple method, 01, S., 291.

Boston.

Foreign trade growth due to improvements, 08, 956.

Bottoms.

Plan, soft bottom, 87, 970.

Tester, 88, 931.

Wave action, 72, 107.

Boule Dam. (See Dams.)**Bowlders.**Dredging, **00**, 4044.Natural deposits of, protection against scour, **71**, 884; **72**, 896; **74**, ii, 276.Presence of, remarkable, **00**, 4044.Removing, Taunton River, **70**, 465; **74**, ii, 222.**Boxes, Horse.**Breakage, movable dams, **11**, 2141.**Braces, Sway.**Tramway, **94**, 2564.**Bracing.** (See Dikes.)Dikes, **94**, 1598; **95**, 4003; **97**, 3896; **98**, 3499.System, dikes, **03**, 2438.**Brass.**Expansion, rate of, **71**, 1006; **72**, 1046.Tapes of, tests, **93**, 1926.**Breaches.** (See Breakwaters.)Repairing, breakwaters, **95**, 2793, 3216.Repairing, piers, **95**, 2800.**Breaks.** (See Levees.)**Breakwaters.** (See Concrete; Cribs; Harbors; Piers; Piles; Riprap; Rubblestone; Stone; Timber. See plates)Absorption of, by advancing shore lines, **94**, 2474.Alignment of, remarkable, **00**, 4134.Artificial stone for, **67**, 516; **70**, 457; **73**, 1125.Bar Harbor, **87**, 483.Barnstable Bay, **70**, 488.Best slopes for, **98**, 2284; **99**, 2718.Best top for, **84**, 573.Block Island, **72**, 821, 824; **74**, ii, 242; **85**, 612.Breaches in, repairing, **95**, 3216.Breaches in, sanitary conditions improved by, **93**, 3155.Bridgeport, **71**, 793.Buffalo, **68**, 232; **75**, 306; **78**, 1269; **87**, 2356.Building, **93**, 677, 3255.Building, Delaware Bay, **99**, 1346.Building, Sandy Bay, **93**, 749.Building, work of, laying out, **98**, 3765.Burlington, Vt., **68**, 296.Buttress cribs for, Cleveland Harbor, **99**, 3062.Calais, **82**, 486.Cape Cod, **70**, 488, 489.Cape Foulweather, Cal., **79**, 1798, 1801.Capping for, laying, **00**, 4116.Cherbourg, **72**, 754; **73**, 1124.Chicago, **78**, 1184; **81**, 2153, 2158, 2164.Cleveland, **74**, 234; **75**, 303, 310; **78**, 1262; **80**, 2142, 2145.Columbia River, **80**, 2319, 2320.Concrete, **67**, 516; **70**, 457; **71**, 871; **73**, 1125; **79**, 255, 1798; **81**, 2650, 2674; **82**, 2270; **87**, 483, 504, 2353, 2364.Concrete, blocks of, **67**, 516; **70**, 457; **73**, 1125; **79**, 258, 1798; **00**, 4068.Concrete, blocks of, behavior of, **97**, 2622.Concrete, blocks of, filling molds, **10**, 2058.Concrete, blocks of, foundations of, concrete in bags for, **97**, 2619.Concrete, blocks of, laying, **98**, 2676; **00**, 4068.Concrete, blocks of, movement of, wave action, **93**, 3209.**Breakwaters—Continued.**Concrete, blocks of, setting, **00**, 4108.Concrete, economy of, **00**, 4151.Concrete, endurance of, **93**, 3212.Concrete, failure of, **81**, 2674.Concrete, formula for, simple, **00**, 4066.Concrete, molding and molds, **00**, 4134.Concrete, placing, **91**, 1080; **00**, 4066, 4128.Concrete, steel-caisson type, Algoma, Wis., **08**, 1954.Concrete, superstructures of, **82**, 793, 2270; **86**, 119; **87**, 483, 504, 2060, 2069, 2111, 2353, 2363; **98**, 2676; **00**, 4125.Concrete, superstructures of, advantages of, **95**, 3138.Concrete, superstructures of, building, **96**, 2365-2385; **97**, 3080; **98**, 2753; **00**, 4125.Concrete, superstructures of, building, Cleveland, **99**, 3057.Concrete, superstructures of, failure of, **81**, 2674.Concrete, superstructures of, repairing, **00**, 4102.

Concrete, superstructures of, rubblestone

hearting, Dunkirk, **99**, 3098.Concrete, superstructures of, sections, **98**, 2676.

Breakwaters—Continued.

Designing, 93, 3202.
 Designing, Cape Canaveral, 95, 1606.
 Designing, Cape Lookout, 97, 1430.
 Designing, Pacific coasts, H. D. 557, 59th, 1st;
 H. D. 407, 59th, 2d.
 Deterioration, preventing, sheathing for, 00,
 4075, 4092.
 Dover, 68, 888; 72, 754; 73, 1126.
 Duck Island, Conn., 87, 642, 644.
 Early repair important, 95, 3101.
 Ends of, strengthening, 93, 2803.
 Excavating for, clam-shell dredge, Buffalo
 Harbor, 99, 3108.
 Expansion basins, Great Lakes, 06, 1821.
 Extending, 98, 2754.
 Extension, 03, 2081; 04, 1222; 09, 1919; H. D.
 573, 61st, 2d.
 Extension, settlement, 04, 3184.
 Facing blocks, 01, 3318.
 Factors favoring, New York Harbor, H. D.
 205, 61st, 2d.
 Footing blocks, 10, 2058, 2088.
 Forms, various, 04, 3819.
 Foundations, 73, 353; 75, 57, 305; 78, 1269;
 00, 4090; 09, 1919.
 Foundations, borings for, 97, 3289; 97, 3247.
 Foundations, Cleveland Harbor, 75, 306, 309;
 99, 3058.
 Foundations, concrete, 98, 2752.
 Foundations, concrete, placing, 96, 2369.
 Foundations, designing, 93, 3202.
 Foundations, excavating, 98, 2752; 00, 4120.
 General facts relating to, 67, 516; 75, ii, 422.
 Gloucester, Mass., 71, 871, 873; 87, 504.
 Great Lakes, 04, 3818.
 Harbors at, 98, 2725.
 Harbors at, entrances of, covering, 74, 235;
 09, 1966.
 Heads, concrete, 11, 2259.
 Holyhead, 73, 1126.
 Honolulu, 08, 2316.
 Hyannis, Mass., 70, 460; 71, 895; 72, 952; 73,
 947.
 Ice coating, 96, 2384.
 Ice pressure, H. D. 575, 61st, 2d.
 Injury of, ice action, 87, 2352.
 Injury of, ice action, protection against, iron
 sheathing for, 73, 294, 296; 74, 210, ii, 135;
 75, 320.
 Injury of, storm action, 88, 2279; 99, 3059.
 Jetty and, channel deepening, 96, 574.
 Jetty and, harbor formation, H. D. 1067, 61st,
 3d.
 Harbor of Refuge, Lake Huron, 73, 293, 294,
 295, 296; 77, 927.
 Kind and location, factors, 01, 2902.
 Large stones in, Delaware Breakwater, 93,
 3260.
 Lava stone for, Hawaii, H. D. 407, 59th, 2d.
 Lighting of, 95, 2780.
 Light structures, futility, 09, 73.
 Low breakwaters, efficiency of, 75, 277.
 Mackinac, 80, 2055.
 Maintaining, 93, 3255.
 Manra, East Indies, 81, 1064.
 Marking of, lightship for, Milwaukee, 99, 2768.

Breakwaters—Continued.

Materials for, measuring, 98, 2766
 Materials for, placing, 98, 2766.
 Milwaukee, Wis., 81, 2118.
 Monterey, Cal., 75, ii, 708.
 Mooring rings, 73, 294; 74, 210.
 Mooseabec, Me., 86, 534.
 Natural slopes, 99, 1350.
 Necessity for, lakes, 00, 3773.
 New Haven, 75, ii, 251; 80, 455; 81, 595.
 Newport, 71, 782.
 Old superstructure, removing, 00, 4127.
 Old works, removing, 98, 2676.
 Openings through, currents induced by, 98,
 2602.
 Oswego, 74, 265; 75, 346; 80, 2, 13, 2215, 2217.
 Pacific coast, 77, 1051.
 Parallel system, modification, 01, 3265.
 Piling and slabs in, maintenance expensive,
 94, 2024.
 Plan and section, Sandy Bay, 02, 854.
 Plans of, outlining on ice, 99, 3065, 3068, 3071.
 Plymouth, 67, 516; 68, 888; 73, 754; 73, 884.
 Point Sal, Cal., 68, 888.
 Port Jefferson Harbor, 71, 809.
 Portland, Me., 66, iv, 39, 185.
 Port Orford, Oreg., 73, 1123; 79, 1804; 81, 2648,
 2694.
 Portsmouth, 80, 342; 81, 500.
 Property saved by, Great Lakes, 06, 569.
 Railroad extension due to, Hawaii I., H. D.
 417, 62d, 2d.
 Reaction, breakwater, theory defective, 01,
 1699.
 Reinforcing, 03, 2080.
 Repairing, concrete molds, 00, 4134.
 Repairing, cost, 05, 2344.
 Repairing, factors, determining, 04, 3365.
 Repairing, Oswego Harbor, 99, 3142.
 Revetment, placing, 00, 4117.
 Richmond Island, Me., 81, 490.
 Riprap slopes, 92, 933, 934.
 Rock instead of wood in, advantages, 93, 3202.
 Rockland, Me., 81, 464, 466; 82, 492.
 Rouse Point, N. Y., 85, 2298, 2299, 2301.
 Rubble mound finish, 12, 2466.
 Rubble mounds in, building, 98, 2767.
 Saco River, Me., 66, iv, 189; 72, 936.
 San Buenaventura, Cal., 79, 1771.
 Sand movement, governing, H. D. 911, 60th,
 1st.
 Sandy Bay, 84, 571; 86, 582.
 San Luis Obispo, Cal., 79, 1767; 81, 2526; 87,
 2434.
 Santa Cruz, Cal., 71, 918.
 Scituate, Mass., 81, 522.
 Scour at, Delaware Bay, 99, 1345.
 Seas, breaking of, controlling, 98, 2720.
 Seaward, ends, cribs for, 09, 1905.
 Settlement, 08, 1917.
 Settlement, rebuilding on, 04, 3254.
 Sheathing, 97, 3080; 00, 4068, 4075, 4092.
 Shifting of, Pacific coast, 98, 2933.
 Shoaling at, Delaware Bay, 99, 1353.
 Shore connection advisable, H. D. 969, 60th,
 1st.
 Shores and, gaps between, closing, 97, 2690.

Breakwaters—Continued.

- Sites, proper, **93**, 3251.
- Sliding, calculations, **H. D. 573**, 61st, 2d.
- Slopes, **66**, 40; **67**, 518; **76**, 488; **71**, 827; **72**, 168; **73**, 884, 1124; **74**, ii, 180, 181, 242; **76**, ii, 596, 598; **79**, 295, 1767; **96**, 2365.
- Slopes, discussion of, **84**, 573.
- Slopes, seas, effect on, **98**, 2665.
- Slopes, wave developed, **84**, 572, 573.
- Slopes, wave movement over, Marquette Bay, **98**, 2284.
- Slopes, waves, effect of, **96**, 2375.
- Spur cribs, Oswego, **84**, 2148, 2150.
- Spurs, effect of, **96**, 3154.
- Soundings for, catamaran employed, **00**, 4134.
- Southport Harbor, **71**, 824; **79**, 355.
- Stability, cross section for, **04**, 3185.
- Stability, computations, **H. D. 573**, 61st, 2d.
- Stone for, capping, **00**, 4116.
- Stone for, depositing, trestle, advantages of, **93**, 3227, 3260.
- Stone for, setting, **00**, 4134.
- Stone for, sizes, **67**, 516; **70**, 452; **71**, 741; **72**, 166, 918; **73**, 884, 948; **79**, 1767.
- Stone for, superstructure, sections, **97**, 3298.
- Stone for, volume of, and space filled by, ratio, **86**, 340.
- Stonington Harbor, **72**, 918, 920; **74**, ii, 246; **75**, ii, 247; **79**, 328.
- Storm, test of superstructure, **09**, 53.
- Strengthening, **09**, 1918.
- Substructure, Delaware Bay, **99**, 1350, 1351.
- Substructure, examining, pole for, **12**, 2466.
- Substructure, improved form, **04**, 3186.
- Substructure, walls of, parting, Oswego, N. Y., **99**, 3140.
- Suitable section, Milwaukee Harbor, **94**, 2083.
- Superstructure of, **96**, 2770.
- Superstructure of, concrete, **04**, 3818; **10**, 2058.
- Superstructure of, Delaware Bay, **99**, 1350, 1351.
- Superstructure of, designing, Cleveland Harbor, **94**, 2412.
- Superstructure of, sections of, **00**, 4068.
- Superstructure of, sheathing, **00**, 4068.
- Superstructure of, timber; replaced with concrete, **01**, 3314.
- Superstructure of, timber; replaced with stone, **H. D. 240**, 59th, 1st.
- Superstructure of, various views, **04**, 3186.
- Tight decking, importance of, **80**, 2215; **84**, 2144.
- Time, effect of, **H. D. 240**, 59th, 1st.
- Toes of, concrete blocks for, preferred to concrete in situ, **97**, 2616.
- Trinidad, Cal., **73**, 1147.
- Types of, **92**, 563, 564, 1078; **97**, 3249.
- Types of, advantageous, **93**, 3202; **00**, 4087.
- Types of, cross sections, **93**, 3208.
- Types of, economical, **00**, 4055.
- Types of, Great Lakes, **03**, 2080.
- Types of, various, estimates for, **H. D. 573**, 61st, 2d.
- Value, Gulf ports, **03**, 1348.
- Vessel entrance, aid to, **03**, 2084; **H. D. 573**, 61st, 2d.
- Vicinity of, accretions, **93**, 2743; **96**, 3140.

Breakwaters—Continued.

- Vineyard Haven, **87**, 577, 580.
- Water telescope, underwater views, **01**, 3318.
- Waves, force of, **71**, 827; **74**, ii, 242; **84**, 573.
- Westport, R. I., **71**, 802.
- Wilmington, Cal., **72**, 1007.

Breakwaters, Auxiliary.

- Advantages of, ports, **03**, 2084.

Breakwater, Concrete. (See above.)

- Building, **98**, 2254; **00**, 4068.
- Concrete foot blocks, **97**, 2626.
- Cost, items, **96**, 2376, **97**, 2637.
- Endurance, **93**, 3212.
- Foundations, **98**, 2752.
- Ice, effect of, **97**, 2626; **98**, 2256.
- Placing in, **91**, 1080, 4128.
- Plan, Marquette, **97**, 2626.
- Sections, **96**, 2365.
- Tests, storms, **97**, 2622.

Breakwaters, Crib.

- 98**, 2770; **00**, 3696
- Aprons for, advantages, **00**, 4071.
- Breaches in, effect of, **96**, 3155.
- Building of, **98**, 2680, 2752, 2770.
- Building of, dovetailing, abandoned, **98**, 2664.
- Building of, inspection, **98**, 2771.
- Building of, methods, **98**, 2684.
- Building of, regulations, **98**, 2771.
- Concrete covering, **98**, 2752.
- Corner posts, advantages of, **94**, 2412.
- Cross sections, **97**, 3106.
- Deficient strength, Oswego Harbor, **99**, 3140.
- Designs, **98**, 2770.
- Designs, improved, **98**, 2680.
- Foundations, excavating, **00**, 4120.
- Old work, condition of, **98**, 2663; **04**, 3818.
- Repair and renewal, methods, **98**, 2662.
- Repair, concrete blocks for, **94**, 2483.
- Repairing, **00**, 4172; **11**, 2284.
- Stone and, stone preferable, **00**, 4084.
- Superstructures, placing, **00**, 4134.
- Tests of, storms, **00**, 4123.
- Trench for, filling, **98**, 2769.
- Trench for, making, **98**, 2769.
- Undermining, **11**, 2284, 2285.

Breakwaters, Crib and Concrete.

- Building of, **00**, 4068.
- Cross sections, **97**, 3106.
- Designing, **97**, 3247.
- Economy of, **00**, 4151.

Breakwaters, Crib and Stone.

- Designs, improved, **96**, 2663.
- Openings in, cutting, methods, **96**, 2940.

Breakwaters, Detached.

- Concrete and timber, **04**, 3818.
- Harbor protection, **99**, 2813, 2818.
- Shore connection recommended, **H. D. 690**, 62d, 2d.
- Timber crib, **04**, 3818.

Breakwaters, European.

- 82**, 486; **87**, 2364.

Breakwaters, Famous.

- Details, **04**, 3818.
- Statistics, **04**, 3818.

Breakwaters, Floating.

93, 3248.

Breakwaters, Foreign.

90, 896.

Breakwaters, Great Lakes.

Comparison with other breakwaters, 04, 3818.

Breakwaters, Indestructible.

Making, Buffalo, H. D. 240, 59th, 1st.

Breakwaters, Low.

Efficiency, 75, 277.

Breakwaters, Old.

Condition of timber, etc., 01, 1072.

Superstructure, concrete shell, 04, 3818.

Breakwaters, Pile.

Fort Brown, Tex., 78, 619.

Breakwaters, Pile and Slab.

Maintenance expensive, 99, 2703.

Reinforcing, 05, 1992.

Breakwaters, Rubblestone.

Building, methods, 98, 2760.

Cross section, Great Lakes, 04, 3172.

Sorted rubble, 04, 3818.

Superstructure, below low water, 04, 3818.

Type proposed, Duluth, H. D. 82, 59th, 2d.

Breakwaters, Stone.

Construction views, 01, 3318.

Breakwaters, Stone and Crib.

Comparison, first preferred, 00, 4084.

Breakwaters, Timber.

Decay of, elements of, 00, 4075.

Decay, preventing, sheathing for, 00, 4092.

Designs, 98, 2665.

Foundations, cross sections, 00, 4090.

Repairing, concrete blocks for, 98, 2676.

Waterproofing, 98, 2664.

Breakwaters, Timber Crib.

04, 3818.

Building, 98, 2763.

Buffalo, 04, 3818.

Erie, Pa., 04, 3818.

Superstructure, concrete, 04, 3818.

Bricks.

Bonding imperative, 04, 3830.

Details of laying, 04, 3831.

Efflorescence, paraffin for, 04, 3831.

Floors, 04, 3832.

Joints, finishing, 04, 3866.

Locks, 81, 1312; 95, 2932.

Mortar, 04, 3831.

Tests, 95, 2912, 2932.

Tiling, better than, fireproofing, 04, 3837.

Waterproofing, paraffin for, 04, 3832.

Bricks, Enamel.

Not advisable for interiors, 04, 3830.

Bricks, Hollow.

Linings, concrete forts. (See p. 1797 of this Index.)

Bricks, Porous.

Tests, and costs, 04, 3718.

Brickwork. (See above.)

Cleaning, 04, 3853.

Cost, etc., 04, 3850.

Bridges. (See Aqueducts; Canals; Piers; Pontoon; Railroads; Steel; see also p. 2137 of this Index; see plates.)

Abutments, sand and gravel for, working of, 00, 5444.

Accidents to, difficult to fix blame, 07, 1820.

Allegheny River, 94, 1917; 95, 2409; 96, 2199; 97, 2427.

Authority of Congress over, not definite, 03, 1690, 1694.

Boule gates, 03, 1922.

Brazos River, 95, 1833.

Building, 96, 2115.

Canals, over, 95, 2760, 2768; H. D. 391, 62d, 2d.

Cement for, 02, 2670.

Changes required; factors, 04, 2437.

Changes, authorized to require, 04, 2439.

Chicago River, 93, 2807.

Closing of, temporary, 95, 1214.

Collisions with, losses from, 82, 1925; 96, 2071; 06, 1557; 07, 1667.

Collisions with, losses from, Ohio River, 97, 2333; 11, 2089.

Commerce retarded by, Chicago River, 11, 2352.

Concrete abutments, building, 00, 5444.

Construction, details, 02, 2674.

Decay of; oak wedges, effect of, 78, 964.

Delays; need of regulation, Chicago River, 11, 2351.

Designing, material, consideration of, 98, 3602.

Designing, points important, 98, 3597, 3602.

Designs, 98, 3597.

Designs, Memorial Bridge, 00, 5134.

Designs, Potomac River, D. C., 86, 897.

Dimensions of, regulation, bill for, 00, 5117.

Dimensions proper, H. D. 700, 59th, 1st.

Draws of, dimensions, proper, 95, 734.

Draws of, location of, 70, 230, 245; 72, 289.

Draws of, passing, methods of coal-fleets, 76, ii, 303.

Draws of, novel, Philadelphia, 71, 710.

Draws of, opening of, frequency of, Chicago, 74, 601, 607, 617.

Draws of, operating, Ohio River, 95, 2333.

Draws of, operating, Rock Island, 72, 289, 291.

Draws of, Rock Island, 70, 245; 72, 289, 293.

Draws of, signal lights on, Rock Island, 73, 415; 78, 723.

Draws of, signals at, 73, 415; 78, 723.

Draws of, spans, Chicago River, 74, 585.

Draws of, weight of, 70, 245.

Draws of, widths of, proper, 68, 383.

Dubuque Railroad, 78, 984.

East River, 95, 933; 96, 856.

Elk River, 95, 2461.

Engineer Troops, 02, 816.

Estimates for, H. D. 263, 59th, 1st.

Flood control. H. D. 81, 62d, 1st.

Floor system, 02, 2658.

Fort Washaki Road, 99, 3900.

Foundations, bedrock, depths to, Mississippi River, 78, 918, 1059.

Grades, effect of, 79, 1461.

Harlem River, 94, 744; 95, 920; 96, 842.

Bridges—Continued.

Height of, navigation, required for, **69**, 395, 401; **74**, 603, 627, 641, 648; **ii**, 654; **75**, **ii**, 681; **76**, **ii**, 302; **78**, 907, 928, 934, 1054.
Hudson River, **96**, 828.
Inlet, type of, **09**, 2357.
Ironwork, strength of, Rock Island, **72**, 286, 291.
Laws relating to, effect of, **82**, 2008.
Legislation concerning, **69**, 309; **71**, 219, 426, 435, 455; **72**, 404, 440; **73**, 561, 570.
Loads on, **69**, 195; **70**, 245, 251, 263; **72**, 286, 291; **77**, 1099; **02**, 2678.
Location of, proper, **68**, 316; **70**, 230.
Many, over Passaic River, H. D. 707, 62d, 2d; H. D. 722, 62d, 2d.
Material in, weight of, **72**, 294.
Material in, various, consideration of, **98**, 3597; **02**, 2670.
Measurements of, Missouri River, **93**, 3944.
Missouri River, **94**, 3108; **96**, 3804; **97**, 3893.
Monongahela River, **95**, 2399; **96**, 2137; **97**, 2407; **98**, 2200.
Muskungum River, **95**, 2375.
Navigable waters, over, **80**, 1849; **81**, 2009; **82**, 1979; **83**, 1591; **84**, 1769; **85**, 1917; **86**, 2111; **87**, 2613.
Navigation, obstructions to, **68**, 717, 822; **69**, 306; **71**, 407, 411, 414, 429, 713; **76**, **ii**, 306; **77**, 646; **78**, 1038, 1054.
Neosho River, **97**, 1986.
Newton Creek, **95**, 938.
Oakland Harbor, **00**, 4219.
Ohio River, **93**, 2465; **00**, 3099.
Obstruction, rivers, **97**, 2796.
Piers, closeness, effect of, **95**, 734.
Piers, concrete in, **96**, 2115.
Piers, cross section occupied by, Ohio River, **71**, 403, 410, 413, 416, 421, 433, 443.
Piers, currents, deflection of, **95**, 734.
Piers, currents, should be parallel to, **68**, 381; **69**, 196.
Piers, examination, **95**, 4085; **96**, 3887.
Piers, foundations, insecure, Potomac River, **96**, 3887.
Piers, protecting, sheer booms for, **78**, 710; **79**, 1144.
Piers, rapid currents, effect on, **95**, 734.
Piers, reconstruction, D. C., **08**, 2346.
Piers, reinforcing with concrete, **10**, 2624.
Piers, repairs, **95**, 4090; **10**, 2623, 2624.
Piers, riprap about, objection to, **75**, **ii**, 687.
Piers, rivers, closing of, with ice, **71**, 716.
Piers, Rock Island, **69**, 195.
Piers, sheer booms at, **75**, **ii**, 683; **77**, 817; **78**, 710, 972, 982, 986, 990, 1002, 1005, 1009, 1018.
Piers, tides, obstruction to, **68**, 717; **69**, 383; **74**, **ii**, 156, 234.
Piers, timber rafts, effect on, **77**, 820; **78**, 931.
Plans, Anacostia River, **96**, 3895.
Propelling system, cars, **02**, 2659.
Railroads, conditions of, use by, **02**, 2654.
Regulations, Duluth, **08**, 1903; **10**, 2061.
Repairing; bridge closing, Potomac River, **95**, 1214.
Requirements for, Detroit River, **74**, 603, 627.
Requirements for, tidal rivers, **96**, 987.

Bridges—Continued.

Rivers, improvement of, where many bridges, H. D. 643, 61st, 2d.
Rivers, navigable, general consideration, **68**, 50, 315, 316, 385; **70**, 67, 261; **71**, 61, 397, 431; **72**, 440; **74**, 583, 636; **75**, **ii**, 677; **76**, 92, **ii**, 260, 298, 299, 306; **77**, 817; **78**, 110, 721, 891, 1038, 1054, 1058, 1078; **79**, 1461.
Roads, **03**, 2456.
Sheer booms at, **75**, **ii**, 683; **77**, 817; **78**, 710, 972, 982, 986, 990, 1002, 1005, 1009, 1018.
Signals and lights, **73**, 415; **78**, 723.
Sill under opening, to direct channel, **11**, 1582.
Sites, borings, Anacostia River, **98**, 3601.
Spans; dimensions required; rafts, passage of, **77**, 820; **78**, 931.
Spans, practical limits of, **71**, 432; **78**, 905, 1019, 1069.
Spans, Rock Island, **69**, 197; **70**, 231, 258; **71**, 301; **72**, 287.
Spans, various, lengths of, **69**, 197; **70**, 231; **72**, 286; **78**, 905, 1019, 1020, 1046, 1062, 1069.
Specifications, **02**, 2666, 2674.
Stone arches, plans, **98**, 3606.
Surveys, Anacostia River, **96**, 3890.
Surveys, borings, **98**, 3576.
Surveys, borings, Anacostia River, **96**, 3901.
Tennessee River, **96**, 1924.
Tidal, flow at, **74**, **ii**, 234.
Trinity River, **96**, 1554.
Trusses, arched, **75**, **ii**, 680.
Trusses, loads on, Rock Island, **69**, 195; **70**, 251, 263; **72**, 286, 291.
Trusses, Rock Island, **69**, 195; **70**, 245, 262; **72**, 286.
Tunnels and, comparison, **74**, 603, 620.
Water main, **90**, 3902.
Weirs; better than maneuvering boat, **05**, 539.
Widths, points determining, **02**, 2656.
Yellowstone Park, **94**, 3447.

Bridges, Arch.

Stability, P. P. No. 7, C. E.

Bridges, Canal.

Types, Delaware & Chesapeake, Sen. D. 215, 59th, 2d.

Bridges, Crib.

Engineer troops, **02**, 816.

Bridges, Highway.

Canals, **98**, 2482; **08**, 2018.
Factors, important, **02**, 2661.
Yellowstone National Park, **02**, 3034.

Bridges, Iron.

Vibration, effect of, **75**, **ii**, 680; **07**, 1099, 1102.

Bridges, Iron Pile.

Building, **89**, 465.

Bridges, Military.

P. P. No. 4, C. E.

Bridges, Mountain.

Mount Rainier National Park, **09**, 2514.

Bridges, Pontoon.

74, 681; **76**, **ii**, 309; **78**, 981.
Draws of, **74**, 681.
Dubuque and Dunleith, **76**, **ii**, 309; **78**, 984.
Engineer troops, **02**, 816.
Railroads, **78**, 981.

Bridges, Railroad.

Illinois & Mississippi Canal, **08**, 2020.

Bridges, Steel-Concrete.

Yellowstone National Park, **08**, 2473.

Bridges, Tubular Arch.

Objections to, **75**, ii, 680.

Strains, **75**, ii, 680; **77**, 1019, 1102.

Bridges, Wagon.

Railroad and, combination, **70**, 244, 261.

Wagon train, built by, **77**, 1354.

Widths, various bridges, **70**, 245.

Bridging.

Harbors, various countries, **96**, 3900.

Briquettes. (See Cement.)

Cement, testing, **95**, 2751; **96**, 2620; **97**, 3942.

Repairing, **01**, 922.

Bronze Case.

Torpedoes, **89**, 492.

Brooming.

Pile driving, **82**, 2164.

Brush. (See Dikes; Jetties; Mattresses; Piers; Revetments.)

Bundles of; jetties, filling of, **93**, 1885.

Cribs, foundations of, **66**, iv, 105; **67**, 106; **68**, 121; **69**, 99.

Dams, piles in, **79**, 1036.

Delivery of, jetties, **00**, 4243.

Disappearance; brush and rock jetties, **95**, 1774.

Earth, stone and, dams, extending, methods, **00**, 2870.

Efficiency of, shore protection, **75**, 316.

Filling, jetties, **93**, 1885.

Filling, pile revetment, **80**, 1839.

Foundations of, failure in, cribs, **69**, 99.

Groins, use of, **74**, ii, 323.

Holding, boxes of gravel for, **93**, 1720.

Jetties, **73**, 444, 448; **74**, 336; **75**, 219; **76**, 180, 188, ii, 403; **77**, 989; **78**, 1194; **79**, 732.

Mats, cost of, **78**, 641, 660.

Mats, crib foundations, **67**, 106; **68**, 121; **69**, 99.

Mats, dikes of, **78**, 659.

Mats, failure of, **69**, 99.

Mats, gabions and, **76**, 574; **79**, 911.

Mats, large, Mississippi River, **76**, 641; **79**, 978, 981.

Mats, making, **77**, 484; **78**, 658; **79**, 737, 977, 981, 1030, 1032, 1052, 1057, 1061, 1063, 1068, 1074, 1078, 1080.

Mats, sand-tightening, piers, **78**, 1211.

Mats, shore protection, **76**, ii, 408; **77**, 492; **79**, 976, 1030, 1032, 1052, 1057, 1061, 1068, 1078, 1080; **93**, 1699.

Mats, teredo attack, **86**, 1312.

Mats, teredo, destruction by, **76**, 316.

Mattresses, **80**, 938, 944, 1211, 1380, 1419; **81**, 1044, 1328, 1504, 1507, 1560, 1598, Plate XV, 1610, 1614, 1639; **82**, 1201, 1362, 1435, 1444, 1455, 1466, 1473, 1500, 1598, 1601, 1603, 1613, 1630, 1647; **83**, 943, 1309, 1312, 1316, 1318, 1326; **84**, 942; **85**, 2988, Plates III, IV, and V; **87**, 1387.

Mattresses, buoyancy, **80**, 1211.

Mattresses, compression of, **87**, 1387.

Brush—Continued.

Mattresses, revetments, **80**, 1275, 1335, 1339, 1389, 1408, 1412, 1417, 1420, 1422, 1427, 1436, 1440, 1442, 1444, 1459, 1496, 1506, 1586; **81**, 1374, 1524, 1552, 1562, 1598, Plate XV, 1610, 1614, 1618, 1639; **82**, 1500, 1598, 1601, 1613, 1683, 1688, 1690, 1694, 1700, 1732; **83**, 1193, 1243, 1308, 1312, 1317, 1326, 1440, 2294, Plate IV, Appendix L; **84**, 2411, 2767, 2776, 2798, 2835, Plates VIII and IX, Appendix L; **85**, 1566, 2776, 2795, 2950, 3026; **86**, 1194, 1489; **87**, 1558, 1565, 2734, 2761, 2765, 3109.

Mattresses, settlement of, resistance to, **89**, 858.

Mattresses, stone jetties, **93**, 3339.

Piers, **66**, iv, 105.

Pile piers, in, **66**, iv, 105; **73**, 201.

Piles and, river banks, protecting, **96**, 1400.

Resistance of, settlement, **89**, 858.

Revetment of, Black Lake Harbor, Mich., **77**, 914.

Revetment of, filling in, **77**, 475.

Sand bags and, shore protection with, **79**, 410.

Sand movement, checking, **00**, 989.

Sand tightening with, piers, **80**, 1906.

Sand tightening with, pile piers, **73**, 201; **75**, 195; **78**, 1211.

Stone and, crevasses, closing, **71**, 207.

Wattling of, **88**, 842.

Wattling of, shore protection, **88**, 842.

Buckets.

Concrete pier construction, **04**, 3802.

Building Material.

Tests, **90**, 421; **91**, 565.

Buildings.

Basements, **01**, 3806.

Ceilings, etc., **01**, 3812.

Cellars, **04**, 3825.

Concrete floors, **96**, 4012.

Concrete work, **04**, 3853.

Electrical wiring, **04**, 3856.

Electric elevators, **98**, 3668.

Elevators, **96**, 4014.

Finish, interior, **04**, 3830.

Fireproofing, **01**, 3811; **04**, 3852.

Floor arches, tests, **96**, 4011.

Floors, **04**, 3852, 3855.

Foundations, **01**, 3803, 3817, 3818, 3821, 3823, 3828.

Grillage, **04**, 3828.

Heating, **01**, 3817; **04**, 3856.

Ironwork, **04**, 3855.

Plumbing, **04**, 3855.

Shoring, **04**, 3826.

Steelwork, designing, **01**, 3808, 3833.

Stonework, **04**, 3854.

Terra cotta in, **96**, 4011.

Trim, iron, **04**, 3854.

Underpinning, **01**, 3817.

Wind pressure, **01**, 3810.

Buildings, Brick.

Concrete piling, foundations, **04**, 3866.

Buildings, Concrete.

Condensation, preventing posts. (See p. 1797 of this Index.)

Buildings, Public.Drinking-water supply, **04**, 3850.**Buildings, Steel.** (See Buildings, above.)Bases, Ceilings, Columns, Costs, Designs, Doorings, Elevators, Fireproofing, Flooring, Foundations, Girders, Heating, Offices, Ornaments, Plumbing, Roofing, Tiling, Toilets, Walls, Windows, Wiring, etc. (See special report, **04**, 3829.) (See plates.)**Bulkheads.** (See Piles.)Cheap bulkheads, retention of, dredgings, **94**, 2609.Dredgings, holding of, **95**, 3419.Dredgings, inclosing of, **95**, 3419.

Harborage, Jamaica Bay, H. D. 1506, 60th, 2d.

Islands, artificial, **02**, 1034.Ore in bags, rocks, removing, **99**, 3279.

Riprapping, Jamaica Bay, H. D. 1506, 60th, 2d.

Should be required, docks, to prevent silting, **08**, 734.**Bulkheads—Continued.**Strengthening, **01**, S., 402.**Bulkheads, Concrete.**

Platforms, on timber piles, H. D. 1506, 60th, 2d.

Bulkheads, Sheet-Pile.Dams, repairs, **02**, 1278.Wave action, preventing, **04**, 3620.**Bulletins.** (See Gauges.)Forms of, gauge readings, **93**, 4222.Gauges, Mississippi River, **93**, 3654; **03**, S., 68.Lake Survey, issue, **08**, 2533.**Bunkers, Material.**Forts, construction, **02**, 2494.**Buoys.** (See Moorings.)**Buttresses.** (See Counterforts.)Piers, protecting, **70**, 187.**By-pass.**Water mains, **90**, 3530.**C.****Cabins.**Dredges, **04**, S., 109.**Cable Gallery.**Submarine mines, **97**, 705.**Cable Hoists.**Building, **96**, 1794.Stone, handling, **96**, 1794; **00**, 2713.**Cables.** (See Mattresses.)Clamps, **05**, 3008.Splices, mattresses, **94**, 2934.Strands (separate wires) better than, mattress weaving, **99**, 3690.Towing with, Dan River, Va., **80**, 788.**Cables, Insulated.**Tests, **90**, 419.**Cable, Multiple.**Insulation, **93**, 656.Tests, **88**, 368.**Cable Tanks.**Clamps, **05**, 3008.**Cable Tramways.**Building work, **02**, 2453.**Cableways.**Lock and dam building, **94**, 1956; **96**, 1937; **99**, 2176; **00**, 2768.**Cage, Diver's.****01**, 2830.**Caissons.** (See plates.)Diver better than, lock repairing, **98**, 1800.Lock gates, caisson type, action, **97**, 2356.Percolation, prevention, **12**, 1777.Sinking; water jet, use of, **79**, 926.Steel and concrete, of, breakwaters, **08**, 1954.**Callsthenics.**Result, Engineer troops, **02**, 806.**Calking.**Columns, steel buildings, **04**, 3860.**Calking Machine.**Lock gates, **96**, 2787.**Camps.** (See Hydrography.)Hydrography, **95**, 4248.**Canal Boats.** (See Boats; Vessels.)Dimensions, Chesapeake & Ohio, **74**, 535.Dimensions, various canals, **73**, 221; **75**, ii, 536.Jetties of, filled with stone, **66**, ii, 36; **75**, ii, 103.Length and breadth, relation, **74**, 534, 536.Proper dimensions, **74**, 534, 535; ii, 118.Tunnels, effect in, **76**, ii, 80.**Canal, Chicago Sanitary.**Illinois River, effect, **99**, 2842.**Canal, Erie.**Shipments on, comparison with those of adjacent railroads, **71**, 647; **73**, 223; **74**, 512, 605.**Canalization.**

Coal fields to reach, Warrior River, H. D. 72, 62d, 1st.

Coal traffic benefited, **11**, 743.

Costs, probable, Tennessee River, H. D. 781, 60th, 1st.

Cumberland River, H. D. 1481, 60th, 2d.

Dredging or canalization, Ohio River, study, H. D. 492, 60th, 1st.

History, Great Lakes, **12**, 2647.

Locks and dams, location a deciding factor, H. D. 219, 58th, 3d.

Locks and dams, Mississippi River, H. D. 50, 61st, 1st.

Canalization—Continued.

- Methods, improved, Cumberland River, H. D. 758, 60th, 1st.
 Overflowage claims, **11**, 2031.
 Panama Canal, effect of, Ohio River commerce, H. D. 492, 60th, 1st.
 Problems, rivers, **11**, 1831.
 Rates, factors affecting, H. D. 785, 59th, 1st.
 Rights of U. S., Connecticut River, H. D. 1311, 60th, 2d.
 Value of system of canal works, Connecticut River, H. D. 231, 58th, 3d.
 Wing dam for securing, channels, rivers, cheaper than canalization, H. D. 341, 59th, 2d.

Canalization, State.

- Assessment districts for, **08**, 841; **09**, 883; H. D. 953, 60th, 1st.

Canalized Rivers.

- 01**, 2504, 2568, 2764; **11**, 1831.
 Depths on, **97**, 2711.
 Long rivers, Ohio River, H. D. 492, 60th, 1st.
 Plant required, **05**, 1772.
 Pools, regulating, **98**, 2147.
 Regulating, **95**, 2658.
 Sediment-bearing rivers, H. D. 50, 61st, 1st.
 U. S. and foreign, **02**, 1753.

Canals. (See Locks, Panama, p. 2357 of this Index; Railways; Ships; Water Power; see plates.)

- Abandoned canal, condition of, Georgia, H. D. 681, 61st, 2d.
 Abandonment, justification, Muscle Shoals, H. D. 781, 60th, 1st.
 Accidents in, **00**, 3495.
 Advantages of (U. S. Waterways Commission), H. D. 301, 61st, 2d.
 Aided by U. S., H. D. 781, 60th, 1st.
 Albemarle and Chesapeake, **76**, 424; **80**, 867.
 Appraising, Chesapeake and Delaware, S. D. 215, 59th, 2d.
 Aqueducts, Illinois and Mississippi, **08**, 2020.
 Aqueducts, strengthening sides, **02**, 1737.
 Artificial stone in, **94**, 2164.
 Assessments to aid, **10**, 983.
 Banks of, building, **75**, 456; **76**, ii, 74; **78**, 295.
 Banks of, movement; Delaware & Chesapeake Canal, H. D. 391, 62d, 2d.
 Banks of, protecting, **70**, 485; **74**, 534, 786; **76**, ii, 542; **78**, 295.
 Banks of, rebuilding, **93**, 2760.
 Banks of, water-tightening of, **75**, 456; **76**, 660; ii, 74; **78**, 295, 1225.
 Barge traffic, **96**, 3060.
 Bayou St. John to Ship Island, **71**, 66, 524.
 Benefits from, probable and improbable, **96**, 3039.
 Boat dimensions and, relation, **74**, 534, 535; ii, 118.
 Bottoms of, slopes of, **67**, 324; **68**, 444; **69**, 537; **72**, 326.
 Bridges over, building, **95**, 2760, 2768.
 Bridges over, types, **08**, 2018; S. D. 215, 59th, 2d; H. D. 391, 62d, 2d.
 Building, details, **01**, 3027. (See Panama Canal, p. 2357 of this Index.)

Canals—Continued.

- Building, estimates, **96**, 2416, 2447.
 Building, cofferdams, **94**, 1932.
 Capacity of, increasing, **95**, 3577; **00**, 4324.
 Cape Cod, **70**, 484, 492.
 Cape Cod, across the isthmus of, **70**, 447, 492.
 Cascades of Columbia River, **77**, 1047; **78**, 1333; **79**, 1843, 1849; **81**, 2561, 2563; **85**, 2434.
 Celebrated tunnels of, **76**, ii, 81.
 Champlain, **75**, ii, 542.
 Champlain, ship, **75**, ii, 588.
 Change, rate of, **06**, 1372.
 Charter of company, Connecticut River, H. D. 818, 61st, 2d.
 Chesapeake and Delaware, **80**, 722; **83**, 725.
 Chesapeake and Ohio, **74**, 493; **75**, 769; **76**, ii, 73.
 Closing, cofferdam, **94**, 1932.
 Commercial advantages of, **03**, 2349; S. D. 215, 59th, 2d; H. D. 953, 60th, 1st.
 Commerce, decline of, through canals, "The Soo," **05**, 2284.
 Commerce, probable, Great Lakes to Mississippi River, H. D. 304, 61st, 2d.
 Commerce, Illinois and Mississippi Canal, **08**, 2022.
 Commerce, Great Lakes, **12**, 2641.
 Concrete, use of, **74**, 786, 820; **75**, 469, 904; ii, 621, 623; **76**, ii, 74.
 Connecticut River, **72**, 848; **73**, 1008; **78**, 278, 294.
 Connecting lakes of differing levels, Puget Sound, H. D. 953, 60th, 1st.
 Construction, plant, **11**, 2418.
 Construction, suit of landowners, **05**, 1764. (See Building, above.)
 Cost of, items of, **96**, 3034.
 Cost of, various canals, **73**, 223; **75**, 365.
 Costs, Illinois and Mississippi, **08**, 2024.
 Costs, lowering by lease of water power, H. D. 953, 60th, 1st.
 Cross section, modern ships, S. D. 215, 59th, 2d.
 Cross section, Muscle Shoals Canal, **11**, 2056.
 Culverts, cost, **01**, 3046.
 Culverts, siphon-shaped, clearing of sand, **99**, 2857.
 Cumberland and Ohio, **74**, 498, 504, 537.
 Currents, effect of guard locks, **05**, 1755.
 Cuts, Illinois and Mississippi Canal, **98**, 2482.
 Dams, Illinois and Mississippi Canal, **08**, 2019.
 Dams, Lake Superior, Mississippi River Canal, **96**, 2431.
 Delaware and Chesapeake Bays, between, **79**, 588.
 Delaware and Maryland, **83**, 755, 760.
 Deposits, sluicing, **88**, 2166.
 Depths, determining, H. D. 953, 60th, 1st.
 Designing, Puget Sound, H. D. 953, 60th, 1st.
 Des Moines Rapids, **67**, 281, 323; **68**, 385; **69**, 219; **70**, 295; **72**, 327; **76**, 657; **77**, 537; **78**, 734, 745.
 Dimensions, various, **96**, 2409.
 Dismal Swamp, **76**, 392; **80**, 867.
 Diversion, flood, H. D. 262, 59th, 1st.
 Drainage of, Colbert Shoals Canal, **98**, 1921.
 Dredging, **98**, 2482.

Canals—Continued.

- Drift, avoiding sand drifting into canal, **01**, 3515.
 Drifting sand, effect of, **74**, 796.
 Dumps, H. D. 391, 62d, 2d.
 Effect of, on Great Lakes, **02**, 2825.
 Effect of, on future industries, Great Lakes to Mississippi River, H. D. 304, 61st, 2d.
 Embankment, maintenance, **05**, 1768.
 Enlarging, methods, **93**, 2547.
 Entrance of, protecting, **00**, 4328; **09**, 1927.
 Entrances to, shoaling, causes of, **97**, 2671.
 Erie, **75**, ii, 535, 536, 549.
 Erie, cost of, **73**, 223; **75**, ii, 538.
 Estimates, form of, **94**, 2182.
 Estimating for, Birmingham Canal, Ala., **99**, 1743.
 Etowah to Ocmulgee Rivers, **71**, 64; **72**, 60, 526.
 Excavating, **99**, 2272.
 Features of, Muscle Shoals, **01**, 2444.
 Feeder lines, building, **97**, 2859.
 Feeder lines, estimates, **96**, 2661.
 Feeder lines, obstacles, Illinois and Mississippi, **03**, 1924.
 Feeder lines, surveying, **96**, 2656.
 Ferries, H. D. 391, 62d, 2d.
 Ferry, aerial, operating, **05**, 1973.
 Filling, **99**, 2272; **01**, 2066.
 Filtration, **75**, ii, 547, 566; **76**, 527.
 Flooding of, damages from, **98**, 2109; **05**, 1650.
 Floods, repairs, **02**, 1736.
 Florida, across peninsula of, **76**, 508.
 Flowage, damages from, **93**, 2763.
 Flow in, grass, effect of, **73**, 1008; **78**, 294.
 Fort St. Philip, Mississippi River, **74**, 825, 826, 827.
 Fox and Wisconsin Rivers, **72**, 136.
 Freight rates, Buffalo to New York, **00**, 2374.
 Functions of, H. D. 391, 62d, 2d.
 Grass, effect of, **73**, 1008; **78**, 294.
 Hennepin, **83**, 1754, 1788; **84**, 1950; **85**, 2056; **86**, 1733; **87**, 2137.
 Hennepin, to Rock Island, **70**, 32; **71**, 57, 302.
 Highway bridges, **98**, 2482.
 Ice, formation of, Delaware and Chesapeake Canal, **82**, 955.
 Illinois and Michigan, **68**, 454; **83**, 175; **87**, 2141, 2143.
 Illinois and Mississippi, **08**, 2012.
 Illinois River, **68**, 440.
 Improving, cost of, various canals, **96**, 2144.
 Inclined planes, **74**, 498, 550, 552, 555; **75**, 770, 879; **76**, ii, 82, 100; **77**, 682.
 James River and Kanawha, **71**, 624, 626, 634, 650, 651; **74**, ii, 86, 110.
 Jetties, H. D. 391, 62d, 2d.
 Jetties, cheap type of, Delaware and Chesapeake, S. D. 215, 59th, 2d.
 Lake Erie to Lake Ontario, **68**, 271.
 Lake Michigan, and Illinois River, **68**, 448.
 Lake Michigan, Wabash River, **76**, ii, 455.
 Land for, estimates of cost, **96**, 2416.
 Land, leases of, **96**, 3046.
 Land, locating, methods, **98**, 2483.
 Land, usual hindrances to acquiring, **11**, 2282.
 Length of, in U. S., **69**, 546.

Canals—Continued.

- Local sentiment, **08**, 2020.
 Locks, emergency, H. D. 391, 62d, 2d.
 Locks, presence and absence of, S. D. 215, 59th, 2d.
 Locks, defensive measures, H. D. 953, 60th, 1st.
 Locks, water power at, H. D. 953, 60th, 1st.
 Louisville and Portland, **68**, 530, 553; **75**, 773, 774; **76**, 749; **78**, 772, 776, 780.
 Maintenance of, **74**, 832, 874; S. D. 215, 59th, 2d.
 Marne-Rhine, **76**, ii, 61, 64, 97.
 Maumee and Erie, **81**, 2354.
 Mississippi River, mouth of, **74**, 786, 821, 825, 827; **75**, 950, 951.
 Mississippi to Rio Grande Rivers, **75**, 876.
 Modern, need for, Delaware and Chesapeake, S. D. 215, 59th, 2d.
 Muscle Shoals, **72**, 498; **78**, 756.
 Navigation on, rules, **95**, 2661.
 Navigation on, rules, Duluth, **98**, 2226.
 Navigation on, water-power rights and, conflict of, **96**, 2635.
 New York, S. D. 887, 62d, 2d.
 Niagara Falls, **68**, 47, 271, 272.
 North Sea, Holland, **74**, 786; P. P. No. 22, C. E.
 Ohio River, **68**, 529, 530; **96**, 2997.
 Operating, cost of, slightly over 2 per cent of cost of building, Muscle Shoals Canal, **98**, 1928.
 Operating, Des Moines Rapids, **80**, 1555. (See Miss. R., p. 1067 of the Index.)
 Operating, fuel, storage of, economy of, **96**, 2231.
 Operating, Louisville and Portland, **80**, 1724. (See Ohio R., p. 905 of this Index.)
 Operating, regulations, **04**, 2769.
 Operating, St. Marys Falls, **81**. (See p. 1422 of this Index.)
 Passing places, **93**, 2716.
 Piers for, Duluth, **98**, 2226.
 Pipes across, placing, methods, **94**, 1939.
 Planning for, **97**, 3156; **00**, 3860.
 Pools of, height of, preserving, regulations, Fox and Wisconsin Rivers, **98**, 2343.
 Portage Lake, Mich., **87**, 1981.
 Potomac River, **74**, 494.
 Prices, unit, H. D. 263, 59th, 1st.
 Prism, enlarging proposed, Erie Canal, **97**, 3265.
 Prism, abnormal increase in volume, **05**, 1553.
 Profiles, H. D. 823, 60th, 1st.
 Prominent canals, characteristics, **00**, 3627.
 Proposed, commercial points to be considered, **96**, 3035.
 Pumpage for, **76**, 407.
 Purchase, Chesapeake and Albemarle, H. D. 589, 62d, 2d.
 Rafting in, regulations, **93**, 2682.
 Rafts in, towing of, rules for, **95**, 2536.
 Rail and, freight rates, **96**, 3062.
 Railroads and, capacity, comparison of, **71**, 647.
 Railroads and, comparison of, **00**, 3622.
 Railroads and, New York State, **96**, 3063.

Canals—Continued.

Railway along, Muscle Shoals Canal, **00**, 2941.
 Railway, bridges, **08**, 2020.
 Railway, operating, **05**, 1770.
 Rainfall in, **76**, 533.
 Reservoirs and, evaporation, **71**, 639; **72**, 515, 521; **74**, 505, 523; **ii**, 95; **75**, **ii**, 547, 566; **78**, 293.
 Revetment of, **76**, **ii**, 417.
 Revetment of, repairing, **97**, 2666.
 Revetment of, responsibility for damages by vessels, **08**, 1926.
 Right of way, describing, **98**, 2483.
 Right of way, locating, **98**, 2483.
 Riprapping, **08**, 2020.
 Rivers, lateral to, **97**, 2251.
 Rock, removing, cofferdams, **94**, 1932.
 Routes, Great Lakes to the sea, **97**, 3128.
 Routes, rail and canal, comparisons, **00**, 3622.
 Routes, surveys of, Atlantic Coast, H. D. 391, 62d, 2d.
 Rules and regulations, **93**, 20; H. D. 261, 59th, 2d.
 Rules and regulations, enforcement of, **93**, 21.
 St. Clair Flats, **66**, iv, 47.
 St. Marys Falls, **67**, 225; **71**, 42, 161, 164; **72**, 39, 195; **73**, 40, 286; **74**, 45, 196; **75**, 50, 164; **76**, 103; **ii**, 523; **77**, 109, 921; **78**, 124, 1217, 1218; **82**, 2358; **86**, 1786, 1792.
 Santee, S. C., **81**, 1149.
 Sauk Rapids, **75**, **ii**, 450.
 Section, **74**, 534, 817.
 Shipments by, and railroad, compared, **71**, 647; **73**, 223; **74**, 512, 605.
 Signal towers, paint for, **09**, 1861.
 Siphons, H. D. 391, 62d, 2d.
 Slackwater navigation and, comparison, **74**, **ii**, 97, 119; **75**, 365.
 Specifications; S. D. 215, 59th, 2d.
 Speed allowable, various canals, H. D. 391, 62d, 2d.
 Steamboats required for, **75**, 409.
 Structures over, provisions, H. D. 953, 60th, 1st.
 Sturgeon Bay and Lake Michigan, **87**, 2024, 2030.
 Suez, **71**, 187; **74**, 796, 818; **80**, 985.
 Surfaces of, slopes of, **70**, 483; **73**, 1007; **78**, 294.
 Surplus water, definition of, **98**, 2344.
 Surveys, **95**, 3424; **96**, 1088.
 Surveys, methods, **96**, 2390, 3365; **97**, 2870; **99**, 1735.
 Systems, origin of, Ohio, **96**, 2997.
 Tennessee River, **68**, 558, 573.
 Tennessee to Coosa Rivers, **71**, 64; **72**, 60, 520.
 Terminals, H. D. 391, 62d, 2d.
 Three hundred feet wide, St. Clair Flats Canal; too small for vast commerce, **99**, 2998.
 Tidal locks, H. D. 391, 62d, 2d.
 Toledo, **69**, 121.
 Tolls, Connecticut River Falls, **78**, 274. (See Channels, Private.)
 Tolls, Green River, **80**, 1800.
 Tolls, Louisville and Portland, **72**, 449; **73**, 538; **76**, 761, 767; **77**, 613, 616, 619, 640, 649; **78**, 774, 782, 785, 787; **79**, 1286, 1289, 1291, 1297; **80**, 1726; **82**, 1907.

Canals—Continued.

Tolls, Monongahela River, 1841-; **96**, 2160.
 Tolls, rail charges, compared with, **82**, 2497; **86**, 1944.
 Tolls, Suez, **80**, 985.
 Towing on, Belgium system, **77**, 595.
 Towing on, horses, effective power of, **77**, 688, 690, 692.
 Towing on locomotives, **79**, 1251.
 Towing on, methods, various, experiments, **77**, 690, 695, 700.
 Towing on, rate of, Erie Canal, **74**, 535; **75**, **ii**, 537.
 Towing on, small section, effect of, **76**, **ii**, 79.
 Towing on, steam power, application of, **69**, 536; **73**, 833; **74**, 498, **ii**, 90, 101; **75**, **ii**, 537; **77**, 688, 690, 694, 703; **79**, 1251.
 Towing on, submerged cable, **77**, 691, 695, 700.
 Towing on, tunnels, through, experiments, **74**, 513, **ii**, 90; **77**, 686, 692, 694, 700.
 Traffic, U. S. and Canadian, **12**, 2629.
 Trans-Allegheny route, **79**, 1389.
 Transportation by, cost of, **69**, 541; **71**, 630, 639, 644, 646; **73**, 221, 833; **74**, **ii**, 111; **75**, **ii**, 555; **78**, 784; **79**, 1289, 1291.
 Transportation capacity, Albemarle and Chesapeake, **76**, 424.
 Transportation capacity, Erie Canal, **71**, 646; **74**, 512; **ii**, 110, 118, 123; **76**, 424.
 Trunks and embankment, maintenance, **04**, 2384.
 Tunnels on, **76**, **ii**, 79, 124; **77**, 685.
 Tunnels on, boats in, velocity of, **77**, 685, 689, 700.
 Tunnels on, central water route, **71**, 626, 638, 643; **73**, 830; **74**, **ii**, 90, 100, 120; **77**, 684, 767.
 Tunnels on, Chesapeake and Ohio, **76**, **ii**, 124.
 Tunnels on, objection to, **77**, 690.
 Tunnels on, sections, boat effect, **76**, **ii**, 80.
 Tunnels on, towing, **77**, 695.
 Tunnels on, traction, **74**, **ii**, 90; **76**, **ii**, 79; **77**, 686, 689, 700.
 Tunnels on, turnouts, **76**, **ii**, 79; **77**, 689, 691, 694.
 Types, various, costs, H. D. 391, 62d, 2d.
 Use of, rule and regulations, **75**, 784; **76**, 756, 765; **77**, 608; **78**, 745; **95**, 2563.
 Value of, factors of, **00**, 3620.
 Value of, for deep-draft vessels, S. D. 301, 61st, 2d.
 Value of, military and naval, S. D. 215, 59th, 2d.
 Various, **68**, 272; **69**, 535, 539, 546; **73**, 221; **75**, **ii**, 536.
 Various, dimensions, **96**, 2409.
 Vessel dimensions, St. Marys R., H. D. 64, 62d, 1st.
 Vicinity of, caving, **93**, 2780.
 Vicinity of, tile drainage, effect of, **96**, 3047.
 Wabash and Erie, **81**, 2363, 2413.
 Walls, voids filled with grout, **11**, 2110.
 Water, drawing of, rules, **95**, 2659.
 Water, illegal use of, Fox River, **96**, 2525.
 Water, pools, **69**, 535.
 Water power from, **96**, 3046; H. D. 304, 61st, 2d. (See Locks, above.)

Canals—Continued.

- Water power from, dams for, flush boards on, **97**, 2713.
Water power from, navigation interests and, conflict between, **97**, 2721.
Water power from, regulations, Fox River, **96**, 2535.
Water power from, rules, **95**, 2659, 2661.
Watershed, Colbert Shoals Canal, **98**, 1921.
Water storage, dam sites, Lake Superior and Mississippi River Canal, **96**, 2432.
Water supply, **71**, 639; **72**, 515, 521, 530; **73**, 831, 1008; **74**, 495, 504, 507, 520, 523, 538; **ii**, 95, 112; **75**, 411; **ii**, 545, 547, 552, 566, 591; **76**, 406, 519, 525; **ii**, 61, 97; **77**, 389, 704, 755, 756, 770, 798; **78**, 293; **79**, 1391; **96**, 2402, 2446, 3007.
Water supply, evaporation, **71**, 639; **72**, 515, 521; **73**, 1008; **74**, 505, 507, 520, 523; **ii**, 95; **75**, **ii**, 547, 566; **76**, 519, 526, 528; **ii**, 97; **77**, 386, 704, 707, 756; **78**, 293.
Water supply, feeding, economy of, **76**, **ii**, 62.
Water supply, filtration of, **71**, 639; **73**, 1008; **74**, 95, 505, 507, 520, 523; **ii**, 95; **76**, 519, 526, 534; **ii**, 67, 97; **77**, 386, 704, 707; **78**, 293; **81**, 571, 1152; **86**, 1252.
Water supply, Lake Superior and Mississippi River Canal, **96**, 2402.
Water supply, leakage at locks, **71**, 306; **74**, **ii**, 95; **76**, 528; **77**, 389, 704, 707, 756; **78**, 293; **79**, 1540.
Water supply, lockage, **73**, 1008; **76**, 519, 526, 529; **77**, 704, 707, 724, 756, 770; **78**, 293.
Water supply, locks, reservoirs of, **76**, 407.
Water supply, pumpage, **76**, 406, 407.
Water supply, pumping, **81**, 1152.
Water supply, rainfall, **76**, 533.
Water supply, reservoirs, **96**, 3026.
Water supply, summit levels, **80**, 871; **81**, 1152, 1890, 2402, 2410; **86**, 1252.
Water-tightening, concrete for, **76**, **ii**, 74.
Welland, **75**, **ii**, 540.
Widening proposed, St. Marys River, H. D. 215, 58th, 3d.
Width, determining, **82**, 1239; **11**, 2049.
Wisconsin River, **76**, **ii**, 291.
World-famous canals, S. D. 215, 59th, 2d.
Wrecks in, **97**, 2448.
Wrecks in, removing, **96**, 2232.

Canals, Atlantic Coast.

- History, with maps, H. D. 391, 62d, 2d.

Canals, Drainage.

- H. D. 262, 59th, 1st.
Cross sections, H. D. 262, 59th, 1st.

Canals, Intercepting.

- Flood control, H. D. 81, 62d, 1st.

Canals, Intercoastal.

- Rates, freight, H. D. 391, 62d, 2d.

Canals, Lateral.

- Advantages of, rivers, **97**, 2251.
River improvement, Mississippi River, H. D. 50, 61st, 1st.

Canals, Lock, and Sea Level.

- Costs, H. D. 391, 62d, 2d.

Canals, Ohio.

- Expenses and receipts, 1827-, **96**, 3043.
Government surveys, **96**, 3005.
Lands for, **96**, 3003.

Canal, Sea Level.

- Waves, tidal, H. D. 391, 62d, 2d.

Canals, Ship.

- 68**, 278; **74**, 817; **75**, 409.
Commercial aspects of, **97**, 3195.
Ferry-aerial, operating, **05**, 1973.
Florida, **77**, 388.
Movement for, history, North Atlantic coast, S. D. 215, 59th, 2d.
Requirements of, **81**, 2576.
St. Marys, **70**, 162.
Sturgeon Bay, **72**, 171; **76**, **ii**, 344; **77**, 856.
Tolls, H. D. 391, 62d, 2d.
Traffic on, lakes to the Atlantic, **97**, 3166.
Transportation by, cost of, **97**, 3207.

Cane Carpets. (See Mattresses.)

- Shore protection, **78**, 616; **79**, 876, 931.

Canvas.

- Dams, for, **96**, 1941.
Leakage, preventing, locks, **73**, 287.

Cape Hatteras.

- Rounding, difficulty of, **93**, 1365.

Capes.

- Erosion, rate, Cape Cod, H. D. 821, 61st, 2d.

Capping. (See Breakwaters; Stone; Timber.)

- Breakwater, laying in, **00**, 4116.
Methods of, levees, **97**, 3796.

Capping, Timber.

- Rapid deterioration, **95**, 1728.

Caps.

- Crib piers, underneath, **96**, 1836.

Capstans.

- Bear-trap gates, raising, **96**, 1840.

Carbolization.

- Piles, preserving, **74**, 787; **79**, 393.

Cargoes.

- Sizes increasing, Portage Lake canals, **06**, 1723.
Transferring, methods, **97**, 3219.

Cars. (See pls. 12, 46.)

- Flat cars and turntable, **04**, 3738.
Propelling system, bridges, **02**, 2659.
Stone, transfer of stone from cars, cheapening, **01**, S., 253.
Supply of freight cars, regulated by waterway improvements, H. D. 510, 61st, 2d.

Casemate.

- Casemate shield, experiments, **70**, 7.

Castings.

- Concrete piers, **04**, 3802.

Catamarans. (See Currents; see pl. 72.)

- Breakwater, sounding for, **00**, 4134.
Current meters on, **00**, 5325.
Currents, measuring, **00**, 5325.
Hyacinth removal, **11**, 461.
Soundings with, for making from, **00**, 4134; **02**, 2774; **03**, 2764.

Catches. (See Sand Catches.)

Caving. (See Banks; Crevasses; Undermining;

Yellow banks; see pls. 63-65.)

Canals, **93**, 2780.

Extent and rate, Mississippi River, H. D. 50, 61st, 1st.

Peculiar, banks, Red River of the North, **78**, 730.Preventing, Mississippi River levees, **04**, S., 235.River banks, **75**, ii, 519.River banks, falling stages, **72**, 436; **78**, 615.

Stopped by cable and sand, H. D., 46, 62d, 1st.

Caving Banks.Mississippi River, **75**, 558, 608; **78**, 841; **79**, 976, 979.Protecting; methods, **96**, 3421.Red River of the North, **80**, 1586.Sacramento River, **80**, 2238.**Cavities.**Repairing, bridge piers, **10**, 2624.**Cedars.**Shore protection, **79**, 931.**Ceilings.** (See Forts, p. 1793 of this Index.)Batteries, **99**, 786, 798; **00**, 843, 859, 898.Beams in, batteries, **00**, 898.Beams in, setting, **00**, 898.Buildings, **01**, 922, 3812; **04**, 3825, 3837, 3841, 3848.I-beams for batteries, **97**, 630.Linings for, forts, **03**, 2380, 2382, 2390, 2396, 2415; **05**, 3009.Tile for, batteries, **99**, 786; **00**, 849; **03**, 2372.Wire boards in, **02**, 2494.**Cement.** (See Beton Agglomerate; Concrete; Sand;

Silica; Slag; Tests.)

Adhesion tests, **95**, 2921.Aeration, effect of, **95**, 2924.Bags of, repair of jetties unsatisfactory, **02**, 2283.Bridges, **02**, 2670.Briquettes, breaking of, clips for, **95**, 2913.Briquettes, making, machine, **96**, 506.Briquettes, mixing, **95**, 2751.Briquettes, molding, **95**, 2751.Briquettes, repairing with sulphur, **01**, 922.Briquettes, tensile stress, applying, **95**, 2916.Character of, San Diego forts, **02**, 2472.Clay in, effect of, **95**, 2924.Clay in, use of, **96**, 2803.Compression tests, **96**, 2803.Coping, **99**, 3826.Defective character of, Muskingum River, **85**, 1823; **87**, 1814.Expansion of, locks injured by, **87**, 1814.Foreign substances in, effect of, **95**, 2938.Freezing tests, **95**, 2745.Fresh-water, salt water and, effect of, **95**, 2918.House for, **99**, 2175.Lime, effect of, **96**, 2803.Limestone screenings and, tests, **94**, 2325.Locks, **97**, 2975.Mixing machine, **85**, 2054.Mixtures of, mortars, tests of, **93**, 3021.Molders for, different tests, **94**, 2331.Molds, filling, **94**, 2349.**Cement—Continued.**Mortars, abrasive tests of, **96**, 2803.Mortars, adhesion of, **96**, 2803.Mortars, adhesion of, tests, **95**, 2921.Mortars, arches, tests, **96**, 2876.Mortars, cement, mixtures of, tests of, **93**, 3021.Mortars, comparison of, **98**, 2274.Mortars, consistency, variations, **94**, 2332.Mortars, ingredients in, **94**, 2326.Mortars, materials, heating, **94**, 2353.Mortars, regauging, effect, **94**, 2327.Mortars, rich and poor, comparison, **95**, 2918.Mortars, sawdust, effect of, **96**, 2803.Mortars, strength, **94**, 2318.Mortars, strength, diagram showing, **93**, 3022.Mortars, temperature, effect of, **94**, 2335.Mortars, terra cotta in, effect of, **96**, 2803.Mortars, tests of, **96**, 2620, 2803.Mortars, tests of, detailed, **93**, 3013.Obtaining, precautions, **98**, 2451.Plaster of Paris in, effect of, **95**, 2938; **96**, 2803.Quicklime in, effect of, **95**, 2917.Salt water in, effect of, **95**, 2955.Sand in, effect of, **95**, 2919.Sand in, tests, **96**, 506.Sea walls, **05**, 3025.Setting of, quicklime, effect of, **95**, 2937.Specifications, **98**, 771.Stonehouse for, **02**, 2453.Strength, diagrams, **93**, 3022.Temperatures, different, effect of, **95**, 2917.Temperatures, various, effect of, **95**, 2917.Tensile strength of, **00**, 918.Tensile strength, tests, **96**, 2803; **98**, 773.Tests of, **88**, 1084; **90**, 423, 1573; **91**, 567; **93**,3009; **94**, 2311; **95**, 2743, 2912; **96**, 471, 505,526, 1941, 2620, 2613, 2803, 3275; **97**, 706, 2623,2627, 3941; **98**, 771, 772, 2256, 2754; **00**, 979,2168, 2180, 2257, 2779, 3473, 3849; **01**, 3042,3252; **02**, 2455, 2471; **04**, 3792.Tests of, air test, **98**, 2480.Tests of, apparatus, **92**, 2412, 2420.Tests of, briquettes, **95**, 2751; **96**, 505; **97**, 3942.Tests of, briquettes, making, **96**, 2620.Tests of, detailed, **95**, 2935.Tests of, different molders, results, **94**, 2331.Tests of, Duluth piers, **99**, 2650.Tests of, elaborate, St. Marys River at the Falls, **94**, 2293.Tests of, equipment for, **00**, 2181.Tests of, exposure, **94**, 2348.Tests of, hot-water, **94**, 2351.Tests of, methods, **01**, 1827.Tests of, mixtures, **96**, 2633.Tests of, moist air, effect of, **94**, 2348.Tests of, molds, filling, variations, **94**, 2349.Tests of, mooring posts, **96**, 1885.Tests of, rammer, **96**, 2670.Tests of, six-month tests, **98**, 2480.Tests of, strength, **94**, 2352.Tests of, various brands, **93**, 3013; **95**, 2745, 2924; **96**, 2803; **98**, 771, 2480; **99**, 741.Tests of, vicat needles, **96**, 2670.Tests of, water for, substances in, various effects of, **95**, 2937.Various brands, fineness, **94**, 2318.

Cement—Continued.

- Various brands, mortars, strength, **94**, 2318.
- Various mixtures, tests of, **95**, 2924.
- Various substances in, effect of, **96**, 2803.
- Various tests, **94**, 2649.

Cement, American. (See Cement, Tests.)

- German cement and, comparison, **96**, 2621.
- Portland, improvement of, **96**, 2613.

Cement, German.

- American cements and, comparison, **96**, 2621.

Cements, Hydraulic.

- P. P. No. 9, C. E.
- Experiments proposed, **69**, 19.
- Failure, St. Louis, **75**, 458.
- Mixing machine, Illinois River, **85**, 2054.
- Rock formation, Elk River, **76**, ii, 176; **79**, 1417.
- Salt, effect of, **82**, 2350.
- Strength determination, experiments, **82**, 2345; **83**, 1848.
- Teredo-proofing with, **76**, 570.
- Testing, instructions for, **95**, 2750.
- Tests, **69**, 19; **75**, 458; **77**, 583; **97**, 2847.
- Tests, summary of, **96**, 2634.
- Utica, superiority of, **76**, 663.

Cement, Natural.

- Slow setting, **98**, 750, 2255.
- Tests, **94**, 2318.
- Tests, 10 brands, **95**, 2918.

Cement, Portland.

- Specifications, **95**, 2756.
- Tests, **94**, 2318.
- Tests, 8 brands, **95**, 2989.
- Use of, advisable for climatic conditions, Maine forts, **01**, 911.

Cement, Sand.

- Making, methods, **00**, 2768.

Cement, Silica.

- Experimental manufacture, **99**, 2177.

Cement, Slag.

- Tests, **98**, 665.
- Tests, satisfactory, **98**, 665.

Cereal Crops.

- Great magnitude of, Columbia River district, **01**, 3523.

Chains. (See Dams.)

- Cribs, sinking of, **74**, 209; **75**, 228, 239, 276.
- Locks, gates, operating, **98**, 1800.
- Movable dams, **98**, 2127.

Chambers, Dry. (See Forts, p. 1797 of this Index.)**Channels.** (See Harbors; Jetties; Piers; Rivers; Walls; Plates.)

- Annual fill, **96**, 2919.
- Bars, changes in, **94**, 1271.
- Bars, making through, Savannah, H. D. 287, 62d, 2d.
- Bars, scraping, **98**, 2977.
- Beds, effect of water power, **01**, 3387.
- Bends, necessity of protection, H. D. 962, 60th, 1st.
- Blasting, **95**, 1501, 1621.
- Bottom of, various tides, effect of, **92**, 1341.
- Bottoms, examining, **02**, 2498.
- Changes in, bars, **94**, 1006, 1271.

Channels—Continued.

- Changes in, cause of, jetties, **93**, 1616.
- Changes in, conditions governing, **93**, 1374.
- Changes in, jetties, effect of, **00**, 4434.
- Changes in, jetties, vicinity of, **97**, 1478, 1534.
- Chute, making through, **02**, 1964.
- Contraction of, dikes for, **00**, 4272.
- Contraction of, portable jetties, **95**, 2062.
- Contraction of, rivers, **00**, 4272.
- Contraction of, with artificial island, **02**, 1033.
- Cost, Mississippi River, **05**, 1590.
- Cross sections, Mobile harbors, **00**, 2166.
- Cross sections, various periods, Nantucket Coasts, H. D. 536, 62d, 2d.
- Cross sections, width, contraction of, elevation due to, formula, **75**, 536.
- Damages from norther, H. D. 328, 61st, 2d.
- Deepening, breakwater and jetty, **96**, 574.
- Deepening, dredging, **93**, 3571.
- Deepening, entrances, harbors, **04**, 3067.
- Deepening, jetties, **93**, 3571; H. D. 328, 61st, 2d.
- Deepening, jetties, Charleston Harbor, **94**, 1110.
- Deepening, levees, effect of, **95**, 3624.
- Deepening, long rivers, Ohio River, H. D. 492, 60th, 1st.
- Deepening, methods, rivers, **00**, 4434.
- Deepening, piers, weakening of, **98**, 2654.
- Deepening, plans for, **95**, 2579.
- Deepening, rivers, **96**, 975; **00**, 4434.
- Deepening, scraping, **93**, 3571.
- Deepening, water-jet, **82**, 1595, 1610; **83**, 1238; **84**, 1302; **85**, 769.
- Deepening, wing dams, **93**, 3571.
- Deposits in, some causes of, **98**, 2620.
- Depths, effect of currents, H. D. 328, 61st, 2d.
- Depths, increasing, methods, H. D. 730, 59th, 1st.
- Depths, not increasing as fast as vessel draft, H. D. 1114, 60th, 2d.
- Depths; Great Lakes, projects, original and amended, **11**, 2323.
- Depths and widths, proposed, Detroit River, H. D. 676, 61st, 2d.
- Depths in, controlling elements, **96**, 1078.
- Depths, restoring, Portland, Me., H. D. 489, 62d, 2d.
- Designing, large vessels, Jamaica Bay, H. D. 1506, 60th, 2d.
- Designing, mathematical computing, of design, **02**, 1750.
- Development of, H. D. 262, 59th, 1st.
- Development of, and water power coordination, Tar and Pamlico Rs., H. D. 270, 62d, 2d.
- Development of, combined aid of jetties and dredges, Mississippi River, mouth, **07**, 1401.
- Development of, importance of revetted levees, **07**, 2622.
- Development of, levees important, **12**, 3725.
- Dikes and dredging combined, Swinomish Slough, H. D. 796, 61st, 2d.
- Dikes for, reducing cost, Galveston Bay, C. D., H. R. 1, 62d, 1st.
- Dimensions, bars, Mississippi River, **12**, 3839.
- Directing, sill for, under bridges, **11**, 1582.
- Diversion of, dam for, **98**, 1954.

Channels—Continued.

- Diversion of, proposed, Mare Island, H. D. 1103, 60th, 2d.
- Diversion of, to control floods, H. D. 1107, 60th, 2d.
- Diverting, rivers, 98, 1952.
- Electric lighting, 93, 1080.
- Enlargement, flood control, H. D. 81, 62d, 1st.
- Establishing, complications, 95, 1081.
- Excavating, water-jet, directed by diver, San Francisco, 99, 3153.
- Fill of, 98, 2698.
- Fill of, advantages of hydraulic dredges, 02, 495.
- Fill of, study of, 96, 2919.
- Flow of, concentrating, ditches for, building, 97, 3400.
- Forming, 00, 2292, 2426.
- Forming, dikes, experiments, 00, 4778.
- Forming, dikes, Mississippi River, 00, 4569.
- Forming, inlet formation, H. D. 1506, 60th, 2d.
- Forming, jetties, 00, 2293.
- Forming, jetties, and blasting for, 98, 1539.
- Forming, temporary expedients, 98, 1705.
- Forming, theory of, from jetties, H. D. 1506, 60th, 2d.
- Hurricane, effect of, 12, 1806.
- Ice in, boats for moving, 73, 874.
- Improvement of; should be local cooperation where benefits of improvement would be local, H. D. 599, 62d, 2d; H. D. 660, 62d, 2d.
- Jetties, not attributable to, 95, 1591.
- Jetties, effect of, 93, 1616, H. D. 340, 59th, 2d.
- Location, factors of, H. D. 724, 59th, 1st.
- Locks and dams of, doubtful value, sediment-bearing streams, H. D. 50, 61st, 1st.
- Maintenance of, fill, effect of, 98, 2697.
- Maintenance of, high cost, Mobile, Ala., H. D. 647, 59th, 1st.
- Maintenance of, various measures and methods, 03, 2298; 07, 1273; 11, 670; H. D. 647, 59th, 1st; H. D. 952, 60th, 1st; H. D. 962, 60th, 1st; H. D. 50, 61st, 1st; C. D., H. R. 17, 61st, 2d; H. D. 772, 61st, 2d.
- Maintenance of, Savannah, Ga., 07, 1273.
- Material, movement of, H. D. 181, 59th, 1st.
- Movement of, 00, 1729; 03, 2230.
- Movement, 1792-1903, Columbia River, 03, 2278, 2305.
- Multiplication of, by jetty, 10, 2407.
- Natural filling, 98, 2698.
- Navigating, rules, Duluth, 98, 2226.
- New towns, to, H. D. 774, 61st, 2d.
- Permanence of, Nantucket Coasts and New Haven, Conn., H. D. 536, 62d, 2d; H. D. 535, 62d, 2d.
- Phosphate industry, development of, St. Johns R., H. D. 281, 62d, 2d.
- Profiles, between jetties, 05, 1432; H. D. 611, 61st, 2d.
- Protecting from great storms, Galveston, 01, 1926.
- Rafts, towing of, rules for, 95, 2536.
- Rectifying, flood control, H. D. 81, 62d, 1st.
- Rectifying, rivers, 72, 839; 76, ii, 279, 285, 408; 78, 255.
- Regulation, dikes successful, H. D. 1103, 60th, 2d.

Channels—Continued.

- Rivers, Mississippi River, 95, 3669.
- Rock in, blasting, methods, 96, 2065.
- Rock in, excavating, methods, 96, 2224.
- Sand, excluding, revetments for, 80, 1906, 1914, 1916; 81, 2078.
- Salt water in, ruinous to rice planting, H. D. 836, 61st, 2d.
- Sawdust in, effect of, 01, 994.
- Scour, action of, 98, 2621.
- Scour, enormous, Savannah, Ga., 07, 1272.
- Scour, produced by jetties, Columbia River 10, 2407.
- Scraping to deepen, 93, 3571.
- Sections of, and shore lines, Mississippi River, 05, S., 196.
- Sediment-bearing rivers, methods of making channels, H. D. 50, 61st, 1st.
- Sewage deposits in, great, 98, 2422.
- Shoaling, causes of, 00, 4436.
- Shoaling, from city sewage, Chicago, 11, 2351.
- Shoaling, from snow, Chicago, 11, 2351.
- Slopes of, Lake Huron to Lake Erie, 00, 5362.
- Slopes of, measuring, St. Clair River, 00, 5362.
- Storms, effect of, Pacific coast, H. D. 961, 60th, 1st.
- Theory of formation; from dredging, H. D. 1506, 60th, 2d.
- Turning basins, Milwaukee Harbor, H. D. 667, 61st, 2d.
- Vessels and; economical types (Raymond Board on Deep Waterways, Great Lakes to Atlantic), H. D. 710, 62d, 2d.
- Width, mathematical computation of, 00, 3034.
- Widths, narrow; a handicap in growing harbors, H. D. 719, 62d, 2d.
- Widths, study of, waterway, Lockport to St. Louis, H. D. 263, 59th, 1st.
- Winds, effect of, Aransas Pass, H. D. 678, 61st, 2d.

Channels, Blasted.

- Examining, methods, 93, 1585.

Channels, Deep.

- Breakwaters necessary, lake harbors, 00, 3773.
- Forty-foot, difficulties of making, 08, 1075.
- Forty-foot, effect on rates problematical, H. D. 340, 59th, 2d.
- Forty-foot, increasing need for, H. D. 340, 59th, 2d.
- Forty-foot, rates of progress on, 09, 1092.
- Fourteen-foot, Mississippi River, 7 methods of gaining, H. D. 50, 61st, 1st.
- Jetties for, 99, 1867.
- Maintaining, rivers, 98, 1111.
- Planning, 97, 1790; 00, 4016.
- Planning, harbors, 97, 1257.
- Rivers, effect on, 00, 4016.
- Thirty-five-foot, Southwest Pass, 99, 1866.
- Thirty-foot, development, St. Johns River, Fla., H. D. 611, 62d, 1st.
- Thirty-foot, over; causes for, Delaware River, H. D. 733, 61st, 2d.

Channels, Diverted.

- Maintenance, cost of, Appomattox River, H. D. 952, 60th, 1st.

Channels, Dredged.

- Currents, flow of, New Haven Harbor, H. D. 535, 62d, 2d.
- Immediate filling of, **95**, 1936.
- Immediate filling of, Calumet River, **94**, 2147.
- Protecting, dikes for, **96**, 2920.
- Sand movement into, **96**, 3140.
- Scour and fill, **94**, 2390; **97**, 1548, 3041, 3055.
- Scour and fill, study of, **93**, 3050.
- Sides of, sinking, **95**, 1936.

Channels, Entrance.

- Designing, harbors of refuge, H. D. 573, 61st, 2d.
- Designing, bay harbors, H. D. 1506, 60th, 2d.

Channels, Improved.

- Bends, proper widths, **05**, 1496.
- Curves, proper widths, **05**, 1496.
- Maintenance by natural causes, Delaware River, C. D., H. D. 7, 59th, 2d.
- Rates reduced by, Great Lakes, **07**, 1898.

Channels, Interior.

- Designing, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.

Channels, Low-Water.

- Dredging, effect of, **98**, 3166.
- Maintenance practicable, **04**, S., 10.

Channels, Narrow.

- Navigation of, rules, **00**, 4028.
- Rocky sides, injury from; fenders for, **98**, 1046.
- Tortuous and; crib dikes unsatisfactory, **98**, 2069.

Channels, Open.

- Flow through, **73**, 896; **76**, 296.

Channels, Permanent.

- Securing 6-foot channel, Missouri River, H. D. 1287, 61st, 3d.

Channels, Private.

- Right of owner to take toll confirmed, Grand Pass, H. D. 967, 60th, 1st.

Channels, Restricted.

- Flow of, **74**, 346; **79**, 774.

Channels, Rocky.

- Wing dams, effect on, **99**, 1684.

Channels, Ship.

- Surveys, **94**, 2263.

Channels, Slack-Water.

- Obtaining, methods, Bayou Teche, La., H. D. 527, 59th, 1st.

Chanoine Wickets. (See Dams.)**Charges.**

- Torpedoes, **80**, 57.
- Water power, H. D. 50, 61st, 1st.

Charter.

- Waterway and canal company, H. D. 818, 61st, 2d.

Charts. (See Maps; Rainfall; see p. 2041 of this Index.)

- Great Lakes, cost to public, **08**, 892.
- Reproduction, methods; Great Lakes survey, **08**, 2516, 2517.
- Rainfall, **75**, 676.
- St. Marys River, **96**, 4056.

Charts, Old. (See Channels, Columbia River; Mississippi River, pp. 1067 and 1616 of this Index.)

Pensacola Harbor, **95**, 1648.

Chemicals.

Water hyacinth, destroying, **01**, 1748.

Chicago Drainage Canal.

Effect on Lake Huron, **02**, 2825.

Chimneys. (See Steamboats.)**Chipmunks.**

Road cleaning, **03**, 2466.

Chips. (See Quarries; Stone.)**Chips, Quarry.**

In stone jetties, **94**, 1231.

Chisel Boats. (See Boats.)

Rock, breaking, **67**, 267; **68**, 422, 434, 436; **69**, 237; **71**, 164, 269; **72**, 330, 331; **74**, 314; **76**, 661; **77**, 544; **78**, 708.

Rock, removing, **68**, 422, 434, 436; **72**, 321.

Rock, removing, daily work, **74**, 314; **78**, 709; **79**, 1134.

Unsuccessful, rock breaking, **71**, 164.

Chiseling. (See Rock.)

Blasting and, comparison, **79**, 1134.

Blasting and, drilling and, comparison, rock removing, **79**, 1134.

Chiseling Machine.

Rock removing, **94**, 812.

Chrysanthemums.

Growing, **02**, 2718, 2760.

Chutes. (See Drift; Rivers; see pl. 15.)

Channel, making, Ohio River, **02**, 1964.

Closing, a problem, Missouri River, **01**, 2381.

Dredgings, transporting (see Dredging, Hydraulic), **76**, 288; **77**, 886; **79**, 503, 1540; **86**, 883; **87**, 886, 1614, 2345.

Navigable, Ohio River, **72**, 403.

White River, **72**, 375.

Use of, in rivers, **81**, 1935, 1943, 1980.

Circus.

Labor scarce because of, Mississippi River, **05**, S., 215.

Cistern.

Details, forts, **04**, 3738.

Cities. (See Water Supply.)

Aqueduct system, D. C., **01**, 3651.

Dumpings of, harbors, injury of, **76**, ii, 429; **77**, 928; **95**, 3608; **97**, 3499.

Playgrounds, D. C., **01**, 3702.

Refuse of, dumping of, at sea, **93**, 3541; **01**, 3612.

Refuse of, dumping of, at sea, best methods, **96**, 3395.

Refuse of, slowness to use for reclamation, **09**, 2284.

Reservoirs for, **98**, 2854.

Shoaling from dumpings of, **12**, 2541.

Streams within limits, removal difficult, **05**, 2073; **06**, 1774.

Water supply of, improvement methods, **92**, 3363.

Cities—Continued.

- Water supply of, pumps, requirements of, **76**, ii, 697.
- Water supply, measuring, D. C., **01**, 3659.
- Water supply, wastage, D. C., H. D. **342**, 61st, 2d.
- Wharfage, Kansas City, **12**, 2202.

Citizens.

- Rights of citizens or corporations, reservoir systems, waterways, **06**, 1455.

Claims.

- Canalization, **11**, 2031.
- Overflowage, tidal records valuable, **04**, 1647.
- Protecting against, river and harbor works, Bayou Teche, **09**, 1466.

Clamps.

- Torpedo cables, **05**, 3008.

Clay.

- Cement, effect on, **95**, 2920.
- Cofferdams, building, **95**, 2907.
- Facing, sand levees, **76**, ii, 626.
- Filled with bowlders, water-jet, broken by, **79**, 62, 382, 393.
- Foundations on, settlement of, **74**, 829, 830.
- Industries, Ohio, **96**, 3082.
- Use of, cement, **96**, 2803.
- Valley of Mississippi River, **83**, 2315.

Cleanings.

- Shoaling from, **12**, 2541.

Clips.

- Cement, briquettes, breaking, **95**, 2913.

Closets, Lamp.

- Concrete walls, forts, **02**, 2477, 2480, 2494.

Coagulation.

- Substitute for storage of drinking water, H. D. **342**, 61st, 2d.

Coal.

- Analysis, **77**, 314; **79**, 1401, 1427.
- Beds, thickness of, Alabama, **81**, 1236.
- Big Sandy Valley, **01**, 2769.
- Deposits, Appalachian, **77**, 306.
- Deposits, Cuivre River, **72**, 392, 393.
- Deposits, Cumberland River, **71**, 481.
- Deposits, Kanawha River, **77**, 306.
- Deposits, Monongahela River, **76**, ii, 132.
- Deposits, Salisbury River, **74**, 545.
- Deposits, Somerset River, **74**, 545.
- Deposits, Warrior River, **75**, ii, 26.
- Deposits, West Virginia, **74**, ii, 104.
- Marketing helped by slack waterway, Allegheny R., H. D. **540**, 62d, 2d.
- River used as car supply regulator, H. D. **510**, 61st, 2d.
- Soft-coal movement, Wis., **06**, 1754.
- Traffic in, Tradewater River, H. D. **346**, 61st, 2d.

Coal Fields.

- Arkansas, H. D. **510**, 61st, 2d.
- Big Sandy River, **00**, 3417.
- Black and Ouachita Rivers, **00**, 2511.
- Elk River, **04**, 2585.
- Sandy River, **98**, 2164.
- Waterway to, construction, Warrior R., H. D. **72**, 62d, 1st.

Coal Fields—Continued.

- West Fork River, **00**, 3276.
- Youghiogheny River, **00**, 3291.

Coal Fleets. (See Plates.)

- Draws, passage of, **76**, ii, 303.
- Ohio River, **77**, 639, 648, 654.
- Freight, handling, **97**, 3183.
- Kanawha River, **96**, 3086.
- Locks, foundations under, **94**, 1993.
- Various, **75**, ii, 26.

Coal Freight.

- Large saving, by slack water, **10**, 690.
- Rates saved by improved Ohio and Mississippi Rivers, **03**, 1692.
- Towing system, Ohio River, **04**, 2434.

Coal Mining.

- Affected by improved waterways, H. D. **510**, 61st, 2d.
- Philippines, **04**, 3870.

Coal Tar.

- Timber, protection of, **69**, 28.

Coal Tows.

- Size of, Ohio River, **84**, 1685.

Coal Transportation.

- 76**, ii, 134; **77**, 638, 639, 648, 649, 654.
- Barges, coast, **97**, 3202.

Coast Attacks.

- Probable plans, **80**, 8.

Coast Defense.

- Armor questions, injudicious delay due to, **87**, 8.
- Board of 1885, report of, **86**, 499.
- Essentials, **69**, 6; **70**, 5; **71**, 4; **80**, 8; **82**, 6; **84**, 56.
- Guns, **83**, 52.
- Importance of, **81**, 5.
- Metals for, experiments, **69**, 4.
- Navy, restricted value of, **80**, 9.
- Plans, Board of, 1885, **86**, 499.
- System of, principles, **84**, 4.
- Torpedoes, value of, **70**, 5; **84**, 5.

Coast Storms. (See Storms.)**Coasts.**

- Atlantic, commerce, **04**, 1459.
- Sand belt, along, **76**, 378.
- Southern, lands of, richer than Holland's, **00**, 1898.
- Traffic, commercial, H. D. **391**, 62d, 2d.

Coasts, Sea. (See Forts, pp. 1793 and 1818 of this Index.)

- Army and militia, functions, **81**, 402.
- Attacks, character of, **81**, 401.
- Equipment, foreign, **82**, 435.
- Fortifications and accessories, **81**, 405.
- Harbor fleet, defense by, **81**, 403.
- Perfect defense, **81**, 408.
- Strengthening, importance of, **81**, 399.
- Torpedo boats, **81**, 410.

Cofferdams. (See Clay; Countercoffers; Cribbs;

- Locks; see pls. **28**, **31**, **37**, **39**.)
- Blossom Rock, **69**, 488, 491, 493; **71**, 926.

offerdams—Continued.

- Building, 88, 779; 92, 1747; 94, 1698; 98, 1991, 2017, 3572.
- Building, dam, 97, 4020.
- Building, locks, 94, 1919, 1956, 1995; 95, 2500; 96, 2291.
- Building, within, cribs, 95, 2907.
- Canals, building, 94, 1932.
- Canals, closing, 94, 1932.
- Centrifugal pump in, 68, 422; 71, 164; 77, 299.
- Centrifugal pumping, 68, 422.
- Cheap form, 01, 2370.
- Collapsed, repairing, 93, 1731.
- Construction, 75, ii, 623; 01, 1595, 1596.
- Dams, building, 98, 2120.
- Des Moines Rapids, 69, 225; 76, 657, 660.
- Dimensions, proper, 68, 426; 69, 249.
- Excavating in, 94, 1995.
- Excavating in, locks, 94, 1292.
- Excavating, within, 95, 2907.
- Excavation of, 74, 312.
- Filling of, gravelly loam, advantage of, 86, 1451.
- Filling of, proper, 69, 249.
- Great Kanawha, 78, 468.
- Hell Gate, 70, 434.
- Kanawha River, 77, 299, 301, 302.
- Large, 68, 421; 69, 243.
- Leakage, wooden washers on tie-rods, 11, 2030.
- Leaks governed with sand bags, 11, 2030.
- Leaks, preventing, 93, 1726.
- Leaks, preventing, countercoffers, 98, 2125.
- Leaks, repairing, 94, 1956.
- Leaks, stopping, 93, 1726; 98, 2093; 01, 2318; 02, 1668; 09, 2157.
- Locks, building, 94, 1919, 1956, 1970, 1995.
- Maintaining, difficulty, 95, 2411.
- Plans of, Rock Island Rapids, 86, 1450, 1461.
- Puddle walls, 68, 426.
- Pumping, 68, 422, 426; 93, 2485; 98, 3541, 3571.
- Raising "Maine," Habana, 11, 3039, 3048.
- Rapid pumping, 68, 426.
- Rapid construction, details, 99, 2177.
- Removing, 71, 300; 97, 1648.
- Repairing, leaks, 94, 1956.
- Repairing miter sill, dams, 05, 1942.
- Reservoir dams, 96, 1834.
- Rock Island Rapids, 67, 295; 68, 421, 437; 69, 238, 248, 249; 72, 330; 77, 543.
- Rock removing, 67, 295; 68, 421, 437; 69, 225, 238, 243, 248, 491; 70, 434; 71, 300, 330, 926; 74, 312; 76, 657, 660; 77, 299, 301, 543; 78, 468; 85, 1753; 86, 1450, 1461.
- Rock removing, canals, 94, 1932.
- Sills of, placing, locks, 00, 3533.
- Solidifying, 93, 2994.
- Unwatering, Black Rock Harbor, 09, 2157; 10, 2316.
- Weirs, building, 98, 2124.
- Work on, movable dams, building, 96, 2251.

offerdams, Earthen.

- Building, 95, 2759.

ollistons. (See Bridges.)

- Bridges, with, Ohio River, 11, 2089.
- Losses annually from, bridges, 06, 1557; 07, 1667.
- Repairing damages, piers, 08, 1902.

Columbia River.

- Jetty construction, 08, 823.

Columns.

- Covering Government Printing Office, 01, 3817.
- Protecting, buildings, 04, 3840.
- Steel buildings, 04, 3860.

Commander. (See Fort.)

Commerce. (See Canals; Rates; Steel; Traffic; Waterways; Vol. I, p. 21.)

- Canal traffic, Great Lakes, 1855-1912, 12, 2641.
- Canals, advantages of, 03, 2349.
- Cargo sizes increasing, Portage Lake Canals, 06, 1723.
- Channels, deeper; commerce not attracted by, Charleston, H. D. 288, 62d 2d.
- Coal movement, soft, Wisconsin, 06, 1754.
- Coal movement, Youghiogheny River, H. D. 330, 60th, 1st.
- Coastal, Atlantic coast, 04, 1459.
- Congestion, terminals, New York, H. D. 1506, 60th, 2d.
- Dams, when they are beneficial, 03, 1507.
- Decline of, causes, H. D. 1120, 60th, 2d.
- Decline of, neglect of terminals a cause, Missouri River, H. D. 1120, 60th, 2d.
- Decline of, Soo, 05, 2284.
- Depths and widths, adequate, Mobile, Ala., H. D. 657, 61st, 2d.
- Determining, H. D. 50, 61st, 1st.
- Determining, methods, Great Lakes, 05, 2283.
- Development, U. S. participation in, H. D. 781, 60th, 1st.
- Economic report, Black and Ouachita Rivers, 00, 2509.
- Economy of barges, and small cargoes, 01, 1521, 1522, 1526, 1528, 1540.
- Effect from improving Missouri River., H. D. 1287, 61st, 3d.
- Eight feet, not less than, helpful, Mississippi River, 05, 1591.
- Facilities for, foreign ports, H. D. 1506, 60th, 2d.
- Foreign and domestic, relation, New York, H. D. 1506, 60th, 2d.
- Foreign trade of Boston due to improvements, 08, 956.
- Future, calculating, New York, H. D. 1506, 60th, 2d.
- Future, estimating, Mississippi River, H. D. 50, 61st, 1st.
- Geological value of Coosa Valley, special report, H. D. 219, 58th, 3d.
- Great Lakes, 96, 3088.
- Great Lakes and Mississippi River, probable, H. D. 304, 61st, 2d.
- Great Lakes and Portage Canals, 08, 1928.
- Great Lakes, Duluth-Superior, 08, 1911.
- Great Lakes, Sault Ste. Marie, 94, 2271.
- Great Lakes, statement, 1855-, 09, 2085.
- Great Lakes, summaries, yearly, 12, 2637.
- Great Lakes, surveys required, 07, 849.
- Great Lakes, tonnage, 12, 2630.
- Growth and decline, Ohio River, H. D. 492, 60th, 1st.
- Growth, between North and South, 04, 1420.
- Growth, Brunswick Harbor, H. D. 407, 59th, 1st.

Commerce—Continued.

- Growth compared with cost of improvements by U. S., **10**, 2095.
 Growth, Cumberland River, H. D. 758, 60th, 1st.
 Growth, enormous, Great Lakes, **01**, 3281, 3286.
 Growth, enormous, Oakland, Cal., **01**, 3436.
 Growth, Fla., H. D. 1312, 60th, 2d.
 Growth, great; due to waterway improvement, **09**, 665.
 Growth, Great Lakes, **06**, 1710, 1861; **07**, 1844, 1859, 2055; **08**, 2088, 2137; **09**, 1915, 2076; **10**, 2065, 2236, 2279; **11**, 2264, 2443; **12**, 2646.
 Growth, Great Lakes and Portage Canal, **09**, 1931.
 Growth, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.
 Growth, marked, Duluth-Superior, **05**, 1984.
 Growth, marked, Port Arthur, Tex., H. D. 772, 61st, 2d.
 Growth, Mississippi River, depends upon maintenance of waterway, **05**, S., 10.
 Growth, Missouri River territory, H. D. 1120, 60th, 2d.
 Growth, New York Harbor, H. D. 1506, 60th, 2d; H. D. 205, 61st, 2d.
 Growth, Pacific coast, H. D. 440, 59th, 2d.
 Growth, Portage Canals, **10**, 2084.
 Growth, rapid, Texas, H. D. 719, 59th, 1st.
 Growth, rate of, Mississippi River, H. D. 50, 61st, 1st.
 Growth St. Marys River, H. D. 64, 62d, 1st.
 Growth, Southern ports, H. D. 340, 59th, 2d; H. D. 328, 61st, 2d.
 Growth, tremendous, Great Lakes, **07**, 846.
 Harbors, how commerce may be attracted to, **09**, 1329.
 Harbors, kinds employing (Kingman), H. D. 634, 61st, 2d.
 Harbors of refuge, character of commerce using, H. D. 610, 61st, 2d.
 Hudson River (Merchant), S. D. 301, 61st, 2d.
 Immensity and rapid increase, Great Lakes, **12**, 953.
 Improvements, favorable effect of, **08**, 717.
 Improvements, river and harbor; not guaranteed by, H. D. 1211, 60th, 2d.
 Intracoastal waterways, effect of, C. D. 3, 61st, 2d.
 Levees, effect of, Mississippi River, **04**, S., 23.
 Lockage traffic, Monongahela River, **11**, 2114.
 Movement, tonnage, New York, diagram, H. D. 1506, 60th, 2d.
 Navigation, seasons, Great Lakes, **11**, 2281.
 One firm's traffic, a doubtful reason for public works, **04**, 1282; H. D. 955, 60th, 1st.
 Outlet, natural, Galveston, H. D. 328, 61st, 2d.
 Panama Canal, effect of, H. D. 492, 60th, 1st. (See p. 2357 of this Index.)
 Possibilities of, New England, H. D. 1159, 60th, 2d.
 Probable commerce, Illinois and Mississippi canals, **08**, 2022.
 Rail and water rates, Cohansey River, N. J., H. D. 645, 59th, 1st.
 Rail and water rates compared, **04**, 2225.

Commerce—Continued.

- Rail and water rates, Mississippi River, **10**, 1765.
 Rail and water, relation, H. D. 781, 60th, 1st. (See Rates.)
 Railroads, influence of, Missouri River, H. D. 1120, 60th, 2d.
 Rates, comparative, Kanawha River points, **11**, 2169.
 Rates, effect of 40-foot channel problematical, H. D. 340, 59th, 2d.
 Rates, Great Lakes, **12**, 2638.
 Rates, rail and water, Columbia River points, H. D. 440, 59th, 2d.
 Rates, rail and water, comparison, Coosa and Alabama Rivers, H. D. 219, 58th, 3d.
 Rates, rail and water, Mississippi River, H. D. 50, 61st, 1st.
 Rates, reduction from improving waterways, H. D. 231, 58th, 3d.
 Rates, saving due to improved channels, Great Lakes, **07**, 1898.
 Retardation of, from bridges, Chicago River, **11**, 2352.
 Retarded by lack of suitable harbors, Hawaiian Islands, H. D. 593, 61st, 2d.
 Rise and fall of, Mississippi River, H. D. 50, 61st, 1st.
 River and rail tonnage, Mississippi River, H. D. 50, 61st, 1st.
 River traffic, estimating, Coosa and Alabama Rivers, H. D. 219, 58th, 3d.
 Rivers, probable commerce on, study of factors, Ohio River, H. D. 492, 60th, 1st.
 Routes chosen by, factors determining, Napucket Sound, H. D. 536, 62d, 2d.
 St. Marys Falls Canal, **93**, 2974; **96**, 2762.
 Ships, size increasing, Great Lakes, H. D. 266, 59th, 2d.
 Southern, Savannah, H. D. 181, 59th, 1st.
 Statistics, correcting, **05**, 2531.
 South, typical commerce of, Mobile, Ala., H. D. 657, 61st, 2d.
 Statistics, determining value of freight, **12**, 2461, 2628.
 Statistics, discussion, St. Marys Falls Canal, **94**, 2273; **95**, 2875; **97**, 2999.
 Statistics, fallacious computations, **02**, 1703.
 Statistics, inadequate methods of acquiring, Mississippi River, **10**, 2976.
 Statistics, studying, **02**, 1696.
 Statistics, type of valuable reports, **05**, 2531.
 Study of, Arcadia Harbor, Mich., H. D. 701, 62d, 2d.
 Tonnage of, lakes, 1895 and 1898, **00**, 3566.
 Traffic, various rivers of the world, H. D. 492, 60th, 1st.
 Traffic, various U. S. divisions, **04**, 1422.
 U. S. various ports, 1897, **98**, 2225.
 Unit value of, discussion Galveston, **05**, 1487.
 Valuation, source of data, **12**, 2674.
 Vast commerce, St. Clair Flats Canal, **99**, 2998.
 Vast proportion passing through St. Clair Flats Canal, **01**, 3205.
 Vessel damage, and causes, Great Lakes, **09**, 1941.
 Volume, factors determining, **04**, 1340.

commerce—Continued.

- Water, rates saved by, Great Lakes, **10**, 2096.
(See Rates, above.)
- Water, transportation by, Great Lakes, **09**, 1943.
- Waterway improvement, factors in, **04**, 2723; **05**, 1388.
- Waterways, intracoastal, H. D. 1236, 60th, 2d; H. D. 391, 62d, 2d.
- Waterways, intracoastal, effect of; C. D. H. R. 3, 61st, 2d.

Commercial Points, U. S.

- Distances apart, **77**, 679.

communications.

- System of, forts, **99**, 1003; **03**, 2423.

companies.

- Charter, canal company, Connecticut River, H. D. 818, 61st, 2d.
- Supervision over power companies, **12**, 3553.

comparator.

- Surveys, use in, **68**, 944.

compass.

- Deviations, Great Lakes magnetic studies, **04**, 4133; **10**, 2726, 2731.

compensating Works. (See Works, Compensating.)

competition. (See Commerce; Rail; Rates.)

- Hope of, doubtful reason for improvement of waterways, H. D. 231, 58th, 3d.
- Principle preserved in improvements, **12**, 810.
- Transportation, effect on, **74**, 599.

compressor Boats.

- Rocks, drilling, **98**, 1952.

computing Machines.

- 82**, 2786.

concrete. (See Abutments; Batteries; Breakwaters; Bridges; Canals; Cement; Cribs; Dams; Dikes; Jetties; Levees; Locks; Piers; see Plates.)

- Abutments, bridges, building, **00**, 5444.
- Adhesion, preventing, **98**, 776; **99**, 776.
- Adhesion, preventing, tarred paper, **98**, 776.
- Anchor bolts, setting, **94**, 453.
- Apron, cracked by, storm, piers, **99**, 3097, 3100.
- Apron, repairing, piers, **00**, 4110.
- Aqueduct, Washington, **87**, 2547.
- Ballast, **04**, S., 278.
- Ballast, cost details, **02**, S., 155.
- Ballast, mixing, **01**, S. 357.
- Batteries of. (See Forts, p. 1797 of this Index.)
- Blocks of. (See Breakwaters.)
- Bolts in, setting of, **94**, 453.
- Brands, locks and dams, **04**, 3755.
- Breakwaters. (See Breakwaters.)
- Bridge piers, building, **96**, 2115.
- Bridges. (See Bridges.)
- Buildings. (See Buildings.)
- Buildings, waterproofing, **05**, 3007.
- Canals, in, **74**, 786, 820; **75**, 469, 904; ii, 621, 623; **76**, ii, 74.
- Ceilings, forts, **02**, 2478. (See Forts, p. 1797 of this Index.)
- Cement. (See Cement.)

Concrete—Continued.

- Cement, Portland, best for North Atlantic coast, **01**, 911.
- Checking of surface stopped by earth covering, **01**, 923.
- Closets of, concrete walls, **02**, 2477.
- Compact, details of making, **01**, 913.
- Composition, proper, for walls and masses, **01**, 911.
- Construction, details, **02**, 772; **05**, 1986.
- Copings, parks, District of Columbia, **04**, 3918.
- Cost of, **80**, 1228.
- Covering of, crib breakwaters, **98**, 2752.
- Covering of, disintegration, **99**, 2774.
- Covering of, molding, **97**, 2624; **00**, 1012.
- Covering of, conduits, **96**, 3911.
- Cracks in. Details of measures to prevent in various climates of the U. S. (See Forts, p. 1797 of this Index.)
- Cribs, superstructure of, **87**, 2069, 2111, 2353, 2363.
- Crusher dust, advantages of, **02**, 2457.
- Culverts, steel-concrete work, Mississippi River levees, **04**, S., 196.
- Dams. (See Dams.)
- Depositing, rules, **98**, 2453.
- Design to save, batteries, **98**, 750.
- Different grades, **00**, 1027, 1040.
- Dikes. (See Dikes.)
- Dikes of, Falls of St. Anthony, **74**, 277; **75**, 356; **76**, 700; **77**, 564; **79**, 1164.
- Dikes, use in, **87**, 972.
- Drain holes, forming of, **00**, 898.
- Dry, superiority of wet over, **01**, 911.
- Economy of, breakwaters, **00**, 4151.
- Exposed surfaces, batteries, **98**, 660.
- Exposure, effect of, **93**, 3212.
- Facing, hollow tile for, forts, **05**, 3030.
- Failure of, breakwaters, **81**, 2674.
- Filled caissons, jetties, **79**, 926.
- Floors, building, **96**, 4012.
- Floors, concrete locks, **98**, 2482.
- Foot blocks, breakwaters, **97**, 2626.
- Footing blocks, molding, piers, **98**, 2226.
- Forms, batteries, **97**, 732.
- Forms, building, locks, **95**, 2413.
- Forms, concrete walls, **96**, 2283; **98**, 1992; **00**, 2257, 2784.
- Forms, curved surfaces, **96**, 536.
- Forms, locks, **95**, 2416.
- Forms, locks and dams, **11**, 2030.
- Forms. (See Forts, p. 1797 of this Index.)
- Forms, steel lining, advantages, **98**, 2254.
- Formula for, breakwaters, **00**, 4066.
- Foundations. (See Foundations.)
- Foundations, locks, **88**, 2167.
- Foundations, steel buildings, **04**, 3860.
- Frost, effect of, **05**, 1987.
- Glare of sunlight from, reducing, **01**, 811; **04**, 3727.
- Grades, cheap, **00**, 4897.
- Granite, powdered, an ingredient, **96**, 514.
- Gravel and stone in, comparison, **00**, 978.
- Gravel in, **00**, 978.
- Gravity mixer, **00**, 821.
- Groins, **93**, 1654.

Concrete—Continued.

Gun platforms, tests, Hampton Roads defenses, **98**, 683.
 Handling, movable dams, **96**, 2260.
 Hand mixing, **98**, 622.
 Ingredients of, **93**, 2840; **94**, 1996; **95**, 515; **96**, 2283; **98**, 1992; **99**, 698.
 Ingredients of, delivery of, rules, **98**, 2454.
 Ingredients of, gun platforms, **96**, 529.
 Ingredients of, powdered granite, **96**, 514.
 Ingredients of, proportions of, **68**, 513; **70**, 298; **74**, 277, ii, 399; **77**, 1068; **79**, 808; **93**, 609, 621; **96**, 471, 2202; **97**, 620, 679, 737, 747, 757, 2431; **98**, 660, 860; **00**, 793, 944, 2256, 2768, 3504.
 Ingredients of, proportions of, rules, **98**, 2452.
 Ingredients of, sand and stone, sharp and smooth, advantages of each, **98**, 2280.
 Jetties. (See Jetties.)
 Joints, vertical; necessity for, in walls, **05**, 1987.
 Laying; cost, **01**, 2320.
 Laying, good and poor work, **02**, 2494.
 Leaks in, linseed oil for, **02**, 2465; **04**, 3718.
 Leaks, laying to prevent, **05**, 3004.
 Leaks, preventing, **03**, 2413.
 Leaks, tamper to prevent, **03**, 2424.
 Levees, in, **00**, 4913.
 Locks and dams. (See Locks; Dams.)
 Locks, special devices for building, **11**, 2029.
 Making, **76**, ii, 75; **99**, 741, 2175; **00**, 2793; **01**, 916; **02**, 2470, 2473, 2484.
 Making, locks, **94**, 1293.
 Making, mattresses, sinking of, **00**, 4921.
 Making, plant for, floating, **89**, 2389, 2392; **94**, 1293; **00**, 4128.
 Masonry, large stones omitted, **94**, 2166.
 Masonry, making, expense, items of, **00**, 3474.
 Masonry, making, rules, locks, **94**, 2165.
 Masonry, placing, guard locks, **94**, 2173.
 Masonry, repair of, **93**, 612.
 Materials for, testing, **97**, 2623.
 Materials, handling, forts, **02**, 2484. (See Forts, p. 1797 of this Index.)
 Materials, sea walls, **05**, 3026.
 Materials, standards, **02**, 2471.
 Materials, tests of years on file, Duluth-Superior office, **05**, 1988.
 Mattresses, sinking, **00**, 4879.
 Mixer, **89**, 1480; **91**, 3335; **94**, 1956, 2172; **95**, 2416; **97**, 716; **00**, 821.
 Mixer, gravity mixer, **00**, 821.
 Mixing of, **88**, 1083; **89**, 1378; **90**, 2389; **94**, 1996, 2172; **98**, 741, 3543; **00**, 950, 1043, 3504.
 Mixing of, building, **02**, 2494.
 Mixing of, costs, **99**, 1001.
 Mixing of, dry and wet, **00**, 906.
 Mixing of, economy of gravity mixer, **01**, 861.
 Mixing of, handwork cheapest at times, **01**, 3805.
 Mixing of, locks and dams, **01**, 2113; **11**, 2030.
 Mixing of, methods, **93**, 602; **96**, 2283; **98**, 620; **02**, 2454, 2494; **03**, 2474; **04**, 3785.
 Mixing of, methods, hand, **98**, 622.
 Mixing of, mixtures, Mississippi River, **01**, 2303.
 Mixing of, monument foundations, **01**, 3831.

Concrete—Continued.

Mixing of, overmixing, advantages, **95**, 2729.
 Mixing of, piers, **04**, 3784; **05**, 1986.
 Mixing of, plant, **94**, 2176; **96**, 2367; **97**, 620, 629, 672, 757; **99**, 679, 732, 792; **00**, 757, 760, 765, 1009; **01**, 702; **S.**, 357; **04**, 3802; **05**, 1986.
 Mixing of, plant, arrangement, convenient, **98**, 1810.
 Mixing of, precautions, **94**, 2173.
 Mixing of, records, keeping, rules, **98**, 2454.
 Mixing of, rules, **98**, 2452.
 Mixing of, without machine, **02**, 2470.
 Molding, **00**, 4128.
 Molding, under water, concrete blocks substituted, **98**, 2753.
 Molds for, breakwaters, **00**, 4134.
 Molds for, piers, **05**, 1986.
 Molds for, sea walls, **05**, 3027.
 Molds for, steel lining, **97**, 2621.
 Monoliths, **02**, 772. (See Concrete Blocks.)
 Mortar battery, proof firing, **94**, 454.
 Mortar, bolts in, tests, **95**, 2940.
 Mortar platforms, tests, gun firing, **98**, 683.
 Names in, making, **05**, 3033.
 Natural formation, **68**, 684.
 Obelisk core, **01**, 3833.
 Overhead cover, forts, **02**, 2480.
 Painting, **03**, 2386.
 Paints and washes, **02**, 2494.
 Pavements, batteries, **00**, 848.
 Paving, banks, **02**, **S.**, 159.
 Percolation, oil treatment, **03**, 2408.
 Percolation, preventing, **04**, 3724. (See also Forts, p. 1797 of this Index.)
 Piers. (See Piers.)
 Piles substituted for, jetties, **95**, 509.
 Placing, **89**, 2389, 2392; **90**, 896, 1629; **91**, 1080; **98**, 3543; **99**, 697, 728; **00**, 969.
 Placing, batteries, **98**, 620; **00**, 757, 765, 770, 809, 979, 1003.
 Placing, breakwater, **91**, 1080; **00**, 4066, 4128.
 Placing, breakwater, foundations, **96**, 2369.
 Placing, dams, **96**, 2200.
 Placing, elevated track, **98**, 620.
 Placing, foundations, locks, **88**, 2167.
 Placing, locks, **95**, 2416; **96**, 2283.
 Placing, locks, building, **94**, 1293.
 Placing, locks, foundations of, **88**, 2167.
 Placing, lock walls, **96**, 2284.
 Placing, plant, **98**, 740; **00**, 2256.
 Placing, simple methods, lock walls, **97**, 2430.
 Placing, stone breakwaters, **00**, 4066.
 Placing, under water, **97**, 2619.
 Plants, **01**, 1596, 2113, 2319; **02**, 2453, 2470; **03**, 2418; **04**, 3754.
 Platforms, loading, forts, **02**, 2478.
 Pressures, unit, piers, **01**, 2859.
 Proportions, proper, forts, **01**, 911.
 Ramming, rules, **98**, 2453.
 Reinforcing, **02**, 2477, 2494.
 Repairing, batteries, **93**, 612.
 Reservoirs, dams, design of, **00**, 2789.
 Resurfacing timber dam, **03**, 1760.
 Revetments. (See Revetments.)
 Salt, effect of, **82**, 2438.
 Sand, crusher dust superior to, **01**, 913; **02**, 2457.

Concrete—Continued.

Sand for, **02**, 2470.
Sand for sea walls, **05**, 3025.
Sea walls, reinforcing and anchor walls, **05**, 3026.
Sea walls, specifications, **05**, 3024.
Shell of, jetties, **04**, 3818.
Shell of, old breakwaters, **04**, 3818.
Slopes, batteries, **97**, 630; **98**, 651; **99**, 798; **00**, 848, 854.
Slopes, gun firing, effect of, batteries, **96**, 534.
Stairways, forts, **05**, 3033.
Steel and, telephone booths, forts, **03**, 2372.
Stone and, ironwork, placing, locks, **94**, 1996.
Stone and, superstructures, crib piers, **97**, 3075.
Stone, broken, for sea walls, **05**, 3025.
Stone in, effect of, **00**, 978.
Stone in, gravel and, in, comparison, **00**, 978.
Strength of, determining, experiments, **82**, 2345; **83**, 1849.
Strengths, tests of, **05**, 3027.
Structures of, blasting, **94**, 477.
Structures of, not monolithic, **94**, 477.
Substitution of, pile jetties, **95**, 509.
Superstructure, breakwater. (See Breakwaters.) **04**, 3818.
Surfaces, checking, preventing, **01**, 923.
Surfaces, coloring, **04**, 3720.
Surfaces, cracks in, closing, **03**, 2411.
Surfaces, cracks, line of fire, **96**, 534.
Surfaces, finishing methods, **96**, 536.
Surfaces, leaks, preventing, **00**, 1025.
Surfaces, seepage, preventing, **03**, 2405. (See Forts, p. 1797 of this Index.)
Surfaces, tests of, **88**, 1084; **95**, 2922.
Tampers for, **03**, 2424.
Timber dikes and, **87**, 970.
Triangulation station, plan and section, **94**, 1378.
Viaducts, **01**, 3778; **03**, 2470.
Walking surfaces, wear proofing, **03**, 2422.
Walks of, building, **97**, 2973.
Walls, coloring, **04**, 3727.
Washes and paints for, **03**, 2420.
Water-tightening, canals, **76**, ii, 74.
Wet and dry spots, and composition behind, **01**, 923.
Wet concrete, advantages of, **01**, 911.
Wood replaced by, breakwaters, **01**, 3314.

Concrete Blocks.

Behavior, breakwaters, **97**, 2622.
Concrete in mass and, comparison, **96**, 1421.
Concrete in situ, preferred to, breakwaters, **97**, 2616.
Concrete molding, under water, substitute for, **98**, 2753.
Concrete upon, **03**, 2097.
Costs, **11**, 2260.
Cracking of, **91**, 1633.
Crib breakwaters, repairs, **94**, 2483.
Failure of, Cherbourg, **67**, 516.
Forming of, special design, **00**, 2769.
Foundation of, breakwaters, **97**, 2619.
Ingredients, **97**, 2625.
Ingredients, proportions of, **98**, 665.

Concrete Blocks—Continued.

Jetties, **68**, 500, 512; **71**, 545; **80**, 1126.
Large, **98**, 2752.
Laying, **98**, 2676; **00**, 4068.
Making, **89**, 2368; **90**, 896, 2817; **95**, 1676; **96**, 2371; **97**, 2620; **00**, 4125.
Making, piers, **07**, 1995.
Making, under cover, advantages of, **97**, 2616.
Molding, **04**, 3781.
Molding, breakwaters, **10**, 2058.
Molding, on barges, experiments, **01**, S., 358.
Molding, under cover, **97**, 2624.
Molds for, steel lining, advantages of, **97**, 2621.
Roofs, forts, **05**, 3006.
Sea walls, proposed, **71**, 520.
Setting, breakwaters, **00**, 4108.
Seven-ton weight, making, **98**, 2224.
Storing, **95**, 1676.
Thirty-ton weight, making, **93**, 3159.
Timber breakwater, repairing, **98**, 2676.
Use of, Galveston, Tex., **68**, 500, 512; **71**, 520.
Weather, effect of, **98**, 2255.

Concrete In Bags.

Concrete blocks, foundations, **97**, 2619.

Concrete In Mass.

Concrete blocks and, comparison, **96**, 1421.

Concrete In Situ.

Concrete blocks, preferred to, breakwaters, **97**, 2616.

Condemnation.

Lands for levees, **03**, 1387.

Condensation. (See Forts, p. 1797 of this Index.)

Conduits. (See Locks; Water.)

Accidents, guarding against, water supply, H. D. 347, 61st, 2d.
Bear-trap dams, **01**, 2314.
Capacity, increasing, water supply, H. D. 347, 61st, 2d.
Concrete in, cracks in, **96**, 3911.
Flushing, locks, **95**, 2366.
Water flow, formula, **93**, 4277.
Water in, gauging, **97**, 4004.
Wire mains and, forts, **02**, 2482; **04**, 3721.

Connections.

Plates, piers, **01**, 2855.
Steelwork, buildings, **04**, 3834.
With railroads, new harborage, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.

Constructions.

Details, dredges, **06**, 972.
Material bunkers, forts, **02**, 2494.
Methods, forts, **05**, 3030. (See Forts, p. 1797 of this Index.)
Plants, **02**, 2452, 2494. (See Forts.)
Progress, showing, jetties, **06**, 1296.

Continental Divide.

Profile of, between Atlantic and Pacific, **77**, 1246.

Contraction. (See Channels; Dikes; Jetties; Rivers.)

Contraction Works. (See Channels; Works, Contraction.)

Effect of, Savannah Harbor, H. D. 181, 59th, 1st.

Contraction Works—Continued.Failure, causes of, **02**, 1748.

Mississippi River, H. D. 50, 61st, 1st.

Contractors.Aided with advance money, Mississippi levees, **05**, S., 241.**Contracts.** (See Vol. I, p. 21.)Laws regulating, unfavorable action of, **67**, 56, 97, 156, 168, 183, 268, 377, 394, 416, 423, 431.**Contracts, Informal.**Advantages of, small works, improvement, **98**, 2613.**Contract Systems.**Hired labor compared with, **82**, 735.Objections, fortifications, building, **97**, 9.**Conveying Machine.**Dredging, **94**, 1061.**Copings.** (See Capping.)Asphalt courses under, forts, **02**, 2494.Concrete, parks, District of Columbia, **04**, 3918.Lining, forts, **03**, 2373.**Copper.**Cases, corrosion, explosives, **86**, 684.Mines, N. C., **75**, ii, 135.Ore, reducing, method, **75**, ii, 135, 136.**Coral.**

Foundation for breakwaters, H. D. 593, 61st, 2d.

Cords and Floats.Resistance, currents, **74**, 534; **75**, ii, 369; **76**, 216; **78**, 380.**Cores.** (See Jetties; Wall.)Solid, method of giving, Preslor Crawley Co. (mention), **03**, 1713.**Corporate Work.** (See Private Work, pp. 22, 2041 of this Index.)Expenditures for, Glasgow, Scotland, **74**, ii, 43.**Corporations.** (See Citizen; Companies.)

Commerce of one firm, doubtful cause for waterway improvement, H. D. 955, 60th, 1st. Improvements, public; not for benefit of, H. D. 139, 59th, 1st.

Reservoirs, building, **98**, 2866.Rights of, determining value, waterways, **05**, 909, 914.

Waterway development, one corporation better than many, H. D. 781, 60th, 1st.

Water power, legalization of right to, waterways, H. D. 781, 60th, 1st.

Corps of Engineers. (See p. 2039 of this Index.)Promotion, slow rate of, **02**, 5.Plan of increasing, **10**, 8.**Corrosion.**Friction at lock gates due to, **11**, 2096.**Cost of Work.** (See Estimates, p. 21.)

Since the cost of work varies so largely on account of location, competition, and previous experience, only a comparatively small number of references are given. These will be found as subdivisions under the various subjects.

Cotton. (See Commerce; Rates; Waterways.)World's production, statistics of, **75**, 633.**Countercoffers.** (See Cofferdams.)Cofferdams, leaks, preventing, **98**, 2125.**Counterforts.** (See Buttresses; Cribs; Groins.)Cribs, **66**, iii, 17; **68**, 127; **69**, 157, 161; **70**, 188, 196, 207; **71**, 215; **73**, 266; **74**, 265; **75**, 346; **77**, 982; **78**, 1277.**Counterpoising.**Sluice gates, **09**, 2010.**Cracks.** (See Concrete; Forts.)Linseed oil to fill, concrete work, **99**, 1003.Railroad iron in concrete to prevent, **99**, 995, 1002.Repairing, concrete, **00**, 1023.**Cranes.** (See Forts; Hoists; see pls. 2, 46.)Ammunition, handling of, **00**, 850; **01**, 913.Locks, building, **94**, 1873; **96**, 1937.**Cranes, Travelling.**Lock building, **94**, 1873.**Crater Formulae.**Explosions, **79**, 36.**Crater Gauge.**Explosives, **88**, 354; **89**, 479; **90**, 4 3.Test, explosives, **88**, 353.**Creosoting.** (See Timber.)**Crests, Movable.**

Dams, Kanawha system, H. D. 480, 62d, 2d.

Reconstructing dams, **05**, 1842.**Crevasses.** (See Levees; see pl. 63.)Causes, Mississippi River, **12**, 3722.Closing of, **90**, 2915, 3258, 3293, 3302; **94**, 3022.Closing of, brush and stone used, Mississippi River, **71**, 207.Closing of, floods, **91**, 3413.Closing of, levees, **84**, 2866.Closing of, mattresses, placing, **95**, 1738.Closing of, methods, **03**, S., 56.Closing of, Mississippi River, **93**, 3849.Closing of, plans for, **95**, 1737.Closing of, reservoir dams, **97**, 2143.Closing of, sheet-pile dam, undermining, Pass a Loure, **98**, 1487.Discharge of, **90**, 3263, 3281; **95**, 3656.Discharge of, Mississippi River, **93**, 3663; **95**, 3656.Easily caused, **00**, 2291.Effect of, Mississippi River, **75**, 541.Floods and, Mississippi River, **12**, 3977.Floods, effect on, **00**, 4554.Formation of, **91**, 3684, 3713; **92**, 3186.Gauges, effect on, Mississippi River, **95**, 3656.Levees, Mississippi River, **12**, 3864.Measurements, Mississippi River, **93**, 3702; **94**, 2844.Mississippi River, **75**, 542, 601; **97**, 3671.Repair, levees, **98**, 1782.Reservoir dams, **97**, 2143.River bed, effect on, **91**, 3465.River depths, effect on, **91**, 3473.Water heights, effect on, **91**, 3444; **95**, 3656.**Crib Angles.**Piles in, **68**, 169, 174; **69**, 107, 122, 126; **78**, 1201, 1204, 1207.**Cribs.** (See Breakwaters; Piers; Superstructures.)Affected by dredging, piers, **01**, 2833.Alongside, depths, changes, **68**, 95.

Cribbs—Continued.

Aprons, **00**, 4071.
Aprons, advantages of, **96**, 2937, 2944.
Aprons, breakwaters, **00**, 4071.
Ballast, experiments with, **02**, 2546.
Ballast for, space occupied, **99**, 2639.
Ballasting, Duluth Harbor, **99**, 2634.
Bases of, wide, advantages of, **96**, 2932.
Bolts in, amount of, diagram showing, **96**, 2578.
Bolts in, direction of, **69**, 154.
Bolts in, fastening of, **94**, 2411.
Bolts in, forms of, **76**, ii, 538.
Bolts in, holding power of, **76**, ii, 538.
Bolts in, size of, **68**, 210, 239.
Bridges of, Engineer troops, **02**, 816.
Building, **66**, iv, 92, 141; **68**, 80, 103, 225, 233;
70, 195; **72**, 656; **75**, 238; **76**, ii, 330, 538; **77**,
931; **78**, 1187.
Building, best methods, **97**, 3066.
Building, breakwaters, **94**, 2440.
Building, cofferdams within, **94**, 2304; **95**,
2907.
Building, cost of, diagram showing, **96**, 2578.
Building, lake harbors, **81**, 2153, 2158, 2164;
84, 1968; **87**, 2110.
Building, methods valuable, **96**, 3157.
Building, piers, **99**, 2633.
Careening, cause and remedy, **68**, 179, 182; **93**,
2742.
Careening, preventing; piles, failure of, **69**, 126.
Careening, resistance to, **99**, 2642.
Careening, righting, **95**, 2778.
Close bottoms, **68**, 182, 193, 296.
Close bottoms, disapproved, **69**, 122, 126.
Cofferdams, building, **98**, 1991.
Collision with steamer, effect, **08**, 1902.
Collisions, repairing damages from, **08**, 1902.
Concrete superstructure, **87**, 2060, 2111, 2353,
2363; **96**, 2945.
Connections, piers, **01**, 2850.
Cost of, Ashtabula, Ohio, **80**, 2165.
Cost of, Buffalo, N. Y., **80**, 2202.
Cost of, Calumet, Ill., **80**, 1989.
Cost of, Frankfort, Mich., **80**, 2010.
Cost of, Grand Haven, Mich., **80**, 2023.
Cost of, Ludington, Mich., **80**, 2014.
Cost of, Manistee, Mich., **80**, 2012.
Cost of, Menominee, Mich., **80**, 1904.
Cost of, Milwaukee, Wis., **87**, 2059.
Cost of, Mississippi River, **02**, S., 164; **07**,
2741.
Cost of, Muskegon, Mich., **80**, 2018.
Cost of, Ontonagon, Mich., **80**, 1898.
Cost of, Pentwater, Mich., **80**, 2015.
Cost of, St. Joseph, Mich., **80**, 2032.
Cost of, Sand Beach, Mich., **80**, 2076.
Cost of, Sturgeon Bay, Wis., **80**, 1909.
Cost of, White River, Mich., **80**, 2017.
Counterforts, **69**, 157, 161; **70**, 188; **74**, 265;
75, 346; **77**, 982; **78**, 1277.
Counterforts, offset section, **68**, 127; **70**, 196,
207; **71**, 215; **73**, 296.
Cross section, **66**, iv, 92; **68**, 225, 226, 233, 237.
Cross section, Burlington Breakwater, **68**, 296.
Cross section, Harbor of Refuge, Lake Huron,
73, 295; **76**, ii, 538; **78**, 1220; **79**, 1652.
Cross section, Manistee, Mich., **75**, 246.

Cribbs—Continued.

Cross section, Manitowoc, **75**, 203.
Cross section, Marquette, **75**, 189.
Cross section, Oswego, N. Y., **75**, 346.
Cross section, piers, **94**, 2134.
Decay of, **96**, 2951.
Decay of, causes, sediment movement, **94**,
2406.
Decay of, checking, **96**, 2952.
Designs, **92**, 2341; **96**, 2952.
Designs, best, **68**, 80, 224, 236; **72**, 164.
Designs, breakwaters, Cleveland Harbor, **94**,
2412.
Destruction of, **69**, 39, 141, 148, 154; **70**, 151.
Destruction of, Au Sable River, Mich., **70**, 151;
71, 175; **76**, ii, 533.
Destruction of, Black Lake, **70**, 146.
Destruction of, Buffalo Harbor, **74**, 227, 231.
Destruction of, Cape Fear, **75**, ii, 99.
Destruction of, Charlotte Harbor, N. Y., **71**,
228.
Destruction of, Duluth, **72**, 165.
Destruction of, Dunkirk, N. Y., **69**, 154, 161;
70, 187.
Destruction of, ice, a cause, **75**, 310; **76**, 258,
ii, 533.
Destruction of, Kenosha Harbor, **75**, 214.
Destruction of, Michigan City, Ind., **77**, 896;
78, 1187.
Destruction of, Oswego, N. Y., **70**, 209; **73**,
371; **74**, 265; **75**, 345; **76**, ii, 601.
Destruction of, Racine, Wis., **68**, 107.
Destruction of, St. Joseph, Mich., **77**, 919.
Destruction of, Sand Beach, **77**, 931.
Destruction of, teredo, **75**, ii, 99.
Destruction of, White River, **77**, 910.
Details, piers, **01**, 2948.
Dikes, pile and mattress dikes, **96**, 1887.
Displacement of, **69**, 156; **77**, 906.
Displacement of, Buffalo, N. Y., **73**, 351.
Displacement of, Dunkirk, N. Y., **70**, 189, 191.
Displacement of, Erie, Pa., **78**, 1268.
Displacement of, ice the cause, **87**, 2058.
Displacement of, Kenosha, Wis., **79**, 1529.
Displacement of, Ludington, Mich., **75**, 247;
76, ii, 477; **77**, 906; **79**, 1608.
Displacement of, Michigan City, Ind., **76**, ii,
444, 447; **79**, 1587, 1595.
Displacement of, Oswego, N. Y., **72**, 260.
Displacement of, South Haven, Mich., **74**, 192;
76, ii, 515.
Dovetails, holding power of, **68**, 241, 242; **84**,
2069.
Driftbolts, holding power, **84**, 2051.
Durable cribs, building, **95**, 3119.
Earth filling, **71**, 658; **75**, ii, 185; **79**, 1044.
Ends, seaward, breakwaters, **09**, 1905.
Estimates for, **75**, 300, 306.
Estimates for, formula, **98**, 2420.
Fastenings, improved, **93**, 3091.
Fastenings, methods, improved, **95**, 3119; **96**,
2945.
Filling of, furnace slag, **77**, 626.
Filling of, loss of, grillage bottoms, **69**, 146.
Filling of, proper, **72**, 162.
Filling of, thrust of, **68**, 238, 242.
Foundations, **73**, 211, 353; **74**, 209; **75**, 305,

Cribbs—Continued.

306, 309, 320; **76**, ii, 571; **78**, 1270; **89**, 2365; **90**, 2814; **93**, 3134.
 Foundations, brush, **66**, iv, 105; **67**, 106; **68**, 121; **69**, 99.
 Foundations, brush, failure of, **69**, 99.
 Foundations, brush mats, **67**, 106; **69**, 99.
 Foundations, displacement of, ice, effect of, **87**, 2058.
 Foundations, effect of, **71**, 548; **72**, 162, 163; **74**, 234; **75**, 305.
 Foundations, failure of, **67**, 222; **69**, 99.
 Foundations, Milwaukee, **84**, 1864.
 Foundations, piles for, **72**, 166; **78**, 1185-1188; **79**, 1557, 1558, 1590.
 Foundations, settlement of, Milwaukee, **84**, 1865.
 Foundations, stone for, **72**, 122, 161, 164, 165; **73**, 306, 353; **76**, ii, 436.
 Foundations, trenches for, **75**, 305; **76**, ii, 571.
 Framing, improved methods, **93**, 3091; **95**, 3119.
 Gravel and rock, better than, piers, **88**, 1761.
 Gravel and rock, ballast, **99**, 2635.
 Grillage bottoms, **68**, 182, 183; **70**, 191.
 Grillage bottoms, building of, **95**, 3119.
 Grillages for, **97**, 3076.
 Height of, **68**, 225, 232, 233; **73**, 294; **75**, 305.
 Height of, economical, **87**, 2407.
 Hole in, large concrete block for filling, **93**, 3159.
 Horns objectionable, **68**, 240; **70**, 204.
 Ice, effect of, **68**, 231; **69**, 108; **73**, 294, 296; **74**, 210, 220, 228, ii, 135; **75**, 57, 310, 354; **76**, 258, ii, 533; **77**, 251.
 Ice, ice guards, **97**, 2809.
 Ice, impact, effect, **68**, 231.
 Ice, protecting against, **97**, 2809.
 Injury of, colliding vessels, **76**, ii, 388, 427.
 Interior angles of, piles at, **67**, 149; **68**, 169, 174, 181, 209; **69**, 107, 122, 126; **76**, ii, 533; **78**, 1201, 1204, 1207; **79**, 1588, 1590.
 Jetties, protecting, **93**, 1799.
 Large cribs, **93**, 2879; **96**, 2588, 2944; **97**, 3065.
 Large cribs, advantages of, **97**, 3072.
 Lateral movement, resistance to, **99**, 2640.
 Launching, **00**, 4172.
 Lengths of, unusual, **68**, 169.
 Leveling, breakwaters, **00**, 4127.
 Leveling, dredging, failure of, **70**, 151.
 Long cribs, advantages of, **00**, 4122.
 Long cribs, building, **93**, 3134.
 Masonry superstructure, foundations, **67**, 222; **74**, 151; **76**, ii, 390.
 Mattresses, foundations of, **82**, 2321.
 Moving, piers, **01**, 2948.
 One-hundred-and-twenty-foot, launching, Huron, Ohio, **02**, 2262.
 Overthrow, breakwaters, Milwaukee Harbor, **94**, 2085.
 Pile dike stabler, double row, Great Lakes, **06**, 1699.
 Piles and mattress, dikes, **96**, 1887.
 Piles, foundation of, **72**, 166; **78**, 1185, 1188; **79**, 1557, 1558, 1590; **82**, 2321; **84**, 1968, 1985.
 Piles, sections of, **00**, 3878.
 Placing, **93**, 2887; **98**, 2684.

Cribbs—Continued.

Plans, improved, **94**, 2411.
 Protecting against ice, **68**, 231; **73**, 294, 296; **74**, 210, 220, 228, ii, 135; **75**, 310, 354; **76**, 258, ii, 533; **79**, 1481.
 Protecting, night, **76**, ii, 427.
 Protecting, oak sheathing, **71**, 107.
 Protecting, riprap, **69**, 108, 137, 142; **70**, 151; **76**, ii, 445.
 Protection plates, repairing through ice, **01**, 2830.
 Removing, dynamite for, breakwaters, **98**, 2752.
 Repairing, **11**, 2284.
 Repairs, piers, **98**, 2752.
 Rock ballast, **99**, 2634.
 Round timber in, **67**, 216; **72**, 157.
 Rubble mounds superior, jetties, **04**, 3216.
 Scows, use of, **93**, 626.
 Settlement, **69**, 122, 146; **72**, 162, 165, 245; **74**, 209, 233.
 Settlement, Au Sable River, Mich., **69**, 108; **71**, 175.
 Settlement, Black Lake Harbor, Mich., **78**, 1211.
 Settlement, Buffalo, N. Y., **69**, 146; **76**, ii, 571.
 Settlement, channel from, **74**, 145.
 Settlement, controlling, **94**, 2410.
 Settlement, Duluth, Minn., **75**, 182.
 Settlement, Erie, Pa., **68**, 171, 182.
 Settlement, Grand Haven, Mich., **67**, 108; **76**, ii, 494.
 Settlement, Grand River Harbor, Ohio, **73**, 338.
 Settlement, Kenosha, Wis., **73**, 211.
 Settlement, Manitowoc, Wis., **73**, 203.
 Settlement, Michigan City, Ind., **75**, 236.
 Settlement, Muskegon, Mich., **76**, ii, 487, 492.
 Settlement, Oswego, N. Y., **70**, 209.
 Settlement, St. Joseph, Mich., **76**, ii, 516.
 Settlement, Sheboygan, Wis., **76**, ii, 378.
 Settlement, South Haven, Mich., **76**, ii, 512.
 Settlement, Swanton, Vt., **78**, 423.
 Sheathing steel, impracticable to drive through riprap, **11**, 2363.
 Shores, protecting, **89**, 770.
 Sinking of, **95**, 2796; **97**, 3076; **98**, 2660, 2680.
 Sinking of, breakwaters, **00**, 4068.
 Sinking of, chains, on, **74**, 209; **75**, 228, 239, 276.
 Sinking of, Charlotte Harbor, **94**, 2458.
 Sinking of, costs, Duluth-Superior, **10**, 2056.
 Sinking of, ice, through, **68**, 95, 135; **69**, 146; **76**, ii, 332; **79**, 1481.
 Sinking of, piles, on, **72**, 166; **78**, 1185, 1188; **79**, 1557, 1558, 1590.
 Sinking of, plan for, **72**, 162.
 Sinking of, precision, obtaining, **93**, 3210.
 Sinking of, spuds, on, **76**, ii, 538.
 Sinking of, uneven, remedying, **93**, 2899.
 Slopes, breakwaters, **94**, 2090.
 Sloping sides, **67**, 228; **68**, 228, 233; **70**, 197; **79**, 1044.
 Solid walls, above water, **70**, 196.
 Stability of, **68**, 229, 230, 231, 238, 242; **70**, 197; **71**, 237.
 Stability of, breakwaters, **94**, 2090.

Cribs—Continued.

- Stone for, amount, diagram showing, **96**, 2578.
 Stone, filling of, weight, **68**, 230.
 Stone, foundations, economy of, **82**, 2321; **87**, 2407.
 Stone, foundations, sections of, **00**, 3878.
 Stone, removed by ice, **79**, 1735.
 Stone, removed by storm, **75**, 276; **77**, 896, 903.
 Stone, removed by theft, **77**, 959.
 Storms, effect of, piers, **95**, 2778.
 Strengthening of, iron tie-rods for, **98**, 1044.
 Strengthening of, vertical posts, **79**, 1588, 1590.
 Substructures, fine example, Lorain, Ohio, **03**, 2066.
 Superstructures, **89**, 2365; **90**, 2814.
 Superstructures, advantages, breakwaters, **93**, 3203.
 Superstructures, cast-iron facing, **87**, 2060.
 Superstructures, concrete in, **87**, 2069, 2111, 2353, 2363.
 Superstructures, design for, **96**, 2952.
 Superstructures, durability, average, **84**, 2020; **87**, 2111.
 Superstructures, early completion of, **78**, 1188.
 Superstructures, form modified, **83**, 1808.
 Superstructures, height of, **71**, 216.
 Superstructures, parapet, form for, **84**, 2144; **85**, 2279, 2307; **87**, 2382.
 Superstructures, removing breakwaters, **96**, 2369.
 Superstructures, stone, **67**, 222; **74**, 151; **76**, ii, 390.
 Supports for, proper, **93**, 3211.
 Suspension, by chains, **74**, 209; **75**, 228, 239, 276.
 Teredo attacks, sand to check, **73**, 800.
 Teredo, destruction by, **75**, ii, 99.
 Timberheads, protecting, **96**, 2937.
 Timber in, amount of, diagram showing, **96**, 2578.
 Timber, protecting by coal tar, **69**, 28.
 Training walls, **95**, 1491.
 Triangular section of, **68**, 127; **70**, 207.
 Undermining, **11**, 2284.
 Undermining, breakwaters, **11**, 2284.
 Undermining of, aprons to prevent, **97**, 3065.
 Unequal settlement of, preventing, **00**, 4071.
 Valuable estimates, **75**, 300, 306.
 Vertical posts, strengthening, **79**, 1588, 1590.
 Wave action on, **68**, 234.
 Wave pressure, **91**, 2557.
 Waves, effect on, **68**, 229, 230, 231; **70**, 197; **71**, 237.
 Wide base, advantage of, **92**, 1519.
 Widths of, proper, **97**, 3287.
 Wooden pins in, **67**, 138, 216.

Cribs, Buttress. (See Breakwaters.)**Cribs, Guide.**

- Building, **00**, 3510.
 Eagle Harbor, Mich., **77**, 848; **78**, 1139; **79**, 1481.
 Locks, **96**, 2269; **04**, 3761.
 Reconstructed with concrete, **11**, 2250.

Cribs, Movable.

- Scows used as, **93**, 626.

Cribs, Old.

- Condition of, **93**, 3141, 3147.

Cribs, Pierhead.

- Sinking upon rock embankment, Ashland, **11**, 2276.
 Omission of bearing piles cause of lower bid, **11**, 2276.

Cribs, Plank.

- Building, **97**, 2690.

Cribs, Protection.

- Dam-extension work, **04**, 2107.

Cribs, Spur.

- 00**, 4172.
 Breakwaters, **84**, 2148, 2150.
 Oswego, N. Y., **84**, 2148, 2150; **87**, 2383.

Cribs, Submerged.

- Weight of, **91**, 2556.

Cribs, Timber. (See Breakwaters; Jetties; Piers.)

- 96**, 2578.
 Building, **00**, 4172.
 Decay, **66**, iv, 71.
 Old, breakwaters, Buffalo, **04**, 3818.
 Piers, **98**, 2660.
 Reconstructed with concrete, **11**, 2250.

Cribs, Triangular.

- Advantages of, piers, **95**, 3118.
 Bars, effect on, **95**, 3118.
 Breaches, preventive, crib piers, **96**, 2966.
 Pier ends, protecting, **95**, 3118.

Cribwork.

- Reservoir dams, **96**, 1837.
 Shore protection, **89**, 770.

Crops, Cereal.

- Great magnitude, Columbia River district, **01**, 3523.

Cross Fences.

- Illegal, levees, **08**, 2654, 2743.

Crossings, Waterway.

- Intraoceanal canals, H. D. 391, 62d, 2d.

Cross Section. (See Breakwaters; Channels;

- Cribs; Dikes; Harbors; Jetties; Levees; Rivers; Waterways.)
 Channels, Nantucket Coasts, H. D. 536, 62d, 2d.
 Elements, Mississippi River, **96**, 3577.
 Elements, Missouri River, **94**, 3140.
 Mississippi River. (See p. 1076.)
 Missouri River. (See p. 1023.)
 Slope and, terms of current velocity, **72**, 139; **79**, 1579.
 Unique, Great Lakes, piers, **06**, 1841.

Cross Weirs. (See Weirs, Cross.)**Crushers.**

- Dust of, superior to sand, for concrete, **02**, 2457.

Culverts. (See Canals; Gates; Locks; Sluices;

- Turbines; see pls. 24, 26, 31, 37, 39.)
 Canals, cost, **01**, 3046.
 Concrete locks, **98**, 2482.
 Designing, locks, **00**, 2976.
 Designing, locks, Lockport to St. Louis, H. D. 263, 59th, 1st.
 Floors, locks, **94**, 2303.
 Locks, **04**, 3758.

Culverts—Continued.

- Plan, locks, **95**, 2906.
- Repairing, locks, **98**, 1800, 2983.
- Roads, **03**, 2458.
- Steel concrete, levees, Mississippi River, **04**, S., 196.
- Syphon-shaped, cleaned of sand, canals, **99**, 2857.

Culverts, Drainage.

- Levees, Mississippi River, **04**, S., 244.

Current Meters.

- Outfit, verticle curves, etc, **02**, 2869.
- Rating, **02**, 2796, 2828.

Current Observations.

- 88**, 1147, 1276, 2385; **89**, 848, 1326; **94**, 1005; **96**, 1228; **98**, 2740; **99**, 2275.
- Biscayne, Fla., H. D. 554, 62d, 2d.
- Data, index to, Mississippi River, **95**, 3706.
- Double floats, **93**, 3666.
- Floats, cords and, effect of, **78**, 1311, 1313.
- Floats, cords and, resistance of, **74**, 534; **75**, ii, 369; **76**, 213, 216; **78**, 380.
- Floats, description of, **69**, 434.
- Floats, discussion of method by, **69**, 563.
- Floats, for rivers, **76**, iii, 339.
- Floats, use of, San Francisco Harbor, **78**, 1305.
- Harbors, **97**, 3100.
- Humboldt Bay, **94**, 2549.
- Lake Michigan, **98**, 2331.
- Low tide, unsatisfactory at, Mobile, Ala., H. D. 657, 61st, 2d.
- Methods, St. Johns River, Fla., H. D. 611, 61st, 2d.
- Motion of steamer, effect of, **93**, 3670.
- New York Harbor, **99**, 1287.
- Pole floats, **93**, 1624.
- Registering device, **93**, 3670.
- Savannah River, **94**, 1137.
- Torpedo defense, **78**, 34.

Currents. (See Discharge; Floats; Harbors; Jetties; Piers; Rivers; see pl. 72.)

- Absence of, Mississippi River, mouth, **77**, 433.
- Bottom of, velocity of, **68**, 763; **70**, 563, 629.
- Breakwaters, opening in, effect of, **98**, 2662.
- Bridge piers, **68**, 381; **69**, 196.
- Canals, effect of guard locks, **05**, 1755.
- Changes in, jetties, vicinity of, **96**, 1195.
- Channels, effect on, Galveston, H. D. 328, 61st, 2d.
- Combined currents a cause of erosion, **95**, 2301.
- Concave dikes, effect on, **69**, 382.
- Control of, jetties, effect of, **93**, 3315.
- Control of, rivers, **00**, 4436.
- Control of, Savannah, Ga, **07**, 1274.
- Cross currents, avoiding, Detroit, Mich., H. D. 676, 61st, 2d.
- Deflection of, causes, bridge piers, **95**, 734.
- Deflectors for, **11**, 2002.
- Dikes, effect of, **69**, 382.
- Direction, lakes, **73**, 261.
- Dredges in, anchoring of, **93**, 2449.
- Effect of, large rivers, H. D. 1287, 61st, 3d.
- Flow of, dredged channels, New Haven, Conn. H. D. 535, 62d, 2d.
- Great Lakes harbors, H. D. 82, 59th, 2d.
- High velocity of, necessity of, **85**, 569.

Currents—Continued.

- Hydrometric pendulum, **97**, 4094.
- Ice dikes, effect on, **93**, 1146.
- Ice, effect of, **02**, 2809.
- Investigation of, Great Lakes, **97**, 2776.
- Jetties, oblique to, effect of, **79**, 524.
- Lake Erie, **95**, 3086; **98**, 2713.
- Locks and dams for swift-current streams, **01**, 3513.
- Materials in, velocity required to move, **68**, 764; **76**, 463.
- Matresses, destruction of, **99**, 1859.
- Mean velocity, mid-depth, relation to, **75**, ii, 301, 305; **78**, 260, 349; **79**, 1970.
- Measurements, discharge curve, **01**, 2138.
- Measurements, methods, **01**, 1597.
- Measurements, St. Lawrence, details, **02**, 2792.
- Measuring, **00**, 5327.
- Measuring, catamarans, **00**, 5325.
- Measuring, hydrometric pendulum, **97**, 4094.
- Measuring, loaded poles for, **96**, 1204.
- Measuring, meters, two, **00**, 4744.
- Measuring, reel for, **00**, 5327.
- Metering, computing methods, H. D. 231, 58th, 3d.
- Mid-depth velocity, wind, effect of, **69**, 254.
- Moving across, scows, **77**, 3459.
- Scour due to, **01**, 575.
- Strengthening, rivers, **95**, 3860.
- Strong currents, tides, **95**, 1422.
- Tidal estuaries, sub and surface, relation between, **78**, 558.
- Velocities of, **88**, 429, 475; **89**, 1306, 1333, 1334, 1409; **90**, 1273, 1594; **91**, 1583, 1719; **92**, 1334.
- Velocities of, bends, at, **76**, ii, 265.
- Velocities of, bottom and surface, ratio, **79**, 770, 773, 791.
- Velocities of, Brazos, Santiago River, Tex., **81**, 1353, 1368.
- Velocities of, Columbia River, **79**, 1847, 1851; **93**, 3383.
- Velocities of, comparison of, by floats, **70**, 556; **75**, ii, 301, 304; **78**, 259, 262, 305, 380, 1306, 1308, 1315.
- Velocities of, computation, Tennessee River, **99**, 2279.
- Velocities of, Connecticut River, **68**, 763.
- Velocities of, cross section and slope, terms of, **72**, 139; **79**, 1579.
- Velocities of, depth, relation to, **76**, 451.
- Velocities of, depths, various, **69**, 588; **75**, ii, 313.
- Velocities of, determining, current meters for, **78**, 259, 262, 305, 380, 392.
- Velocities of, determining, harbors, **96**, 1237.
- Velocities of, East River, **72**, 805.
- Velocities of, Erie Harbor, **98**, 2740.
- Velocities of, formula for, **72**, 139; **74**, 790; **75**, ii, 79, 344; **76**, 452, 464; **78**, 1308; **79**, 1970.
- Velocities of, formulas for, **82**, 2480; **83**, 1349; **86**, 1302.
- Velocities of, Galveston Bay, **74**, 728.
- Velocities of, Gulf Stream, **76**, 379.
- Velocities of, head, terms of, **76**, 464.
- Velocities of, Hell Gate, **68**, 736.
- Velocities of, Hudson River, **66**, iv, 214.
- Velocities of, Illinois River, **68**, 448; **69**, 253.
- Velocities of, Lake Michigan, **98**, 2331.

Currents—Continued.

- Velocities of, lakes, outlets of, **68**, 961; **70**, 556.
- Velocities of, Lockport to St. Louis, H. D. 263, 59th, 1st.
- Velocities of, Lynn Harbor, Mass., **84**, 546.
- Velocities of, materials, movement of, **76**, 463.
- Velocities of, measuring, **00**, 5400.
- Velocities of, Mississippi River, **79**, 1009.
- Velocities of, Newburyport, Mass., **81**, 508.
- Velocities of, Niagara River, **68**, 955.
- Velocities of, observing, methods, **93**, 3669.
- Velocities of, Ohio River, **76**, ii, 301.
- Velocities of, piers, **98**, 2740.
- Velocities of, reduction, **93**, 1624.
- Velocities of, Reedy Island, Del., **84**, 820.
- Velocities of, river bends, effect of, **75**, 575; **76**, ii, 265.
- Velocities of, river depth, relations, **76**, 451.
- Velocities of, rivers, **93**, 2366.
- Velocities of, Rock Island Rapids, **68**, 426, 433.
- Velocities of, Sacramento River, **79**, 1752.
- Velocities of, St. Clair River, **68**, 955.
- Velocities of, St. Lawrence River, **68**, 956.
- Velocities of, Ste. Marie River, **68**, 955.
- Velocities of, Sandy Hook, N. J., **85**, 777, 784; **86**, 727, 740.
- Velocities of, South Pass, **94**, 1345.
- Velocities of, subsurfaces, **70**, 574, 626.
- Velocities of, surfaces, **68**, 763.
- Velocities of, Tennessee River, **93**, 2366; **96**, 2021; **00**, 2963.
- Velocities of, terms of hydraulic radius and slope, **79**, 1579.
- Velocities of, Yaquina Bay, Oreg., **87**, 2468.
- Water jet, currents induced by, **79**, 383.
- Winds on, effect of, Lake Erie, **98**, 2712.

Currents, Littoral. (See Shores.)

- Action of, theories, Jamaica Bay, H. D. 1506, 60th, 2d.
- Brazos River, **97**, 1839.
- Directions of, conditions governing, **02**, 2503.
- Directions of, Pacific coast, **00**, 4444.
- Gulf of Mexico, **74**, 738; **75**, 940; **76**, 379; **77**, 433; **81**, 1353, 1369.
- Long Island Sound, **69**, 414.
- Newburyport, Mass., **83**, 437.

Currents, Rapid.

- Boring in, **93**, 3162.
- Bridge piers, effect on, **95**, 734.
- Soundings, **93**, 3162.

Currents, Shore.

- Observing, Great Lakes, **03**, 2086.

Currents, Tidal.

- Enormous, Charleston Harbor, **95**, 1422.
- Ice dikes, effect of, **93**, 1146.
- Nantucket coast, H. D. 536, 62d, 2d.

Currents, Tidal—Continued.

- Observations, **96**, 1228.
- Powerful currents, effect of, Charleston Harbor, **99**, 1552.
- Sand and silt, effect on, **71**, 525; **73**, 994.
- Stone jetties, building; effect on, **93**, 3501.
- Undercurrent, Penobscot River, **68**, 866.
- Velocities, **94**, 999.
- Velocities, Harlem River, **96**, 848.
- Velocities, Ocracoke Inlet, **94**, 999.
- Velocities, Passes, **74**, 790.

Curtaining.

- Dikes, **98**, 1860.

Curtains. (See Dikes.)

- Bank protection, **99**, 3706.
- Building, bank protection, **94**, 1597.

Curtains, Wire.

- Brownlow weed dikes, superior to, **80**, 1458.

Curves. (See Bends; Jetties.)

- Concrete pier construction, **04**, 3802; **05**, 1986.
- Pile driving, jetties, **94**, 2544.
- Proper widths, improved channels, **05**, 1496.
- Waterways, intracoastal, H. D. 391, 62d, 2d.

Cushions, Wooden.

- Stone, effect on, **75**, ii, 845.

Cut-off Boxes.

- Torpedoes, **89**, 492.

Cut-offs. (See Rivers.)

- Advantageous, Mispillion River, H. D. 678, 62d, 2d.
- Danger, rivers, **71**, 381; **75**, 540.
- Disadvantages of, floods, **01**, 2345.
- Forming, rivers, **70**, 376; **75**, ii, 499, 507.
- Inadvisability, rivers, **96**, 1578.
- Method of shortening rivers, Leipsic River, Del., H. D. 574, 61st, 2d.
- Preventing, Mississippi River, **04**, S., 235.
- Rivers, **76**, 292.
- Rivers, injurious effect of, **72**, 435; **73**, 645; **75**, 540; **79**, 899.
- U. S. should get rights across bends free of charge, H. D. 523, 61st, 2d.

Cuts. (See Canals; Dredging.)

- Location, dredging, **97**, 3695.

Cutter. (See pl. 53.)

- Hard material, hydraulic dredges, **05**, 3034; **06**, 1964.
- Frame, hydraulic dredges, **05**, 3034.

Cutwaters.

- Molds for, concrete piers, **01**, 2832; **04**, 3802.

Cypress Stumps.

- Teredo ravages, **76**, 327.

Cypress Timber.

- Remarkable preservation of, **76**, 327.

D.

Damages.

Waived by owners of adjacent land, river and harbor improvements, Manistee, Mich., H. D. 599, 62d, 2d.

Dampness.

In concrete structures. (See Forts, p. 1797 of this Index, for details in various climates, etc.)

Dampproofing. (See Dampness, above.)**Dams.** (See Canals; Reservoirs; Water Power; Weirs; see pls. 15, 17-22, 25, 27, 28, 30, 36.)

Abutments, building, 97, 2550.

Abutments, designing, 00, 2983.

Abutments, failures, 04, 3767.

Abutments, plans, Lockport to St. Louis, H. D. 263, 59th, 1st.

Abutments, reconstruction, timber replaced by concrete, 11, 2106.

Banks above and below, protecting, 94, 2108.

Bear-trap. (See Dams, Bear-trap, below.)

Bear-trap gates for, improved, 93, 2265.

Bear Valley, 98, 2825.

Borings, 01, 2758.

Breaks in, repairing, mattress placing, 95, 3781.

Building, 88, 1007; 91, 2364; 92, 1592, 2115, 2647; Atlas, 116; 97, 2550; 98, 2092, 2120; 00, 2182, 3515.

Building, Allegheny River, 99, 2404.

Building, cableway, 99, 2176.

Building, central power plant, advantages of, 93, 2485.

Building, cofferdams, 98, 2120.

Building, company for, act incorporating, 93, 2097.

Building, gangs, arrangement of, 00, 2788.

Building, hydraulic methods, 98, 2828.

Building, objects to be sought, 04, 3765.

Building, plant for, 93, 2485; 99, 2174; 00, 2775.

Building, scour, preventing, mattress placing, 98, 3030.

Building, Yamhill River, 99, 3236.

Channel diversion, 98, 1954.

Cofferdam. (See Cofferdams.)

Cofferdams, building, 97, 4020.

Commerce, when a benefit to, 03, 1501, 1507.

Concrete in, placing, 96, 2200.

Concrete work, 00, 3472.

Concrete work, building, 95, 1675; 00, 3482, 5001.

Concrete work, building, plant for, 96, 2260.

Concrete work, building, plant for, arrangement of, economical, 00, 2792.

Concrete work, cost of, items of, 96, 2203.

Concrete work, foundations, building, 96, 2202.

Dams—Continued.

Concrete work, plans for, 97, 3946.

Concrete work, proposed, Ohio River, 99, 2556.

Construction, details governing, western rivers, 01, 2768.

Crests for, movable; Kanawha system, H. D. 480, 62d, 2d.

Cribs protecting extension, 04, 2107.

Deposits behind, forming bars, after floods, 11, 1581.

Designing, 00, 2972, 2983.

Designing, Mississippi River, H. D. 263, 59th, 1st; H. D. 50, 61st, 1st.

Discharge over, 79, 1552; 00, 2969.

Drift gaps, 89, 1852.

Effect of, determining, mathematical methods, 00, 2968.

Electric power dams, 94, 1780.

Exposure to air, effect, 87, 2107.

Extension work, 04, 2105, 3772.

Fish, effect on, 73, 929.

Fishways, building, 96, 2240.

Flexure, preventing, 94, 1923.

Floods, effect on, 77, 742; 00, 2172, 2985; 04, 1297.

Flushboards, 98, 2344.

Flushboards, canals, 97, 2713.

Foundations, building, 99, 2483.

Foundations, mattresses for, 89, 1093.

Foundations, pile-driving, 00, 5002.

Freshets, levels, effect on, Merrimac River, Mass., H. D. 2, 61st, 1st.

Gates. (See Gates, Lock.)

Headwaters, Mississippi River, 03, 1534.

Height of, formula, 78, 534; 87, 1306.

Height of, raising, 97, 4020.

Ice. (See Ice.)

Ice movement, lowering dams prior to, Ohio River, 11, 2136.

Illinois and Mississippi Canal, 08, 2019.

Lake Superior and Mississippi Canal route, 96, 2431.

Leaks in, stoppage of, 92, 2075.

Locks and, rivers, improving, 00, 2349. (See Locks.)

Locks and, water-power rights, preserving, 98, 983.

Log sluices, flooring of, 96, 1836.

Mattresses, building, 00, 4804.

Mattresses, placing, 98, 3030.

Mattress foundations, 89, 1093.

Mattress sill, scour at, 96, 3827.

Maximum slope, 76, 374, ii, 284.

Missouri River, 94, 1780.

Navigable passes, 93, 2269.

Navigable passes, bear-trap gates, 96, 1838.

Navigable passes, designing, 93, 2269.

Dams—Continued.

Place for, river regulation, **02**, 1874.
Plans, Lockport to St. Louis, H. D. 263, 59th,
1st.
Ramous, effect of, **76**, 375.
Reconstruction, concrete used, with movable
crest, **05**, 1842.
Reconstruction, condition of, Lake Winne-
bigoshish, **01**, 2313.
Reconstruction, cost, Ohio River, **05**, 1843.
Reconstruction, Leech Lake, **01**, 2316.
Reconstruction, Pokegama Falls, **05**, 1674.
Repairs, Coosa River, **02**, 1278.
Repairs, miter sills, cofferdam for, **05**, 1942.
Repairs needed, after floods, Ohio River, **01**,
2627.
Repairs, procedures, **12**, 2332.
Repairs, sheet-pile bulkhead used in, **02**, 1278.
Retaining walls, method of building new con-
crete wall, **06**, 1611.
River banks and, **68**, 448; **73**, 232.
River banks, contraction, Mississippi River,
94, 1593.
River banks, effect on, **73**, 232.
River banks, rectification of, effect on, **76**, ii,
408.
Rivers, **00**, 2967.
Rivers, effect on, **97**, 2250.
Rivers, improvement of, **00**, 2349.
Rivers, improvement of, temporary, **98**, 1650.
Sand foundations, **74**, 414.
Scour produced by bear-trap gate eddies, arrest
of, **11**, 2141.
Settlement of, rivers, **97**, 2208.
Sills, **04**, 2107.
Sites, land sheet of, **00**, 2786.
Sites, those found suitable should not be dis-
closed publicly, **01**, 2758.
Sluices in, objections to, **75**, ii, 609.
Small dams, building, **00**, 4348.
Soft foundations, building on, **94**, 2151.
Steamboat swept over, Monongahela River,
08, 1767.
Stock ramming, **91**, 2714; **92**, 2405; atlas, 110.
Storage reservoir; Ouachita system, H. D. 588,
68d, 2d.
Surveys, **96**, 2214.
Swell on, formula, **87**, 1306.
Swell on, height, **87**, 1306.
Systems of, rivers, **00**, 3203.
Timber foundations, **00**, 2771.
Tops, Betwa adjustable, **11**, 2111.
Undermining, scour, preventing, **00**, 3258.
Value, river regulation, factors determining,
03, 1501.
Various reservoir dams, **82**, 1830.
View of, **00**, 2532.
Water on, depth, formula, **77**, 742.
Water power from, flushboards, Fox River,
99, 2790.
Water power, rights; preserving, Connecticut
River, **98**, 938.
Water power, who has right to, State or U. S.,
Troy, N. Y., Sen. D. 887, 62d, 2d.
Weirs, discharge over, formula, **90**, 2144.

Dams, Bear-trap. (See Dams, Movable.)

85, 1862; **87**, 1882; **94**, 1922.
Design, weaknesses in, Ohio River, **05**, 1843.
Flexure, preventing, **94**, 1923.
Improvements, **94**, 1922.
Operating valve and conduit, Lake Winne-
bigoshish, **01**, 2314.
Scour above and below piers, **05**, 1844.
Small streams, utility on, **96**, 1641.
Stickney's, **99**, 2555.
Utility of, small streams, **96**, 1641.

Dams, Boulé.

Foundations, **00**, 3482.
Frame up, **00**, 3482.
Indiana Chute project, details, **02**, 1976.
Piers for, **00**, 3482.

Dams, Brush and Pile Wing.

Building, **95**, 3300.

Dams, Brush and Rock.

Sand dams and, comparison and tests, **98**,
1758.

Dams, Brush and Sandbag.

77, 1030.

Dams, Brush and Stone.

Ballasting, **94**, 2893.
Bayou Courtableau, **83**, 1123.
Building, **94**, 2891; **00**, 4350.
Columbia River, **87**, 2513.
Crib mats, **94**, 2892.
Foot mats, **94**, 2892.
Hoisting plant, **94**, 2893.
Improvement with, abandoned on Wisconsin
River, **87**, 2096.
Mississippi River, **94**, 2863.
Paving, **94**, 2893.
Permanent, **73**, 444, 448; **75**, ii, 461; **76**, ii, 405;
78, 478, 483.
Repairing, **95**, 3782.
Savannah River, **80**, 934, 944, 1085; **82**, 1168.
Willamette River, **80**, 2259, 2289.
Wisconsin River, **80**, 1962.
Yellowstone River, **82**, 1743.
Yuba River, **81**, 2492.

Dams, Chanoine. (See Dams, Wicket.)

Design, special, **02**, 2500.
Not unsafe standing in a rise, **12**, 2313.
Ramming, **12**, 2313.

Dams, Check.

Advantages of, rivers, **93**, 2355.
Longitudinal and, superiority of, rivers, im-
proving, **93**, 2355.

Dams, Chute.

Building, **96**, 1870.
Mattresses, **94**, 3142.
Settlement of, **96**, 1887.

Dams, Concrete.

Design, details of, **02**, 1668.
Logs, effect of, on, **04**, 2650.
Mammoth Hot Springs, **03**, 2476.
Reconstructing, **05**, 1842.

Dams, Crib.

Coosa River, **78**, 764.
Cumberland River, **75**, 797, 800.

Dams, Crlb—Continued.

Foundations of, **96**, 1833.
 Fox River, **76**, ii, 416; **78**, 1178.
 Illinois River, **69**, 218.
 Kentucky River, **79**, 1406, 1411.
 Plan of, **98**, 2019.
 Sliding of, preventing, **93**, 2767.
 Wabash River, **77**, 668; **78**, 832; **79**, 1442.
 Youghiogheny River, **74**, 562.

Dams, Crlb and Stone.

94, 2107.
 Building, **94**, 2107.
 Foundations, dredging, **94**, 2107.
 Plans, **96**, 1434.

Dams, Deflecting.

Hull of sunken steamer used, **98**, 1391.

Dams, Earthen.

Building, **98**, 2828.

Dams, Earthen Reservoir.

Building, **98**, 2828.

Dams, Emergency. (See pls. 44, etc.)**Dams, Fixed.**

Movable and, comparison, **74**, 566; **75**, ii, 95;
77, 643; **79**, 1354; **89**, 1991; **92**, 2102.

Dams, Fixed and Movable.

Canalization of Mississippi River, H. D. 50,
 61st, 1st.

Dams, High.

Efficacy doubtful, **97**, 2100.

Dams, Impounding.

Plans, mining débris, **00**, 5040.

Dams, Longitudinal.

Advantages, rivers, **93**, 2355.
 Check and, superiority of check dam, rivers,
 improving, **93**, 2355.

Dams, Masonry.

Building, **98**, 2206.
 Des Moines Rapids, **67**, 326.
 Elk River, **76**, ii, 170.
 Foundations of, **98**, 2208.
 Greenbrier River, **77**, 711, 718, 730, 734.
 Kentucky River, **79**, 1409, 1411.
 Potomac River, **68**, 922.
 Red River, **75**, 905, 909.
 Reservoirs, **98**, 2824.
 Sections of, **97**, 4022.
 Wooden and, comparison, **76**, ii, 87.

Dams, Movable. (See Chanoine Wickets; see
pls. 36, 42, 43.)

Abutments, building, **97**, 2548.
 Accidents, tripping apparatus a cause of, **07**,
 1777.
 American system, **74**, 455, 472; **79**, 1548.
 Approaches, building, **97**, 2549.
 Bear-trap system, **85**, 1862; **87**, 1882.
 Building, **97**, 2570.
 Building, cofferdam work, **92**, atlas, 94-99
 (views), **96**, 2251.
 Building, details of, **97**, 2534; **98**, 2120.
 Chains for, **98**, 2127.
 Chanoine system, **80**, 632, 1737.
 Chanoine type, Missouri River, **11**, 2012.
 Concrete for, handling, **96**, 2260.
 Construction, Ohio River, **99**, 2352.

Dams, Movable—Continued.

Cost of, **74**, 566; **76**, ii, 18; **79**, 1330.
 Cost of, estimating, **00**, 2358.
 Davis Island dam, first United States experi-
 ment with movable dams, **89**, 1870, 1874.
 Designs of, **00**, 4327.
 Details, **98**, 2120.
 Details, Big Sandy River, **97**, 2534.
 Details, Great Kanawha River, **99**, 2484.
 Details, modifications, **96**, 2302.
 Discussion, **74**, 417; **75**, 688, 910, 924, ii, 608;
76, ii, 29, 608.
 Drift an enemy, **98**, 2145.
 Drift, effect of, **96**, 2312.
 First built, United States, **98**, 2136.
 Fixed and, compared, **75**, ii, 95; **77**, 643; **79**,
 1354; **89**, 1991; **92**, 2102.
 Floods, effect of, **96**, 2312.
 Forms, **90**, 2145.
 Foundations, building, **96**, 2252.
 Height, limit of, **79**, 1323, 1342.
 Horse boxes, continual breakage, cause and
 remedy, **11**, 2141.
 Hydraulic gates, Bishop's, **69**, 65, 529.
 Hydraulic gates, Brunot's, **73**, 540; **75**, ii, 608.
 Improvements, Big Sandy River, **99**, 2507.
 Items of expense, **00**, 2358.
 Kanawha River, **75**, ii, 92, 95; **76**, ii, 15, 158,
 164; **77**, 299, 302, 747, 753; **78**, 467; **79**, 547,
 550.
 Lehigh River, **74**, 417.
 Lock and, relative dimensions, **75**, 615; **78**,
 804.
 Locks in, details, **87**, 1304.
 Locks, head of, **78**, 804.
 Maneuvering, **76**, ii, 31; **79**, 1324, 1330; **96**,
 2257; **97**, 2555.
 Maneuvering, appliances, **87**, 1742.
 Maneuvering, frequency of, **78**, 474.
 Memoir on, **76**, ii, 28.
 Minnesota River, **75**, 364.
 Model of, Osage River, **98**, 3546.
 Navigable passes, **96**, 2311.
 Ohio River, **76**, ii, 11; **77**, 637, 639, 646, 747,
 753.
 Operating, **98**, 2146.
 Operating, Great Kanawha River, **80**, 682;
81, 913, 921, 927; **82**, 921; **83**, 711; **84**, 932;
85, 1852; **86**, 1594; **87**, 1913.
 Operating, Kentucky River, **84**, 1733; **85**, 1862,
 1869, 1876; **87**, 1882.
 Operating, Ohio River, **85**, 1785; **86**, 1528, 1540,
87, 1786.
 Operation, extent of, **12**, 2420.
 Operation, under noteworthy weather condi-
 tions, **11**, 2137.
 Pasquean, wickets for, **80**, 1753.
 Passes, building, details, **97**, 2546.
 Passes, sills, **96**, 2313.
 Passes, substructure, details of, **97**, 2546.
 Piers, building, **97**, 2548.
 Port a l'Anglais, **74**, 406; **75**, 688; **76**, ii, 15.
 Proposed, Ohio River, **99**, 2361.
 Protection works, building, **97**, 2549.
 Rises, not injured by, if kept standing, **12**,
 2329.
 River bed, raising of, **96**, 2312.

Dams, Movable—Continued.

- Rivers, improvement of, **75**, 688, ii, 613, 630;
76, 624, ii, 25.
Sand accumulations, effect of, **98**, 2146.
Special design, **97**, 3952; **98**, 3546.
Statistics, France, **79**, 1317.
Strains, discussion of, **75**, 690, 910; **76**, ii, 42;
97, 3956.
Successful, **92**, 20, 57.
Surveys for, **95**, 1899.
System successful, **12**, 2326.
Systems, caisson, **74**, 417.
Systems, Caméré, **79**, 1339.
Systems, Caméré and Poirée, comparison, **79**,
1341.
Systems, Carro, **74**, 465, 472.
Systems, Chanoine, **74**, 406, 424, 426, 428, 433,
451, 472; **75**, 688, 917; ii, 91, 96, 609, 611; **76**,
ii, 15, 30, 153, 164; **77**, 299, 302, 747, 751.
Systems, Chanoine, modifications of, Belgium,
79, 1327.
Systems, Cuvinot, **74**, 457, 472.
Systems, Desfontain's, **74**, 426, 433, 441, 472;
75, ii, 611.
Systems, Fouracre, **75**, 919.
Systems, Girard's, **79**, 1548; **74**, 469, 472; **75**,
726, 730, 732, 914; ii, 611.
Systems, John's, **79**, 1548.
Systems, Krantz, **74**, 460, 472; **75**, ii, 608, 611.
Systems, Petitdidier, **74**, 474.
Systems, Poirée, **74**, 419, 422, 426, 433, 442, 447,
459, 472; **75**, 364; **76**, ii, 29; **79**, 1318.
Systems, Poirée and Caméré, comparison, **79**,
1341.
Systems, Poirée, modifications of, Belgium,
79, 1322.
Systems, Poirée, superiority of, **79**, 1316.
Systems, Schopp's, **74**, 476.
Systems, Tavernier, description of, **79**, 1335.
Systems, Tavernier, modification of, **79**, 1336.
Systems, Thenard's, **74**, 418, 422, 472.
Systems, White's, **74**, 417.
Systems, Wood's, **74**, 474.
Trestles, **96**, 2313.
Trestles, calculations, **97**, 2558.
Trestles, maneuvering, **96**, 2315.
Tripping device, **91**, 2353.
Waterways, intracoastal, H. D. 391, 62d, 2d.
Weirs, **96**, 2311.
Wickets, **98**, 2120.
Wickets, long and short, difference, **08**, 1797.
Wickets, operating, **98**, 2120.
Youghiogheny River, **74**, 564.

Dams, Needle.

- Advantages of, **98**, 2148.
Highest in the world, **98**, 2144.
Leakage, preventing, **98**, 2146.
Modifications, **96**, 2310.
Needles, calculations for, **97**, 2558.
Needles, placing, **98**, 2147.
Needles, tripping, **96**, 2317.
Operating, easy methods, **00**, 3356.
Operating, safest methods, **00**, 3356.
Operating, views showing operation, **98**, 2144.
Plans, **97**, 2560; **98**, 2144; **00**, 4328.
Tightest in the world, **98**, 2144.
Views, Big Sandy River, **97**, 2560.

Dams, Old.

- Rebuilding, Green and Barren Rivers, **99**,
2596.
Ruins troublesome, building new work, **04**,
2106.

Dams, Permanent.

- Rivers, improving, **74**, 285, 286, 287, 288, 289;
75, ii, 612; **76**, 624; **77**, 746; **78**, 535.

Dams, Permeable Hurdle.

- 98**, 1703; **99**, 2061.

Dams, Pile.

- 76**, ii, 416; **94**, 1266.
Chute closing, **93**, 3523.
Depressions in, raising, **00**, 4805.
Double row of piles, **94**, 1266.
Fox River, **76**, ii, 416; **78**, 1178.
Savannah River, **77**, 374.
Spurs, **93**, 1562.

Dams, Pile and Brush.

- 79**, 1036.
Building, **93**, 2229.
Filling of, boxes of sand, **93**, 3267.
Section, **98**, 3030.

Dams, Pile and Pole.

- 93**, 1708.

Dams, Pile and Stone.

- 96**, 1671.
Dikes, building, **95**, 2230; **96**, 3245.
Jetties, **83**, 437, 584.

Dams, Power.

- Removing old and abandoned, Allegheny
River, **11**, 2118.

Dams, Private.

- Connecticut River, H. D. 818, 61st, 2d.

Dams, Reservoir. (See Reservoirs; see pl. 18.)

- Building, cofferdams, **96**, 1834.
Concrete, Yellowstone National Park, **02**,
3044.
Crevasses, closing, **97**, 2143.
Cribwork, **96**, 1837.
Flumes in, **96**, 1837.
Foundations, excavating, **96**, 1834.
Height, raising, Great Falls, **96**, 3926.
Mississippi River, **81**, 1763, 1765; **83**, 1455, 1463,
1472, 1475; **85**, 1748; **86**, 1502; **87**, 1667, 1675,
1686.
Operating, methods, **93**, 2265.
Potomac River, **84**, 2321; **85**, 2469, 2478, 2496.
Sheet piling, **96**, 1835.
Sites, Lake Superior; Mississippi River Canal,
96, 2432.
System, headwaters, Mississippi River, **06**,
1433.
Tainter gates, counterweights, etc., **01**, 2314.
Varieties of, **98**, 2824, 2877.
Various, **82**, 1830.

Dams, Restraining.

- Hydraulic mining, specifications, **04**, 3698.

Dams, Rolling.

- Falls of St. Anthony, **74**, 284; **76**, 699; **77**, 565.

Dams, Settling.

- 94**, 2864.

Dams, Sheet Pile.

Foundations, quicksand pocket, effect of, **98**, 1487.

Undermining of, **98**, 1487.

Wing, building, **95**, 1727.

Dams, Sheet Pile Wing.

94, 1335.

Dams, Side.

Waterway improvement, Mississippi River, H. D. 50, 61st, 1st.

Dams, Sill.

Effect of, Atchafalaya River, **97**, 3810; **98**, 3447.

Mississippi River, H. D. 50, 61st, 1st.

Sections of, Atchafalaya River, **98**, 3448.

Slopes, Atchafalaya River, **98**, 3447.

Soundings over, **99**, 3637.

Dams, Spillway. (See pl. 19.)**Dams, Spur.**

Fascines, **93**, 1562.

Foundations, **92**, 1318.

Ineffectual, sandbars, **01**, 1661.

Types, Altamaha system, H. D. 443, 62d, 2d.

Dams, Storage.

River regulation, **07**, 2265.

Dams, Submerged.

Fish passage, **01**, 3515.

Dams, Swash.

Damage of, storms, **00**, 1820.

Profile, Cape Fear River, **00**, 1822.

Dams, Temporary.

Building, **93**, 2421; **00**, 3482.

Dams, Timber.

Building, **98**, 2350; **00**, 3508.

Reinforced with concrete, **03**, 1760.

Dams, Timber and Stone.

Strengthening, **98**, 2000.

Dams, Tralling.

Favorable results, river improving, **98**, 1788.

Dams, U. S.

Power derivable through, consideration of, St. Paul to Minneapolis, H. D. 218, 60th, 1st.

Dams, Water-Power.

Proposed, Muscle Shoals Canal, H. D. 781, 60th, 1st.

Dams, Wicket. (See Movable Dams; see plates.)

Lowering, difficulties of, in rises, **12**, 2328.

Movable dams, **80**, 1753.

Operating, movable dams, **98**, 2120.

Dams, Wing. (See plates.)

Building, **87**, 419; **92**, 1472; **93**, 3526; **99**, 2924.

Channel deepening, **93**, 3571.

Cheaper than canalization for securing river channels, H. D. 341, 59th, 2d.

Connecticut River, **78**, 269.

Depths, effect on, rocky channels, **99**, 1684.

Early-built dams, stability of, **98**, 1893.

Efficient, **00**, 2573.

Illinois River, **77**, 562.

Jetties, **94**, 1336.

Mississippi River, **75**, ii, 461, 466.

Dams, Wing—Continued.

Paving, Rock Island Rapids, **94**, 1664.

Piles and horizontal timbers, dams of, **71**, 359.

Rivers, effect on, **97**, 2250.

Rivers, Mississippi River, **74**, 302; **75**, 453;

76, 655; **77**, 529.

Sheet piles, dams of, building, **94**, 1335; **95**, 1727.

Shore protected by, **75**, ii, 460.

Wisconsin River, **72**, 140, 144, 146, 147; **74**, 169; **75**, 225; **76**, ii, 402.

Yamhill River, **99**, 3238.

Dams, Wooden.

Masonry and, comparison, **76**, ii, 87.

Dams, Wooden Reservoir.

Deterioration, rapid, **00**, 2787.

Rock substituted for, advantages, breakwaters, **93**, 3202.

Danubé.

Regulation details, **02**, 1771.

Datums. (See Stations; Surveys.)

Fortifications, **04**, 3721.

Deaths.

Contaminated water supply and, Washington, D. C., **08**, 2364.

Débris, Mining. (See p. 2108 of this Index.)

Barrier system a protection against, **07**, 2265.

Dredging difficult, **95**, 925.

Treatment, Rivers, H. D. 1123, 60th, 2d.

Waterways, protecting, **07**, 2264.

Decisions.

Rights of U. S. to navigable waters, H. D. 99, 58th, 3d.

Decking, Tight.

Importance of, breakwaters, **80**, 2215; **84**, 2144.

Deeds.

Right of way, form, **02**, 1638.

Deep Water.

Mattresses, jetties, **91**, 3187.

Riprap jetties, **91**, 3187.

River bends, convexity of, effect on, **79**, 1192.

Deep Waterway Commission, Great Lakes to Atlantic tidewaters.

Report of this commission printed as H. D. 192, 54th, 2d.

Reports of the board as follows:

(1) Progress report, H. D. No. 110, 55th, 3rd.

(2) Regulation of Lake Erie, H. D. 200, 56th, 1st.

(3) Final report, estimates, H. D. 149, 56th, 2d.

Defense. (See Forts; Torpedoes.)

Appliances for, measures for, obtaining, **8C**, 520.

Canals, value of, Delaware and Chesapeake Canal, S. D. 215, 59th, 2d.

Elements of, estimates, harbor defense, **84**, 54.

Elements of, plans, harbor defense, **87**, 10; **89**, 5.

Harbor fleet, **81**, 403.

Harbors, rivers and, planning, **87**, 10; **89**, 5; **95**, 4.

Defense—Continued.Supplies for, **99**, 14.

Waterways, intracoastal, H. D. 391, 62d, 2d.

Deflection. (See Breakwaters.)Currents, **95**, 734.**Deflectors.**Novel plan, Missouri River, **77**, 500; **78**, 640, 654; **79**, 1014, 1054, 1058, 1061, 1077, 1088.**Deflectors, Current.**Dikes, Missouri River, **11**, 2002.Haupt system, experiments, Delaware River, **88**, 671.Movable deflectors, Havre de Grace, **71**, 72.Susquehanna River, **67**, 419, 427.**Deforestation.** (See Forests.)**Degrading.** (See Dikes.)Dikes, **97**, 3909.**Degree.**Lengths of, meridian, **70**, 544; **73**, 1174.**Delays.**Locks, deposits a cause, **09**, 1830.**Deltas.**Bars at, forming of, **74**, 804; **76**, 449, 458.Characteristics of, **74**, 805.Jetties, effect of, **74**, 785; **75**, 980.**Deposits.** (See Bays; Breakwaters; Canals; Channels; Fill; Reservoirs; Rivers.)Accumulation, rate of, Savannah River, **09**, 1324.Backwater, due to, rivers, **97**, 1967.Causes, channels, **98**, 2620.Checking, bayous, **93**, 3469.Dams, behind, bars from, **11**, 1581.Drift and, effect of removal of guard locks of canal, **05**, 1755.Locks, delay in, due to deposits, **09**, 1830.Mill waste, river channels, **98**, 840.

Oyster beds, destructive effect on, Biloxi Harbor, H. D. 1088, 60th, 2d.

Rate of, tables, Maumee River, **98**, 2623.Rates of, **03**, 2060.Removing, sluicing for, canals, **88**, 2166.Reservoirs, **93**, 4297; **98**, 2823.

Sedimentation, Missouri River, H. D. 1120, 60th, 2d.

Water conduits, **92**, 3357; **96**, 3924.**Deposits, Artificial.** (See Deposits; Fill.)Harbors, injury of, **81**, 1679, 2485; **83**, 1696; **85**, 1820; **86**, 1092; **87**, 724, 1933.**Depots, Storage.**Need for, U. S. plant, **03**, 2073, 2136.**Depressions.** (See Dikes.)Raising, pile dikes, **00**, 4805.Reservoir sites, for, **98**, 2822.**Depths.** (See Bed Rock; Channels; Harbors;

Jetties; Lakes; Rivers; Waterways.)

Canalized rivers, **97**, 2711.

Commerce, adequate depths for modern, Mobile Harbor, Ala., H. D. 657, 61st, 2d.

Determining, canals, Puget Sound, H. D. 953, 60th, 1st.

Determining, Detroit River, H. D. 676, 61st, 2d.

Depths—Continued.Determining, harbors, **96**, 1237.Harbors, Great Lakes, **11**, 2323.Increase of, jetties, vicinity of, **95**, 1798.Increasing, wing dams, effect of, rocky channels, **99**, 1684.Jetty currents, **00**, 2233.Jetty ends, **95**, 1735.

Maintaining, before regulation works are constructed, Mississippi River, H. D. 50, 61st, 1st.

Maintaining, Savannah River, **09**, 1323.

Obtaining, various methods, Sabine Pass and vicinity, H. D. 772, 61st, 2d.

Required depths, lake harbors, **67**, 17, 34, 252, 255; **73**, 343; **74**, 213; **76**, ii, 543; **77**, 113, 947, 953.

Restoring, in channels, Portland, Me., H. D. 489, 62d, 2d.

Velocity and, relation, rivers, **76**, 451.

Vessel draft, commerce not increasing as fast as, Wilmington, Ala., H. D. 1114, 60th, 2d.

Depths, Increased.

Demand for, source of, Portland, Me., H. D. 489, 62d, 2d.

Derrick Boat. (See pls. 55, etc.)**Derrick, Floating.**Bank grading, **01**, 2225.**Derrick Work.** (See pls. 49, etc.)**Derricks.**Lock, building, **96**, 1937.Piers, building concrete, **04**, 3802.Pile driving with, **01**, 922.**Descriptions.**

Tabular, of rivers, H. D. 862, 61st, 2d.

Detritus. (See Débris; Mining.)Hydraulic mining, **82**, 2556, 2620.**Dewpoint.**Evaporation and relation, **76**, 526.**Diamonds.**Salted mine, Ruby Gulch, **73**, 1208.**Dikes.** (See Ditches; Harbors; Ice; Jetties; Piers; Rivers; see pls. 5, 14-17, 63.)Accretions, **93**, 4247; **95**, 2217, 2218.Arrangement, Mississippi River, **05**, S., 196.Arrangement of, proper; sand-bearing rivers, **72**, 139.Bank protection, **99**, 3505.Bars, movement of, controlling, **96**, 1907.Bracing, **94**, 1598.Breaks, repairing, Cumberland Sound, **05**, 1287.Brownlow weeds for, **80**, 1438, 1454, 1458.Brush and timber foundations, **76**, 315.Building, **88**, 670; **89**, 2762, 2778, 2789, 2790; **91**, 3365, 3596, 3843, 3849; **92**, 928; **93**, 4240; **95**, 2342; **97**, 3903, 3919.Building, bank protection, **96**, 1879.Building, economy of trestle and track in, **02**, 2401.Building, methods, improved, **98**, 1852.Building, Mississippi River, **00**, 4778.Building, Missouri River, **96**, 3815, 3839.Building, regulations, Skagit River, **98**, 3118.

Dikes—Continued.

Building, St. Johns River, **94**, 1215.
 Building, Upper Mississippi River, **75**, 478, 488.
 Building, various methods in detail, **02**, 1576.
 Building, Winyaw Bay, **95**, 1351.
 Channel, contracting, **00**, 4272.
 Channel, forming of, experiments with dikes, **00**, 4778.
 Channel, making, questionable value, Swinomish Slough, H. D. 796, 61st, 2d.
 Concrete construction, Missouri River, **11**, 1992.
 Concrete in, **87**, 972.
 Concrete pile construction, Missouri River, **11**, 1992.
 Cost, Missouri River, **03**, 2439; **04**, 2319.
 Cost of reducing, Galveston Bay, C. D., 1, H. R., 62d, 1st.
 Cracking of, due to eddies, **02**, S., 102.
 Cross section, and estimate, Galveston, **02**, 1401.
 Current deflector, patent form, Missouri River **11**, 2002.
 Currents, effect on, **69**, 382.
 Curtains, building, **94**, 1597; **98**, 1860.
 Degrading, **97**, 3909.
 Depressions in, repairing, **98**, 3361.
 Design, standard, Missouri River, **11**, 2004.
 Dredging and, channel formation, H. D. 796, 61st, 2d.
 Dredging and, to deepen Savannah River, **09**, 1320.
 Eddy breakers, successful as, **02**, S., 101.
 Effect of, **98**, 3499.
 Effect of, Missouri River, **96**, 3815, 3823, 3843, 3927; H. D. 1287, 61st, 3d.
 Effect, study of possible, Galveston, **02**, 1393.
 Experiments with, **99**, 3505.
 Experiments with, channel forming, **00**, 4569.
 Filling, dredgings for, **94**, 1061.
 Floods, effect on, **04**, 1297.
 Form, simple; experiments, Mississippi River, **01**, S., 235, 245.
 Gasconade River, **96**, 3801.
 Gorges caused by, rivers, **04**, 1092.
 Harbors, **89**, 764.
 Hudson River, **66**, iv, 203, 214, 217; **67**, 445; **69**, 382; **70**, 430, 433; **71**, 720; **73**, 932; **74**, ii, 159; **75**, ii, 199; **76**, 236; **77**, 227.
 Ice, protection against, **93**, 2943.
 Length of, shore protected by dike and, relation, **73**, 453; **74**, 332; **76**, 629.
 Materials, best, **91**, 763.
 Mattress, brush; objectionable, Gulf, **02**, 1401.
 Mattresses, placing of, **00**, 4350.
 Mattress work, **01**, S., 390.
 Objections to, Delaware River, **96**, 887.
 Piles, distance between, measuring apparatus, **98**, 3506.
 Pile driving, improved methods, **98**, 3506.
 Plan of, Ohio River, **78**, 796.
 Pole screens for, **95**, 2236.
 Protection of, dredging, **96**, 2920.
 Protection of, hurdles, **99**, 2058.
 Protection of, ice, against, **74**, ii, 155, 159; **77**, 224.

Dikes—Continued.

Protection of, willows for, **76**, 237.
 Quicksands, settlement in, **95**, 1666.
 Removal, opinions for and against, Flushing Bay, H. D. 98, 58th, 3d.
 Repairs, **96**, 3822, 3842.
 Repairs, Alabama River, **95**, 1666.
 Repairs, mattresses for, **92**, 1519.
 Repairs, profiles, **00**, 2584.
 Restoration methods, **02**, 1605.
 Results from, Missouri River, **94**, 3139.
 Revetment, failure of, **06**, 1882.
 River mouths, effect at, **75**, 949.
 Rivers, contraction of, **94**, 1593.
 Rivers, effect on, **96**, 887; **97**, 1990.
 Rivers, improvement of, **76**, 624; **80**, 1427; **85**, 1576; **87**, 2096, 2761.
 Rivers, improvement of, abandoned for, **87**, 2096.
 Sand closure, preventing, harbor entrances, **96**, 3101.
 Sand foundations, excessive settlement on, **72**, 839; **76**, 629; **79**, 1051.
 Sand movement, controlling, **95**, 2577.
 Scour, effect on, **94**, 1023; **00**, 4336.
 Scour, hindrance to, old dike a, **95**, 2323.
 Screens for, wire netting, **95**, 3964; **98**, 1860.
 Section of, Cape Fear River, **76**, 316.
 Section of, proper, **71**, 326.
 Settlement of, excessive, **72**, 839; **79**, 1051.
 Settlement of, quicksands, **95**, 1666.
 Shore protection by, length of dikes and, relation, **73**, 453; **74**, 332; **76**, 629.
 Sill mattresses, **94**, 2599.
 Solid heads, advantages of, **95**, 4020.
 Specifications for, Missouri River, **96**, 3841.
 Spurs, building, **98**, 3442.
 Stability, double row pile dike filled with stone more stable than cribwork, Great Lakes, **06**, 1699.
 Structures to displace, river improvement, **98**, 3473.
 Success of, regulation of channels, Mare Island, H. D. 1103, 60th, 2d.
 Surveys at, Missouri River, **97**, 3927.
 T-dikes, Missouri River, **01**, S., 410.
 T-heads, strengthening, **98**, 1863.
 Ties, strand, **03**, 2439.
 Timber-groins, **77**, 286.
 Tramway system, **94**, 2893.
 Wire netting, **95**, 4015.

Dikes, Bar.

Details, H. D. 46, 62d, 1st.

Dikes, Brush and Pile.

Building, **94**, 2599; **95**, 3402; **96**, 1400.
 Cape Fear River, **95**, 1337.
 Columbia River, **99**, 3230.

Dikes, Brush and Stone.

78, 672; **80**, 1542; **82**, 1744; **85**, 2378.
 Building, **95**, 2004.
 Sections, Alabama River, **94**, 1280.

Dikes, Close Pile.

Economy of, **95**, 2577.

Dikes, Concave.

Currents, effect on, **69**, 382.

Dikes, Concrete.

Bank protection, **10**, 1842.

Dikes, Crib.

Sand filling, **70**, 428, 432.

Small, building, **97**, 3943.

Unsatisfactory, narrow tortuous channels, **98**, 2069.

Dikes, Crib and Stone.

80, 1738, 1740.

Dikes, Curved.

Ends of, **00**, 4963.

Dikes, Deflecting.

Reversed-abatis, **99**, 3518.

Dikes, Earthen.

Section, **93**, 1448; **94**, 1064.

Dikes, Experimental.

00, 4778.

Dikes, Longitudinal.

Methods, **01**, S., 390.

Plans, **01**, S., 398.

Photographs, Missouri River, **01**, S., 398.

Dikes, Mud.

Building, **95**, 1351.

Dikes, Permeable.

Bracing system, Missouri River, **03**, 2438.

Building, **80**, 1365, 1405, 1427; **81**, 1503, 1508, 1523, 1546, 1552, 1562, 1598, Plates X-XII, 1608, 1610, 1628, 1640, 1649, 1656; **82**, 1499, 1601, 1611, 1635, 1678, 1681, 1685, 1690, 1696, 1699, 1702, 1707, 1722; **83**, 1308, 1312, 1326, 1370, 2279, 2286, 2294, Plate III, Appendix L; **84**, 2759, 2765, 2772, 2817, 2829, 2831, Plate II, Appendix J, Plate IV, Appendix L; **85**, 2753, 2760, 2792; **87**, 1560, 1564, 2760, 3098, 3099, 3112; **88**, 1409; **91**, 3402.

Details, **02**, 1576.

Failure, **87**, 2761.

Repairing, **95**, 4020.

Standard, Missouri River, **03**, 2437.

Superior to most methods for river regulation, Missouri R., H. D. 46, 62d, 1st.

Dikes, Pile.

00, 4963.

Bracing, **95**, 4003; **97**, 3896; **98**, 3499.

Building, **91**, 3606; **95**, 2231, 4015; **97**, 2205; **98**, 3499; **00**, 1730.

Cost, **88**, 591, 627, 666.

Holes in, caused by filling being sucked out, **93**, 3031.

Ice harbor, **00**, 4989.

Ice, resistance to, **89**, 851.

Mattresses for, building, **95**, 2231.

Missouri River, **98**, 3504.

Plans of, **95**, 2231.

Sand movement controlled by, Grand Marais, Mich., **05**, 2008.

Wire netting and, details, H. D. 46, 62d, 1st.

Woven mat screen, details, H. D. 46, 62d, 1st.

Dikes, Pile and Brush.

81, 1524, 1552; **82**, 1707; **84**, 2765, 2831; **85**, 1570.

Building, **96**, 1400.

Plans, **96**, 1436.

Dikes, Pile and Mattress.

Building, **93**, 3410; **96**, 1887, 1891.

Cribs used in, **96**, 1887.

Details, H. D. 46, 62d, 1st.

Dikes, Pile-Wattled.

Building, **94**, 2613.

Dikes, Radial.

Photographs, Missouri River, **01**, S., 410.

Dikes, Random-Stone.

78, 662.

Dikes, Rock and Mattress.

Plans, **95**, 2236.

Dikes, Screening.

98, 1860, H. D. 46, 62d, 1st.

Dikes, Sheet-Pile.

71, 590; **75**, ii, 54.

Building of, **95**, 1727.

Dikes, Solid Pile.

Details, **02**, 1576.

Dikes, Spur.

89, 2762; **90**, 1762, 1766.

Abandonment of, **99**, 3590.

Advantages of, **93**, 2477.

Bank caving, preventing, **98**, 3415.

Costs, **02**, S., 164.

Effect of, **00**, 2437.

Mississippi River levees, **04**, S., 233.

Protection from, extent of, Missouri River, H. D. 1120, 60th, 2d.

Dikes, Standard 3-row concrete pile.

Details, H. D. 46, 62d, 1st.

Dikes, Standard 3-row timber pile.

Details, H. D. 46, 62d, 1st.

Dikes, Stone.

Details, **02**, 1576.

Dikes, Temporary.

Experimental, design, Snohomish River, H. D. 1108, 60th, 2d.

Dikes, Timber.

Decay, **90**, 689.

Decay, high-water level, **95**, 911.

Dikes, Training.

Advantages of, **93**, 2476.

Cheaper than stone walls, **99**, 1507.

Materials for, Savannah, Ga., **07**, 1273.

Pile drivers for, **01**, 1662.

Rivers, effect on, **00**, 3904.

Sandbars, ineffective for, **01**, 1661.

Shore protection, effective for, **01**, 1661.

Type, wood and concrete pile dikes, Missouri River, **09**, 1661.

Dikes, Willow Curtain.

Details, H. D. 46, 62d, 1st.

Dikes, Wire Curtain.

Details, H. D. 46, 62d, 1st.

Dipper.

Grapple or, working dredge as, **94**, 811.

Teeth of, durable form, **93**, 1119.

Wide face, advantages, **70**, 315.

Dipper Dredge. (See Dredges.)

Dippers, Clam-Shell.

Quarry spalls, handling of, **99**, 2156.

Discharge. (See Depths; Harbors; Rivers; Weirs.)

Allegheny River, **66**, iv, 271.

Arkansas River, **93**, 3667.

Atchafalaya, **81**, 1394, 1399.

Bartholomew Bayou, **93**, 3668.

Big Sandy River, **00**, 3407.

Charleston Harbor, **96**, 1189.

Coefficient of, **99**, 2280; **00**, 5327.

Colorado River, **79**, 1777.

Columbia River, **93**, 3383.

Computing, methods, **93**, 1976.

Connecticut River, **72**, 860; **75**, ii, 345; **78**, 259, 290, 303, 353, 375, 385; **80**, 405.

Crevasses, **90**, 3263, 3281; **93**, 3663; **95**, 3656.

Crevasser, Mississippi River, **93**, 3663.

Cumberland River, **71**, 475.

Cypress Bayou, **93**, 2082.

Data, comparison of, St. Johns River, Fla., H. D. 611, 61st, 2d.

Data of, Tennessee River, **96**, 2020.

Elk River, **76**, ii, 166, 168; **00**, 3082.

Floods, **04**, 3612.

Floods, California rivers, H. D. 262, 59th, 1st.

Formulas, **83**, 1349, 1359; **85**, 2586.

Formulas, Great Lakes, **03**, 2857.

Fox River, **68**, 467; **00**, 3724.

French Broad River, **00**, 3027, 3053.

Great Lakes channels, **10**, 2714.

Hudson River, **80**, 482.

Illinois River, **69**, 254.

James River, **75**, ii, 79; **76**, 295, 296.

Kalamazoo River, **98**, 2542.

Kanawha River (Great), **68**, 467; **71**, 642; **73**, 839; **75**, ii, 96; **76**, ii, 160, 163; **77**, 745, 749, 802; **78**, 473.

Kanawha River (Little), **75**, 745.

Law governing, when river is obstructed by ice, **02**, 2820.

Minnesota River, **75**, 404, 406, 442.

Mississippi River, **69**, 325, 338; **73**, 472; **75**, 574, 580; ii, 439, 444, 446, 475; **76**, 76; **79**, 1130, 1150, 1203, 1232; **83**, 1459; **94**, 1347, 2808, 2849; **95**, 3656; **00**, 4744, 4758; H. D. 50, 61st, 1st.

Missouri River, **76**, 632; **78**, 667, 670, 699; **91**, 3827; **94**, 1743, 1769; **96**, 3805.

Monongahela River, **66**, iv, 271.

Niagara Falls, **11**, 3024.

Niagara River, **08**, 959; **71**, 220; **93**, 4364; **00**, 5323.

North and Northwestern Lakes, **67**, 564; **68**, 931, 958, 965; **70**, 565, 617.

Ohio River, **66**, iv, 271; **69**, 367; **71**, 401; **75**, ii, 615; **81**, 1929; **93**, 2456, 2459; **96**, 2082.

Ouachita and Black Rivers, **98**, 1611.

Ouachita River, **94**, 1465.

Passes, Mississippi River, **94**, 1347.

Plotting, Tennessee River, H. D. 360, 62d, 2d.

Pumps, **69**, 242.

Rainfall, relation to, reservoirs, **94**, 1709.

Red River, **93**, 1923, 1976, 1984; **94**, 1448.

Regulation of, reservoirs, **85**, 1747.

Reservoirs, Mississippi River, **94**, 1705.

Rivers, Great Lakes watershed, H. D. 779, 61st, 2d.

Discharge—Continued.

St. Clair River, **68**, 958; **00**, 5323, 5362.

St. Croix River, **79**, 1234; **80**, 1643.

St. Francis River, **00**, 4758.

St. Johns River, **79**, 775, 788.

St. Lawrence River, **68**, 960.

St. Marys River, **68**, 958; **96**, 4027; **97**, 4102; **00**, 5324.

Savannah Harbor, **96**, 1222.

Savannah River, **94**, 1153.

Seasonal slopes of, Niagara River, **00**, 5360.

Seine River, **76**, ii, 163; **77**, 749.

Soundings, **00**, 5327; **11**, 1947.

South Pass, **94**, 1345.

Study, detailed, Tennessee River, **02**, 1763.

Study, Great Lakes, H. D. 779, 61st, 2d.

Tennessee River, **93**, 2365; **96**, 1921, 2014.

Tests, **93**, 3670.

Tides, Charleston Harbor, **95**, 1422.

Unusual methods, **93**, 3673.

Water slopes determined from, **76**, ii, 278.

Willamette River, **77**, 1009, 1020.

Winter work, rivers, **02**, 2822.

Wisconsin River, **68**, 363; **76**, ii, 268; **81**, 2137; **87**, 2097.

Wyoming rivers, **98**, 2911.

Yazoo River, **93**, 2036; **95**, 1941.

Youghiogheny River, **74**, 561.

Discharge, Low-Water.

River channels, improving, **98**, 1748.

Discharge Measurements.

Floats, **01**, 2201.

Meters, rating, **05**, 940.

Methods, **01**, 2138, 2757; **02**, 2872; **03**, 2813.

Methods, Lockport to St. Louis, H. D. 263, 59th, 1st.

Mississippi River, **01**, 2199.

Notes used, **01**, 2771.

Ranges, **01**, 2203.

Reservoirs, Mississippi River, **06**, 1473.

Streams, methods, **02**, 1247.

Unusual methods, **93**, 3673.

Weirs, through, **02**, 2777.

Winter work, **01**, 3774.

Discharge, Minimum.

Maximum and, relation, **98**, 2847, 2849.

Discharge Observations.

89, 1518; **90**, 3263, 3281; **91**, 3413, 3417, 3424, 3505, 3827; **92**, 3121.

Areas, measuring, planimeter for, **93**, 1991.

Coefficients, **00**, 5327.

Computations, Missouri River, **11**, 1948.

Computing, **98**, 2542.

Discussion, Great Lakes, **04**, 4072.

Floats for taking, **97**, 3662.

Floats, Mississippi River, **11**, 1947.

Data, index to, Mississippi River and tributaries, **95**, 3714.

Integration method, **00**, 5385.

Lakes, **68**, 950; **69**, 572.

Levels, Great Lakes, **12**, 3546.

Little Kanawha system, H. D. 480, 62d, 2d.

Meter rating, Mississippi River, **11**, 1947.

Methods, **93**, 2456, 3664, 3667, 4364; **94**, 1769; **96**, 2082; **97**, 4092, 4096; **98**, 1611; **98**, 2542; **00**, 2556, 3053, 3082, 4744, 5327, 5377; **01**, 2534; **02**, 8, 59.

Discharge Observations—Continued.

Methods, floods, St. Johns River, Fla., H. D. 611, 61st, 2d.

Methods, Mississippi River, **03**, S., 101; **11**, 1946.

Mississippi River, **93**, 3663, 3675, 3682; **96**, 3554, 3669; **98**, 3277.

Missouri River, **87**, 3079; **96**, 3805.

Niagara River, **00**, 5322.

Novel methods, **93**, 3672.

Outfit, **00**, 5324.

Reducing, **97**, 4097.

Reducing, Mississippi River, **94**, 2808.

Reducing, novel methods, **93**, 1976; **98**, 1612.

St. Johns River, **93**, 1627.

Tennessee River, **99**, 2277, 2285.

Discharge, Tidal.

Charleston Harbor, **95**, 1422.

Displacement.

Cribs, **72**, 260; **74**, 192; **75**, 247; **76**, ii, 444, 447, 477, 515; **77**, 906; **78**, 1268; **79**, 1529, 1587, 1595, 1608.

Dredgings, **93**, 1119.

Measuring by, barge loads, **94**, 2503; **02**, 2511.

Measuring by, unsatisfactory, **94**, 1392.

Ditches. (See Dikes.)

Flood, concentration, channels, **97**, 3400.

Water supply, Yellowstone Park, **02**, 3044.

Divers.

Caissons, substitute for, **98**, 1800.

Suspended cage for, **01**, 2830.

Diver Outfit.

Details of, **76**, ii, 325.

Diversion. (See Channels; Floods; Rivers; Streams.)

Canal for, of floods, H. D. 262, 59th, 1st.

Channel, **98**, 1952.

Effects, Great Lakes, H. D. 779, 61st, 2d.

Floods, to control, Puyallup River, H. D. 1107, 60th, 2d.

Mare Island, proposed at, H. D. 1103, 60th, 2d.

Niagara Falls, **12**, 3552.

Rivers, California, H. D. 262, 59th, 1st.

Streams, reservoir sites, **96**, 3963.

Docks. (See Dry Docks; Wharves.)

Bulkheads, owners should make bulkheads to prevent silting from bank, **06**, 656; **08**, 734.

Ownership, relation to waterway improvements, Sen. D. 301, 61st, 2d.

U. S. piers, used for private purposes, **66**, 15, 22; ii, 37; iii, 5; **67**, 29, 141; **69**, 85; **76**, ii, 559, 561, 571; **79**, 1721.

Docks, End.

End dock substituted for dry dock, mouth of Mississippi River, **73**, 597.

Dock, Floating.

Valette, **68**, 496.

Docks, Iron Ore.

Capacity, Great Lakes, **10**, 2097; **12**, 2488.

Docks, Side.

Snag boat, repairing, **98**, 1619.

Doors. (See Forts; Scows.)

Batteries, **99**, 791.

Closing apparatus, scows, **92**, 1505.

Doors—Continued.

Forts, **01**, 922; **02**, 2494; **04**, 3722; **05**, 3006.

Sliding doors, **05**, 3006. (See Forts.)

Steel buildings, **04**, 3845.

Dovetailing.

Crib breakwaters, abandoned in, **98**, 2664.

Dovetails. (See Cribs.)

Holding power of, cribs, **68**, 241, 242; **84**, 2069.

Draft, Light.

Steamboats, loading, rules for, **95**, 2282.

Strength, inconsistent with, dredges, **78**, 812.

Draft Pipes.

Locks, **94**, 2303.

Drafts.

Atlantic coast trade, H. D. 551, 61st, 2d.

Great Lakes carriers, **12**, 2633.

Drags.

Changes affecting efficiency of hydraulic dredges, **05**, 2336; **06**, 978.

Dredges, **93**, 1498.

Drainage. (See Batteries; Canals; Levees.)

Batteries, **97**, 680; **98**, 604, 645; **99**, 728, 732; **00**, 760, 893, 897, 910. (See Forts, p. 1797 of this Index.)

Borrow pits, **01**, S., 291.

Buildings, **04**, 3818.

Buildings, steel, **04**, 3860.

Canals, California rivers, H. D. 262, 59th, 1st.

Canals, Colbert Shoals, **98**, 1921.

Canals, lock gates, repair of, **99**, 2549.

Comstock mines, **72**, 1153.

Cross section, California rivers, H. D. 262, 59th, 1st.

Culverts, Mississippi River levees, **04**, S., 244.

Evidence of, Great Lakes by Wabash, Illinois, and other rivers, H. D. 769, 62d, 2d.

Faulty drainage, correcting, Forts, **01**, 811.

Flood control, California rivers, H. D. 81, 62d, 1st.

Floors, forts. (See Forts, p. 1797 of this Index.)

Forts. (See Forts, p. 1797 of this Index.)

Foundations, batteries, **96**, 509.

Foundations, locks, **94**, 2166.

Foundations, mortar platforms, **94**, 457.

French Broad River, **00**, 3027.

Lakes, into Mississippi River, **68**, 308, 442; **75**, 396.

Lands, bottom, H. D. 262, 59th, 1st; H. D. 443, 62d, 2d.

Levees, **97**, 3818; **00**, 4861.

Locks, **98**, 1886.

Methods, various. (See Forts, p. 1797 of this Index.)

Mining casemates, **96**, 472.

Mississippi River, **98**, 2387.

Mortar pits. (See Forts, p. 1797 of this Index.)

Mortar platforms, foundations of, **94**, 451.

Rainfall and, relation between, **76**, 532; **77**, 756.

Rainfall, and ratio, **79**, 1391; **81**, 1778.

River basins, H. D. 262, 59th, 1st.

Swamp lands, **77**, 392; H. D. 443, 62d, 2d.

Systems. (See Forts, p. 1797 of this Index.)

Tunnel building, **94**, 3197.

Drainage—Continued.

- Ventilators, forts, **02**, 2494.
- Waterway improvement, relation to, Sen. D. 301, 61st, 2d.

Drainage, Tile.

- Canals, effect on, **96**, 3047.

Drain Holes.

- Forming, concrete work, **00**, 898.

Draining. (See Locks; Mining Casemate.)**Drains.**

- Levees, **93**, 3854.

Drawbridges.

- Improper sites, **96**, 3900.
- Repair, false work, **95**, 1214.

Drawings.

- Celluloid negatives, advantages of, **93**, 2073.
- Negatives, **93**, 2074.
- Photographic, reproduction of, **93**, 2074.

Draws. (See Bridges; Pontoon Bridges.)

- Dimensions, bridges, **95**, 734.
- Novel, **71**, 710.
- Operating, **95**, 2333.
- Passage of, coal fleets, **76**, ii, 303.
- Pontoon bridges, **74**, 681.

Dredge.

- Boats and derrick, plans, **98**, 1957.

Dredged Areas.

- Leveling with I beams, **05**, 1041.
- Shoaling from city sewage and cleanings, **12**, 2541.

Dredge, Improvised.

- Cape Fear River, **95**, 1338.

Dredges. (See Boats; see pls. 53-56.)

- Anchorage of, current, against, **93**, 2449.
- Bearings, overcoming wear of, **06**, 1300.
- Bins, leakage, preventing, **93**, 1498.
- Boilers, testing, **03**, S., 158.
- Boschke's patent, **69**, 460, 466.
- Buckets, shale broken with, **95**, 979.
- Building, **96**, 3630; **98**, 3291.
- Building, economical method, **02**, 1379.
- Building, Mississippi River, **96**, 3606.
- Burned dredges, condition of, **93**, 2318.
- Centrifugal pump, **70**, 316; **72**, 666, 669; **73**, 750; **74**, ii, 11, 71; **75**, ii, 38, 40, 69; **76**, 445; **79**, 560, 1542; **89**, 1097; **90**, 736; **91**, 1472.
- Centrifugal pump, sand, percentage raised by, **72**, 668; **75**, ii, 40.
- Costs, **69**, 466; **71**, 523, **73**, 1119; **78**, 812; **79**, 1192; **06**, 1332.
- Designing, **98**, 3291.
- Designs, obtaining, **95**, 3636.
- Details, New York Harbor, **02**, 2496.
- Dimensions of, Mississippi River, **76**, 656.
- Dimensions of, Ohio River, **78**, 811.
- Drag, new form, **93**, 1498.
- Dredging and, general discussion of, **69**, 460.
- Equipment of, Ohio River, **97**, 2340.
- Experiments with, Mississippi River, **94**, 2875.
- Flow, measuring, **03**, S., 158.
- Flow, Pitot tubes for testing, **03**, S., 158.
- Fuel, costs, **05**, 3036.
- Hire of, difficult, Ohio River, **01**, 2601.
- Jetties and, effect on channel development, **07**, 1401.

Dredges—Continued.

- Levees, building, **95**, 3922; **99**, 3640.
- Light draft, strength inconsistent with, **78**, 812.
- Mississippi River, **99**, 3342.
- Morris & Cumings's, **68**, 519, 522; **69**, 461, 465; **71**, 523; **72**, 311; **73**, 1028; **77**, 1003; **79**, 917.
- Morris & Cumings's, inferiority of, **72**, 311; **77**, 1003.
- New York Harbor, **99**, 1280.
- Ohio River, **99**, 2337.
- Operating, system of, Mississippi River, **96**, 3632.
- Operation, details, New York Harbor, **02**, 2497.
- Osgood's, **69**, 460; **71**, 555; **72**, 311; **79**, 1190.
- Osgood's, superiority of, **72**, 311.
- Pipe lines, efficiency, **03**, S., 143.
- Pipes, discharge; losses in head, **03**, S., 149.
- Pipes in, **93**, 1498.
- Pipes, plans, **03**, S., 158.
- Pipes, stoppage of, oyster shells, **99**, 3206.
- Position of, **95**, 3075.
- Position of, difficult to recover, deep water, **99**, 1273.
- Product and cost, Galveston, **09**, 1516.
- Pumps, capacity, **03**, S., 143.
- Pumps, centrifugal, **02**, S., 44.
- Pumps, design, best, **99**, 3489.
- Pumps, discharge, **03**, S., 162.
- Pumps, efficiency, **03**, S., 165.
- Pumps, jet; efficiency, **03**, S., 148.
- Pumps, plans, **03**, S., 158.
- Pumps, testing, **03**, S., 155; **04**, S., 130.
- Pumps, velocity, Pitot tube measurements, **03**, S., 139.
- Pumps, wear, **99**, 3488; **00**, 4567.
- Pumps, work of, **03**, S., 163.
- Refrigerating plant, specifications, **00**, 4600.
- Remodeling, **01**, S., 218.
- Remodeling, improvements, **01**, 2634.
- Remodeling, Mississippi River, **96**, 3619.
- Repairs, Mississippi River, **02**, S., 75.
- River channelers, **68**, 60, 669; **69**, 460.
- Steamer, improvised, **95**, 1337.
- Suction head, various forms, **03**, S., 146.
- Suction pipes, economical arrangement, **94**, 1407.
- Suction pipes, strengthening, **93**, 1498.
- Suction pumps, **89**, 1097; **90**, 736; **91**, 1472.
- Taggart's patent, **69**, 465, 466.
- Tests, **96**, 3426; **02**, S., 76.
- Tests, methods of, **95**, 3632.
- Tests, Mississippi River, **96**, 3461, 3606, 3630; **99**, 3345, 3495, 3503.
- Tests, preliminaries, **95**, 3632.
- Types, various, output, **03**, 1391.
- Types, various, U. S. plant, **10**, 2449.
- Wide-faced dipper, advantage of, **70**, 315.
- Working of, dipper or grapple, **94**, 811.

Dredges, Bucket.

- 69**, 460, 466; **70**, 315; **72**, 819.

Dredges, Clamshell.

- Breakwaters, excavating for, **99**, 3108.
- Large, **98**, 2769; **00**, 4134.
- Novel details, **01**, 2064.

Dredges, Dipper.

Grapple, change to, **94**, 811.
River work, Tennessee River, **10**, 1864.
Specifications for, **00**, 2932.

Dredges, Elevator.

Details, **96**, 1572.

Dredges, Experimental.

Mississippi River, **95**, 3629.

Dredges, Hydraulic. (See Dredges; Chutes.)

81, 1086; **84**, 1302; **85**, 769, 928; **86**, 731, 739,
883; **87**, 723, 886, 1611, 1614, 2345; **89**, 1720;
90, 1598, 2007; **92**, 1034; **93**, 3517.

Advantages of, filled channels, **02**, 495.

Agitator of, **98**, 3305.

Alterations, specifications, **98**, 3181.

Anchors, sinking, **02**, **S.**, 44.

Building, **97**, 3688.

Cabins, details, **04**, **S.**, 109.

Cutter, disadvantages of, **98**, 3170.

Cutter for hard material, **06**, 1964.

Cutter frame and head, **05**, 3034.

Damages from storms, **94**, 2616.

Details, **01**, 2063; **02**, 1381; **04**, **S.**, 116; **09**,
1488.

Details of construction, Mississippi River, **01**,
2258.

Development, Mississippi River, **05**, **S.**, 59.

Difficult dredging, Habana, **11**, 3039.

Discharge pipes, **95**, 3630.

Discharge pipes, pontoon widening, effect of,
98, 1707.

Discharge pipes, swivel joint, **98**, 1707.

Drag for, **06**, 978.

Drags, efficiency increases by changing, **05**,
2336.

Drawings of, **97**, 2046.

Efficiency, increasing, Mississippi River, **05**,
1642, 1651.

Efficiency, **00**, 4562.

Efficiency, changes to increase, Mississippi
River, **05**, 1651, 2336.

Efficiency tests, Mississippi River, **04**, **S.**, 98.

Fruhling type, advantage of, H. D. 359, 62d, 2d,
Hull, details, **04**, **S.**, 103.

Improvements, **02**, **S.**, 6.

Improvements, desirable, New York Harbor,
07, 1029.

Improvements dictated by experience, **04**, **S.**,
11.

Improvised dredges, **97**, 2017; **98**, 2512.

Indian River, **95**, 1541.

Jet agitator, **98**, 3170.

Light plant, electric, details, **04**, **S.**, 124.

Machinery, arrangement of deck machinery,
05, 3034.

Machinery, miscellaneous, **04**, **S.**, 128.

Measuring load, **05**, 2343.

Mississippi River, **96**, 3630; **98**, 3297; **99**, 3353.

Mud, soft; methods in, **10**, 1258.

Necessity for, New York Harbor, **97**, 1056.

Operating, **95**, 3629; **96**, 3632.

Origin, Mississippi River, **05**, **S.**, 9.

Output, changes to increase, Mississippi River,
05, 1642.

Painting, details, **04**, **S.**, 129.

Pipe line, details, **02**, **S.**, 43.

Dredges, Hydraulic—Continued.

Pipe line, pontoon, details, **04**, **S.**, 127.

Plumbing, etc., details, **04**, **S.**, 112.

Potomac River, **94**, 933.

Product of, Savannah, **09**, 1325.

Propelling machinery, **04**, **S.**, 122.

Pumps and tanks, details, **04**, **S.**, 123.

Pumps, centrifugal; efficiency, **04**, **S.**, 98.

Refrigerating plant, details, **04**, **S.**, 126.

Repairs, details, **02**, **S.**, 37.

Specifications, **94**, 2976; **95**, 3764; **96**, 3467;

97, 3575; **99**, 3353; **00**, 4575; **04**, **S.**, 103.

Steam plant, **04**, **S.**, 113.

Steam tenders, **98**, 3306.

Styles, **95**, 3629.

Tenders, **98**, 3181.

Tests, **95**, 3763, 3792; **96**, 3632; **97**, 3618; **98**,

1707, 3162; **98**, 3313, 3327, 3341.

Type suitable for Arkansas River, **03**, 1413.

Type suitable for river channel maintenance,
H. D. 962, 60th, 1st.

Valves and piping, details, **04**, **S.**, 115.

Working, economical methods, **98**, 1707.

Works, upper, details, **04**, **S.**, 103.

Dredges, Jet.

96, 1724; **98**, 1706.

Improvised, **97**, 2043.

Working, method of, **97**, 2015.

Dredges, Ladder.

90, 726, 3237.

Dredges, Pulsometer.

88, 781; **92**, 909.

Dredges, Pump.

Von Schmidt, **94**, 2503.

Dredges, Rehandling.

Economical, **07**, 1273.

Dredges, Seagoing.

Details, **96**, 1530.

Operating, cost of, items, **96**, 1532.

Small type recommended for local harbors,
H. D. 1395, 61st, 3d.

Dredges, Self-propelling.

99, 3353.

Economy of, **01**, **S.**, 52.

"Iota" first delivered to Mississippi River,
01, **S.**, 47.

Dredges, Side-wheel.

Sand, operating in, **06**, 1300.

Dredges, Small.

Details, **06**, 1995.

Dredges, Steam.

New York Harbor, **93**, 1065; **94**, 776.

Dredges, Suction.

93, 1622.

Altering from end to side, Mississippi River,
05, 1652.

Anchors, advantages of common anchors over
piots, etc., **01**, 2263.

Dredges, U. S.

Advantages of, **06**, 972.

Alterations and repairs required, **06**, 1407.

Capacity on actual work, **12**, 2271.

Construction, details, **06**, 972.

Converted steamboat as, **04**, 2545.

Dredges, U. S.—Continued.

- Defects developed by tests, **09**, 1154.
- Details, "Sabine," **01**, 1911.
- Details, "Texas City," **01**, 1932.
- Effectiveness of, Savannah, Ga., **07**, 1272.
- Efficiency, tests, **03**, S., 136, 160.
- Floating plant, list. (See p. 2337 of this Index.)
- Florida waters, requirements of dredges for, **01**, 1748.
- Fuel, advantages and disadvantages of oil as, **12**, 2611.
- Fuel consumption, **12**, 2154.
- Harbor dredging, H. D. 359, 62d, 2d.
- Maintenance work, commended for, **08**, 1161.
- Ohio River, **95**, 2348.
- Operating, cost of, "Gen. Comstock," **01**, 1926.
- Operating, cost of, suction dredges, **01**, 1504.
- Operating, details of, **06**, 971.
- Operating, low cost of, H. D. 550, 61st, 2d.
- Operating, New York Harbor, cost, **08**, 1076.
- Operating, results of, Great Lakes, **12**, 2612.
- Operation, cost of, **04**, 1977.
- Operation, cost of, clamshell type, **01**, 1504.
- Performances of, **08**, 1538; **09**, 1438, 1695; **12**, 2156.
- Product and cost, southern works, **11**, 1731, 1805.
- Product, Galveston Harbor, **08**, 1538; **10**, 1659.
- Product, "Gillespie," on the Great Lakes, **09**, 2056.
- Product, "Malta," Muskingum River, **11**, 2178.
- Product, "Tortoise," **11**, 2261.
- Rent for, **93**, 1497.
- Repairs required, **06**, 975.
- Running, expense of, **06**, 1332.
- Smaller dredges not economical, **09**, 1092.
- Stern-wheel type, seagoing hopper dredge, **04**, 2252.
- Stones, hydraulic dredges not able to remove large, **07**, 1029.
- Tests, **03**, S., 9, 67, 154.
- Types; hydraulic type apparently best, **08**, 1422.
- Work done by, table of, **12**, 2122.
- Work of, Charleston, **01**, 1602.

Dredges, Vacuum.

- Mixed material, **01**, 1662.

Dredging. (See Bars; Bowlders; Canals; Locks; Plant; Rivers; Waterways; see pls. 8, 48, 51-53.)

- Abandonment of, foundations, locks, **94**, 1826.
- Agitation by, **67**, 364, 366, 367, 370; **68**, 60, 320, 323, 480, 669, 671; **69**, 261, 311, 460; **70**, 323, 324, 329, 340, 447; **71**, 65, 333, 508; **72**, 138, 552; **73**, 596; **74**, 839, 842, 871, ii, 356; **76**, 546, 654, 711; **79**, 903, 1837.
- Bars, coast, **01**, 1662.
- Bars, effect on, **01**, 1664.
- Bars, rough, Columbia River, **03**, 2296.
- Bishop's screw, **67**, 364; **68**, 60, 671.
- Blasting, aided by, **94**, 1407, 2473.
- Blasting, hardpan and, **95**, 3201.
- Bowlders, **00**, 4044.
- Broken rock, **94**, 1847.

Dredging—Continued.

- Canalization or, river deepening, Ohio River, H. D. 492, 60th, 1st.
- Canals, **98**, 2482.
- Centrifugal pumps, **72**, 666, 669; **73**, 750; **74**, ii, 11, 71; **75**, ii, 38, 69; **76**, 445; **79**, 560, 1542; **85**, 2331.
- Channels, forming; theory, Jamaica Bay, H. D. 1506, 60th, 2d.
- Channels made by, sediment-bearing rivers, Mississippi River, H. D. 50, 61st, 1st.
- Cost, **01**, S., 230; **02**, 2499; **04**, 2384.
- Cost of, **82**, 734, 736; **92**, 2271.
- Cost of, Ahnapsee, Wis., **75**, 198.
- Cost of, Atchafalaya Bay, **71**, 555.
- Cost of, centrifugal pumping, **72**, 669; **74**, ii, 12; **75**, ii, 40; **76**, 445.
- Cost of, Chicago, **68**, 111.
- Cost of, Duluth, Minn., **73**, 133; **75**, 181.
- Cost of, Fox River, Wis., **79**, 1540.
- Cost of, Galveston Harbor, **03**, 1326; **07**, 1481 **09**, 1516.
- Cost of, Green Bay, Wis., **78**, 1143; **79**, 1487.
- Cost of, Hell Gate, N. Y., **76**, 241, 242.
- Cost of, Illinois River, **71**, 281.
- Cost of, James River, **74**, ii, 42; **77**, 286.
- Cost of, least recorded, **79**, 674, 1540.
- Cost of, Ludington, Mich., **75**, 248.
- Cost of, Michigan City, Ind., **67**, 96.
- Cost of, Mississippi River, **02**, S., 86; **05**, S., 143; **08**, 2705; **09**, 1602; **10**, 2982; **11**, 1923, 3238; **12**, 3824.
- Cost of, Norfolk, Va., **79**, 674.
- Cost of, Ohio River, **73**, 498; **78**, 800; **01**, 2640; **06**, 1550.
- Cost of, Port Washington, Wis., **78**, 1163; **79**, 1520.
- Cost of, rock removal, **72**, 804; **77**, 229; **78**, 800, 1136.
- Cost of, various years, **00**, 2701.
- Cost of, White River, **70**, 134.
- Cost of, Willamette River, **68**, 872.
- Costs, Wilmington, Cal., **08**, 2211.
- Crib leveling, failure of, **70**, 151.
- Cuts, location, proper, Mississippi River, **97**, 3695.
- Data concerning, Ohio River, **98**, 2064.
- Delays, time lost by, **76**, 355.
- Deposits from, destructive effect on oyster beds, Biloxi Harbor, H. D. 1088, 60th, 2d.
- Difficult dredging, for hydraulic dredges, Habana Harbor, **11**, 3039.
- Dikes and, channel formation, H. D. 796, 61st, 2d.
- Dikes and, to deepen Savannah River, **09**, 1320.
- Dredges and, general discussion of, **69**, 460.
- Dredges, efficiency of, Great Lakes, **05**, 2303.
- Dredges, position of, **95**, 3075.
- Dredgings, disposal of, methods, Norfolk Harbor, H. D. 381, 59th, 1st.
- Dumping grounds, regulations, **01**, 3254.
- Dumping policy, Chicago, **01**, 2989.
- Dunkirk, France, **95**, 1636.
- Effect of, discussion, Mississippi River, **01**, S., 49.
- Effect of, Mersey bar, England, **00**, 2301.

Dredging—Continued.

- Effect of, Mississippi River, **00**, 2299.
Favorable conditions for, **00**, 4202.
Fill, rate of, **01**, 1781, 1804.
Fill, training ashore, **02**, 1426.
Foundations, crib and stone dams, **94**, 2107.
Foundations, locks, **94**, 1826.
Hardpan, **69**, 417; **70**, 212; **74**, 165; **95**, 3201.
Harrowing and, **88**, 1042.
Hindrances, sewage, **95**, 2707.
Improvised dredge, Cape Fear River, **95**, 1338.
Inspection, efficient system, **98**, 2224.
Inspection, methods of, **98**, 2751.
Jetties and, comparison, Pensacola, **95**, 1636.
Jetties, increasing depths obtained by, Coos Bay, H. D. 958, 60th, 1st.
Jetties, preferable, **95**, 1657.
Jetties, supplementary to, **97**, 1393.
Jetty work and, required, mouth of Columbia River, C. D., H. D. 2, 59th, 2d.
Lake Michigan, **93**, 2913.
Locks, foundations of, **94**, 1826.
Low-water channels, effect on, Mississippi River, **98**, 3166.
Material, vacuum dredge for mixed, **01**, 1662.
Measurement of, scow displacement, **79**, 917.
Mersey River, England, **95**, 1644.
Methods, **93**, 2819, 3571.
Methods, suction dredges, **01**, 1288. (See Dredges.)
Obilitation, bar channels, **98**, 2691.
Ocean bars, **11**, 423.
Ohio River, **76**, ii, 9; **77**, 633; **78**, 812; **00**, 8123.
Ostend, Belgium, **95**, 1642.
Oyster beds, injury of, decision in favor of U. S., **00**, 1721.
Parapets formed by, forts, **05**, 3030.
Permanent works and, waterway improvements, H. D. 510, 61st, 2d.
Piers, cribs of, affected by dredging, **01**, 2833.
Pipes, discharge; lengthened by sacking, **01**, 1884.
Pipes, discharge; supported by barges, **01**, 1883.
Pipes, suction; choked by gravel and stones, **11**, 2080.
Place measuring, **94**, 2502.
Pontoons, remodeling, **01**, S., 19.
Prism and scow measurements, relations, **71**, 181, 191, 200, 719; **75**, 275; **77**, 239, 246; **78**, 520, 1136; **79**, 507.
Private parties, statute of State of Washington, **01**, 3599.
Propeller wheel used for, **80**, 2016, 2019; **83**, 1999; **85**, 2380; **87**, 2508.
Pumps, centrifugal; observation of, **01**, S., 52.
Ranges, locating, Mississippi River, **04**, S., 244.
Records of, Duluth Harbor, **00**, 3577.
Regulation works and, **11**, 1592.
Relief by, temporary only, **74**, 839, 842, 874.
Results, Mississippi River, **98**, 3170.
Results of deep-water or explorative dredging, lakes, **71**, 1020.
River regulation; experimental work with training walls and dredging, Savannah, Ga., **08**, 1328.

Dredging—Continued.

- Rivers, large, **97**, 3618.
Rivers, long; large plant needful, Ohio River, **05**, 1803.
Rock difficult to remove by, **95**, 925.
Rock removing by, **71**, 164; **72**, 804; **73**, 776; **74**, 33, ii, 41; **77**, 229; **78**, 800, 1136.
Rock, removing, cost, **04**, 2183.
Rock, removing without drilling, **71**, 164.
Scows, storage of, **01**, 3225.
Scrapers, **67**, 370; **68**, 320, 480, 669; **70**, 324, 329, 340, 447; **71**, 65, 508; **72**, 138, 552.
Sewage, increased by, **99**, 2827.
Snag boats and, proposed combination, **00**, 1844.
Surveys, **94**, 2615.
Surveys, Mississippi River, **95**, 3695.
Tidal rivers, difficult in, **72**, 875; **78**, 407.
Value of, sawdust bars, **00**, 1107.
Water jet, **68**, 671; **69**, 310; **70**, 340; **79**, 383, 384; **82**, 1610; **83**, 1238; **84**, 1302; **85**, 769.
Wharves, area close to private area, **08**, 1921.

Dredging, Daily.

- Elizabeth River, **76**, 355.
Fox River, **79**, 1540.
Illinois River, **78**, 800.
Mississippi River, mouth, **71**, 64; **79**, 903.
Morris & Cumings, **68**, 519, 522; **69**, 465; **77**, 1003.
Ohio River, **78**, 800.
Saginaw River, **67**, 146; **68**, 141.
St. Marys River, **67**, 147, 148; **68**, 139.
Sandusky River, **68**, 39.
Toledo Harbor, **67**, 144; **68**, 39, 146.

Dredging, Difficult.

- Rock debris, **95**, 925.

Dredging, Experimental.

- Bars, **95**, 3628.
Mississippi River, **94**, 2875; **96**, 3630.
Mississippi River, for 14 feet, H. D. 50, 61st, 1st.

Dredging, Explorative.

- Great Lakes, **71**, 1020.

Dredging, Hydraulic.

- Bars, **96**, 1378.
Bars, removal of, Savannah Harbor, **09**, 1321.
Channels, maintaining, Mississippi River, H. D. 50, 61st, 1st.
Cost of, determining, **96**, 1379.
Cost of, items of, **96**, 1379.
Dredgings, amount of, determining, **97**, 3619.
Methods, Mississippi River, H. D. 492, 60th, 1st.
Origin, Mississippi River, **05**, S., 9.
Outfit, **00**, 3904.
Plant, development of, Mississippi River, **05**, S., 59.
Rehandling dredge economical, **07**, 1273.
Slack watering, substitute for, Arkansas River, H. D. 71, 61st, 1st.

Dredging Plant, U. S. (See p. 2337 of this Index.)

- Advantages from, **98**, 2616; **00**, 2444.
Cost, **03**, S., 133; **09**, 1438; **10**, 2449; **12**, 2754.
Cost, Galveston, **05**, 1483.
Cost, Mississippi River, **11**, 1913.
Cost, Ohio River, H. D. 492, 60th, 1st.
Cost, Savannah, **11**, 1593.
Cost, Tennessee River, **09**, 1695.
Development, Mississippi River, **05**, S., 9.

Dredging Plant, U. S.—Continued.

Economical, **97**, 1464; **04**, 1980.
 Efficiency, increasing, **08**, 1619; **10**, 2961.
 Great Lakes, **94**, 2238.
 Items of expense, **00**, 1818.
 Necessity for, Great Lakes, **07**, 1900.
 Operation, low cost, H. D. 550, 61st, 2d.
 Product, Galveston Harbor, **05**, 1483.
 Refrigerating outfit, **01**, S., 52.
 Repairs. (See each annual report M. R. C., and p. 1142 of this Index.)
 Repairs, details, Mississippi River, **01**, S., 46; **03**, S., 124; **11**, 3212.
 Successful, notably, Cape Fear River, **99**, 1508.
 U. S.; desirable for U. S. to have own dredging plant, **07**, 1193.
 Waterways, intracoastal; U. S. plant of special efficiency in maintaining, H. D. 3, 61st, 2d.

Dredging, Private.

Harbors, injury of, **72**, 205; **73**, 291; **74**, 46, 207.
 Regulation of, waterways, **12**, 2340.
 Regulation of, by statute, Washington (State), **01**, 3599.

Dredgings.

Amount, determining, hydraulic dredging, **97**, 3619.
 Bulkheads, inclosing in, **95**, 3419.
 Conveyance of, chutes for, **76**, 288; **77**, 886; **79**, 503, 1540; **86**, 883; **87**, 886, 1614, 2345.
 Conveyance of, floating track, Grand River, **99**, 2921.
 Conveying machine, **94**, 1061.
 Dikes, filling, **94**, 1061.
 Disposal of, artificial island, **00**, 1619.
 Disposal of, dike filling, **94**, 1061.
 Disposal of, Duluth Harbor, **99**, 2630.
 Disposal of, hindrances, Chicago, **00**, 3868.
 Disposal of, land, reclaiming, **95**, 1206; **95**, 3419.
 Disposal of, piers, foundations, Philadelphia Harbor, **95**, 1054.
 Dumping, control of, Great Lakes, **94**, 2410.
 Filling, dikes, **94**, 1061.
 Flats, reclaiming of, **95**, 1206.
 Foundations, piers, **95**, 1054.
 Handling, **93**, 2820.
 Handling, dump cars, **00**, 3900.
 Holding of, bulkhead for, **95**, 3419.
 Impounding, **72**, 709; **73**, 933.
 Inclosing of, bulkhead for, **95**, 3419.
 Measuring, water displacement, calculating, **93**, 1119.
 Placing on shore, box and two dredges for, **93**, 2820.
 Redredging of, lakes, **98**, 2670.
 Retention of, cheap bulkheads, **94**, 2609.
 Stability of, sides of stream, **99**, 1685.

Dredging, Sea.

95, 1643.

Dredging, Supplemental.

Jetties, **97**, 1393.

Dredging, U. S.

Lakes, **95**, 2822; **96**, 2722.

Drift. (See Débris; Mines; Sand; Shores.)

Accumulation, a hindrance in locks, **08**, 1796.
 Cost of, Opher mines, **72**, 1154.

Drift—Continued.

Effect, removal of guard locks, **05**, 1755.
 Jetties, effect on, **94**, 2636.
 Movable dams, effect on, **96**, 2312.
 Movable dams, enemy of, **98**, 2145.
 Piling, injury of, jetties, **94**, 2556.
 Removal, lock chambers, **08**, 1799.
 Utilization of, hurdles, Mississippi River, **94**, 1581.

Driftbolts. (See Cribs.)

Holding power, cribs, **84**, 2051.
 Pneumatic driver, improvised, **00**, 2782.

Drift Chutes.

Locks, **95**, 2366.

Drift Gaps.

Dams, **89**, 1852.

Drift Jams.

Removing, rivers, **97**, 1885.

Drift, Sand.

Avoiding, canals, **01**, 3515.
 Buffalo, **76**, ii, 569.
 Harbors, over piers into, **73**, 275; **75**, 250; **76**, ii, 601.
 Jetties for, **68**, 830; **70**, 457; **72**, 936; **75**, 320.
 Lake shores, **71**, 131; **72**, 896; **74**, ii, 188; **76**, ii, 472, 480, 569.
 New England coast, **70**, 495.
 Piers, ends, around, **74**, 223, 230.
 Pile piers, through, **75**, 255, 258.
 Preventing, fences for, **67**, 457; **75**, 314, 316, 338; **77**, 116, 966, 969.
 Suez Canal, **74**, 796.
 Wave action, **71**, 806; **72**, 896.

Driftwood.

Utilization of, rivers, **95**, 2064.

Drill Holes.

Cleansing of, water jet for, **69**, 427.

Drilling. (See Blasting; Dredging.)

88, 1120; **94**, 1846, 1932; **95**, 2911; **00**, 1731, 4269.
 Ahnapsee, **76**, ii, 346, 357, 360; **79**, 1506.
 Artesian well, **92**, 467.
 Ashtabula, **70**, 180.
 Blasting, chiseling and, comparison, **79**, 1134.
 Blossom Rocks, **68**, 885, 886.
 Boat for, **93**, 3162.
 Columbia River, **69**, 475; **72**, 997.
 Compressed air, superiority of, **98**, 1952.
 Compressor boats, plans, **98**, 1952.
 Cost small when compared with other items, **68**, 738.
 Dome proposed, **69**, 392.
 Dredging dispensed with, **71**, 164.
 Drill borings, jet and, **00**, 2769.
 Eagle Harbor, **68**, 91; **69**, 76; **76**, ii, 324; **77**, 847; **78**, 1134.
 Fixed platform, **74**, ii, 260.
 Georgetown Harbor, **77**, 352.
 Hallets Point, **69**, 392; **73**, 935; **75**, ii, 205; **77**, 228; **79**, 61, 378, 384.
 Harlem River, **76**, 244.
 Hell Gate, **68**, 736; **70**, 439; **71**, 724, 725; **72**, 803; **74**, ii, 160, 164; **75**, ii, 208; **76**, 239, 241.
 Holes, cleaning, jet for, **69**, 427.
 Holes, depth, **68**, 751; **69**, 425.
 Holes, Hell Gate, **71**, 726.

Drilling—Continued.

James River, **73**, 776; **74**, ii, 39; **75**, ii, 82.
 Ludington Rock, Conn., **72**, 877; **74**, ii, 260.
 Methods, **93**, 2378, 3162; **97**, 3117, 3721; **00**, 4496.
 Middle Rock, New Haven, **68**, 751; **70**, 445; **71**, 776.
 New River, **79**, 533.
 Oak Orchard, **74**, 245.
 Platforms, tripods for, **74**, ii, 260; **76**, 670, ii, 323.
 Rafts for, attachments, **96**, 2042.
 Rate of, **72**, 877.
 Rincon Rocks, Cal., **74**, ii, 371; **75**, ii, 695.
 Rock Island, **68**, 423; **79**, 1135.
 Scow for, **68**, 736; **71**, 725; **72**, 805; **73**, 937, **74**, ii, 163; **76**, 239; **79**, 1135, 1154; **93**, 3373, **94**, 1846; **00**, 3677.
 Scow for, Diamond Reef, **72**, 804.
 Scow for, Hell Gate, **68**, 736; **71**, 725; **72**, 805; **74**, ii, 163; **76**, 239.
 Scow for, small, **93**, 3373.
 Tennessee River, **76**, 711.
 Tower rocks, **68**, 812; **69**, 422, 429.
 Tunnels, **76**, ii, 124.

Drilling, Hand.

Detroit River, **77**, 935.
 Rate by, rock drilling, **68**, 425; **76**, ii, 663.

Drilling, Rock. (See pl. 51.)

88, 1120; **93**, 2378, 3162; **94**, 1846, 1932; **95**, 2911; **97**, 3117, 3721; **00**, 1731, 4269, 4496; **01**, 1427.
 Ahnapsee, **76**, ii, 346, 357, 360; **79**, 1506.
 Arch Rock, San Francisco, **01**, 3412.
 Ashtabula, **70**, 180.
 Blossom Rock, **68**, 885, 886.
 Boats for, **93**, 3162.
 Columbia River, **69**, 475; **72**, 997.
 Compressor boats, **98**, 1952.
 Cost, Ohio River, **04**, 2417.
 Dome proposed, **69**, 392.
 Drilling raft and attachments, **96**, 2042.
 Drilling scow, Hell Gate, **68**, 736; **71**, 725; **72**, 805; **74**, ii, 163; **76**, 239.
 Drill scow, **73**, 937; **79**, 1135, 1154; **00**, 3677.
 Drill scow, small, **93**, 3373.
 Eagle Harbor, **68**, 91; **69**, 76; **76**, ii, 324; **77**, 847; **78**, 1134.
 Fixed platform, **74**, ii, 260.
 Georgetown Harbor, **77**, 352.
 Hallets Point, **69**, 392; **73**, 935; **75**, ii, 205; **77**, 228; **79**, 61, 378, 384.
 Harlem River, **76**, 244.
 Hell Gate, **68**, 736; **70**, 439; **71**, 724, 725; **72**, 803; **74**, ii, 160, 164; **75**, ii, 203; **76**, 239, 241.
 Holes, cleaning, water jet for, **69**, 427.
 Holes, depth, **68**, 751; **69**, 425.
 Holes, Hell Gate, **71**, 726.
 James River, **73**, 776; **74**, ii, 39; **75**, ii, 82.
 Ludington Rock, Conn., **72**, 877; **74**, ii, 260.
 Middle Rock, New Haven, **68**, 751; **70**, 445; **71**, 776.
 New River, **79**, 533.
 Oak Orchard, **74**, 245.
 Plant for, compressed air better than steam, **98**, 1952.

Drilling, Rock—Continued.

Platform, tripods for, **74**, ii, 260; **76**, 670; ii, 323.
 Progress, rate of, **72**, 877.
 Rincon Rock, **74**, ii, 371; **75**, ii, 695.
 Rock Island, **68**, 423; **79**, 1135.
 Scow for, Diamond Reef, **72**, 804.
 Tennessee River, **76**, 711.
 Tower Rock, **68**, 812; **69**, 422, 429.
 Tunnels, **76**, ii, 124.

Drills.

Arrangement of, Rock Island Rapids, **79**, 1135.
 Comparison, rock removing, **72**, 803, 877; **73**, 777, 935; **75**, ii, 252.
 Experiments, rock removing, **75**, ii, 204; **76**, 238.
 Steel for, experiments, rock removing, **75**, ii, 204.

Drills, Diamond.

Rock removal, **69**, 388; **71**, 725; **72**, 803; **73**, 776, 935; **74**, ii, 39, 42.
 Steel and, comparison, rock removal, **72**, 803.

Drills, Steam.

Failure, rock removing, **68**, 422.

Driveways.

Riverside, Washington, D. C., **08**, 2400.
 Statues, treatment of, Washington, D. C., **05**, 2646.

Droughts.

Prevention of, and relation to waterway improvements, Sen. D. 301, 61st, 2d.

Drum, Welr.

Chittenden's, **00**, 5001.
 Novel modification, **97**, 3952.

Dry Docks. (See pl. 39.)

Muscle Shoal Canal, **97**, 2307.
 Automatic gates, **98**, 1968.
 End dock substituted for, **73**, 597.
 Fox River, **00**, 3725.
 Plans for, Sault Ste. Marie, **85**, 2125.

Drynness.

Providing, forts. (See p. 1797 of this Index.)

Dry Proofing.

Cellars, **04**, 3825.

Dualin.

Use of, Bath, Me., **71**, 845.
 Use of, Ludington Rock, **72**, 877.

Dump Cars.

Dredgings, handling of, **00**, 3900; **00**, 3904.
 Floating track, **00**, 3900.

Dumps and Dumping. (See Dredging; Fill; see pl. 55.)

Control, Great Lakes, dredgings, **94**, 2410.
 Excavations, canal, H. D. 391, 62d, 2d.
 Illegal dumping, **00**, 4520.
 Illegal dumping, New York Harbor. (See each annual report, supervision of New York Harbor; see p. 2111 of this Index.)
 Methods, **96**, 3395.
 Methods, stone, **95**, 3360.
 Mill refuse, disposal, method proposed, Union River, **99**, 1029.
 Mill refuse, dumping in river, law violated, **99**, 1024.

Dumps and Dumping—Continued.

- Policy, Chicago, **01**, 2989.
- Refuse, cities, **93**, 3541.
- Regulation. (See Illegal dumping, above.)
- Regulation, Duluth-Superior, **10**, 2061.
- Regulation, dumping fleet, **01**, 3224.
- Regulation, grounds, **01**, 3254.
- Regulation, mill refuse, **99**, 1024.
- Regulation, New York Harbor, **94**, 2685.
- Rules, violations, lawsuits, **94**, 2689.
- Sea dumping. (See Illegal dumping, above.)
- Side dumping, stone barges, 800 tons, **99**, 3156.
- Stone, clearing from tracks, **02**, 2131.
- Supervision over, harbors. (See Illegal dumping, above.)

Dwelling. (See pl. 70.)**Dynamite.** (See Blasting; see pls. 50, 70.)

- Bars, effect on, **96**, 1280.
- Black powder, explosions, comparison, **68**, 423; **77**, 26.
- Blasts, surroundings, effect on, **79**, 1508.
- Charges, formula for determination of, **77**, 234.
- Composition, various brands, **77**, 234.
- Efficacy of, bars, **01**, 1664.
- Experiments with, submarine mines, **76**, 31.
- Exploding, methods, Rincon Rock, Cal., **75**, ii, 695.

Dynamite—Continued.

- Explosions, premature, **75**, 524, ii, 695; **76**, ii, 665; **77**, 1042; **79**, 515.
- Explosions, sympathetic, **79**, 37; **80**, 57; **85**, 725; 729, 733; **86**, 686.
- Explosive energy, **79**, 36.
- Gun cotton and, comparison, **81**, 58.
- Gunpowder and, comparison, **77**, 26.
- Nitroglycerin and, comparison, **79**, 1507.
- Old material, strength of, **90**, 416.
- Small charges, rock blasting, **96**, 471.
- Snagging, **73**, 616, 618; **74**, ii, 358; **78**, 538, 539; **79**, 626, 651, 1187.
- Submarine mines, experiments, **76**, 31; **79**, 35.
- Use of, Ahnapsee, Wis., **76**, ii, 348, 360.
- Use of, Eagle Harbor, Mich., **76**, ii, 326; **77**, 846; **78**, 1135.
- Use of, East River, **77**, 229, 233.
- Use of, Hell Gate, **74**, ii, 160.
- Water, action of, **79**, 1507.
- Wrecks, removing, **75**, ii, 714.

Dynamite Batteries.

- Obsolete, and sale of guns, **02**, 11.

Dynamometer.

- Measuring waves, Great Lakes, **03**, 1799.

E.**Earthquake Wave.**

- 77**, 990.

Earth Waves.

- Flood Rock explosion, **86**, 690, 694, 705, 712.

Eddies.

- Dikes, cracking of, due to, **02**, S., 102.
- Scour produced by, bear-trap gates, **11**, 2141.

Efficiency. (See Dredges.)

- Increasing, U. S. dredges, **08**, 1619.

Eflorescence.

- Paraffine, for brickwork, **04**, 3831.

Eight-hour Day.

- Cost of works increased by, **08**, 2271.

Electrical Action.

- Submerged bayonets and cartridges, Habana Harbor, **11**, 3048.

Electrical Installations.

- Forts. (See Forts, p. 1797 of this Index.)
- Water-power plant, Ouachita system, H. D. 588, 62d, 2d.

Electric Batteries.

- Arrangement of, mine explosions, **77**, 237.
- Formula for, rock blasting, **77**, 236, 239.
- Rock blasting, **68**, 814; **69**, 432; **75**, ii, 253, 695; **82**, 2466; **86**, 687, 692.

Electric Elevators.

- Buildings, **98**, 3668.

Electric Fountains.

- 99**, 3824.
- Study for, **00**, 5240.

Electric Lighting. (See Forts, p. 1797 of this Index.)

- Channels, **93**, 1080.
- Storage batteries for, **98**, 679.
- Washington, D. C., **94**, 3256.

Electric Locomotive.

- 96**, 485.

Electric Motors.

- Torpedoes, **83**, 54.

Electric Power.

- Dams, **94**, 1780.
- Dams, surveys for, **94**, 1780.
- Transmission from U. S. to Canada, **08**, 895.

Electric Switch.

- Three-way switch, **04**, 3739.

Electric Wiring. (See Wiring.)**Elevations.** (See Gauge Readings; Water Heights.)

- Black River, **00**, 5391.
- Columbia River, **93**, 3398.
- Detroit-St. Clair Rivers, **00**, 5389.
- Lake Huron, **96**, 2783.
- Lake Winnipeg, **68**, 309.
- Monument, Jefferson City, Mo., **94**, 3085.
- St. Marys Falls, **98**, 2559.

Elevations—Continued.St. Marys Falls Canal, **93**, 2996.St. Marys River, **96**, 2783.**Elevators.** (See Electric.)Buildings, **96**, 4014.**Embankments.** (See Banks; Levees; Slopes.)Floods have bad effect, locks, **11**, 2048.Improvements, Tennessee River, **99**, 2273.Leaks in, stopping, **93**, 2433.Maintenance, canals, **04**, 2384; **05**, 1768.Protecting, canal entrances, **00**, 4328.Repairs, Ohio River, **01**, 2634.Sand for, placing, **99**, 1002.Sand movement, checking, **97**, 690, 972.

Size of, study, H. D. 263, 59th, 1st.

Work on, cost, Mississippi River, **05**, S., 234.**Embankments, Rock.**Sinking cribs on, **11**, 2276.**Embankments, Sandy.**Movement of, checking, **97**, 690.Sand movements, checking, **00**, 598.**Emplacements.** (See Forts, p. 1797 of this Index.)**Employees.**

Quarter boats for. (See pl. 59.)

Enamel.Enameled bricks not best for inside finish, **04**, 3832.**Encroachments, Corporate.** (See Erie H. Pa., p. 1495; and p. 2041.)Private and, harbors, **74**, 202, 207; **76**, ii, 535
77, 828, 928.**Engineer Battalion.** (See p. 2039 of this Index.)Equipment, **01**, 955.**Engineer Corps.**Field manual begun, **01**, 39.**Engineer Depot.**Material, **01**, 951.**Engineer Field Manual.****01**, 911; **02**, 801.**Engineer Tool Box.**Wagon, design, **10**, 1080.**Engineer Tools.**Carbolineum to guard against attacks of white
ants, **10**, 1080.**Engineer Troops.**Bridge, pontoon, **02**, 816.Bridge, trestle, **02**, 816.Bridge, tripod, **02**, 816.Calisthenics, result, **02**, 806.Crib bridge, **02**, 816.Equipment for, **01**, 982; **02**, 811.Pile driver, **02**, 816.Pile driver, floating, **02**, 816.Rafts, building cask rafts, **02**, 816.Railroad work, **02**, 816.Trade school, **02**, 801.Trestles, **02**, 816.**Engineers.** (See Vol. I, p. 11 and p. 2039.)**Engraving, Copperplate.**Charts, Great Lakes surveys, **08**, 2517.**Enrockment.** (See Jetties; Rock; Stone;
Wharves.)Plan of, jetties, **00**, 4450.Profile of, jetties, **94**, 2564.**Enrockment—Continued.**Settlement of, jetties, **00**, 4474.Wharves, **95**, 3494.**Entrances.** (See Canals; Harbors; Parks.)Forts, **04**, 3738. (See also Forts, p. 1797 of this
Index.)Jetties, cheap type, Delaware & Chesapeake
Canal, S. D. 215, 59th, 2d.Navigation difficult, harbors, H. D. 62, 59th,
1st.Parks, **03**, 2469.**Equation.** (See Lockage.)

Flow, H. D. 779, 61st, 2d.

Erosion. (See Abrasion; Banks; Beaches; Cav-

ing; Crevasses; Levees; Sand; Shores; Spurs.)

Beaches, Cape Cod, H. D. 821, 61st, 2d.

California rivers, H. D. 262, 59th, 1st.

Causes, combined currents, **95**, 2301.Causes, wave wash, levees, **00**, 4861.Extensive erosion, jetties, vicinity of, **93**, 3288.

Missouri R., H. D. 1287, 61st, 3d.

Preventing, beaches, **95**, 995.Preventing, locust trees useful for, **98**, 2739.Preventing, river banks, **96**, 1777.Preventing, spurs for, bank angles, **97**, 3818.Preventing, tree planting beneficial, **98**, 2739.River bed, **96**, 3484.**Erosion, Heavy.**Causes of, rivers, **95**, 2273.Jetties, produced by, Brazos River, H. D. 27,
61st, 2d.Progress of, Winthrop Head, Boston, H. D.
144, 59th, 1st.**Estimates.** (See Canals; Costs; Cribs; also Vol.
I, p. 21, Jetties.)Breakwaters, **93**, 3259.Canals, **96**, 2416, 2447.Canals, feeder line of, **96**, 2661.Canals, land for, **96**, 2416.Cribs, **75**, 300, 306.Drinking water, future demands for, H. D. 342,
61st, 2d.Form of, canals, **94**, 2182.Formula, cribs, **98**, 2420.Harbor defense, **84**, 57.Locks, **75**, ii, 616.Locks and dams, Black Warrior River, **04**,
1840.Movable dams, **00**, 2358.River channels, maintaining, **98**, 2697.Rules to be followed, cribs, **75**, 300, 306.**Estuaries.**Currents, sub and surface, relation, **78**, 558.Lengthening, **75**, ii, 196.Regulation works, **01**, 1662.**European Rivers.** (See Rivers, European.)Tides, action of, **66**, iv, 66, 214; **68**, 919; **74**, ii,
379; **75**, ii, 196; **76**, 460.**Evaporation.** (See Water Supply.)Canals and reservoirs, **71**, 639; **72**, 515, 521;
74, 505, 523, ii, 95; **75**, ii, 547, 566; **76**, 756;
78, 293.Determining, **79**, 1213.Determining, rivers, **00**, 3165.Dewpoint, relation to, **76**, 526.Florida coast, **76**, 457, 519, 525.Forests, effect of, **75**, ii, 172; **79**, 1211.

Evaporation—Continued.

- Lakes, **68**, 963, 977, 980; **69**, 645; **70**, 570; **76**, 526; **83**, 2855.
 Land and water evaporation, comparison, **69**, 603; **70**, 570.
 Measuring, **68**, 976.
 Milwaukee, **68**, 977.
 Rainfall and, ratio, **70**, 287.
 St. Clair River, **70**, 570.
 Various places, **68**, 978; **76**, 526; **79**, 1236.
 Water, Florida, **82**, 1207.
 Water supply of canals, **71**, 639; **72**, 515, 521, 73, 1008; **74**, 505, 507, 520, 523, ii, 95; **75**, ii, 547, 566; **76**, 519, 526, 528, ii, 97; **77**, 386, 704, 707, 756; **78**, 293.
 Water surfaces, **76**, 533; **79**, 1200, 1205, 1213, 1226, 1237, 1241.

Examinations. (See Surveys; Sweeping.)

- Blasted channels, **93**, 1586.
 Channels, bottoms, **02**, 2498.
 Must be confined to locality specified, not extended to adjacent land, H. D. 720, 62d, 2d.

Excavation. (See Batteries; Breakwaters; Canals; Channels; Cofferdams; Foundations; Locks; Mortar Pits; Rock; Sand; see pls. 46, 47, 49, 50, 51, 56, 57.)

- Channels, rock in, **96**, 2224.
 Clam-shell dredges, use of, Buffalo, **99**, 3108.
 Cofferdams, **74**, 312; **94**, 1995; **95**, 2907.
 Cofferdams, foundations, locks, **94**, 1292.
 Colbert Shoals Canal, **99**, 2272.
 Costly work, locks, **97**, 2260.
 Dispositions, intracoastal canals, H. D. 391, 62d, 2d.
 Foundations, breakwaters, **00**, 4120.
 Foundations, buildings, **01**, 3817.
 Foundations, locks, **94**, 1292, 1956; **00**, 2769.
 Foundations, mortar platforms, **94**, 450.
 Foundations, stone locks, **96**, 1938.
 Gun batteries, **93**, 603.
 Locks, **95**, 3583; **96**, 3269; **97**, 3420; **98**, 1914, 3542.
 Locks, approaches of, **00**, 2926.
 Locks, entrances, **96**, 2270.
 Mortar pits, **00**, 1002.
 Plant, New York Harbor, **02**, 2495.
 Quicksands, control of, **01**, 913.
 Rock, **99**, 697, 701.
 Rock, Mississippi River, **99**, 2137.
 Sand, **93**, 603.
 Water jet employed, channels, **99**, 3153.

Excavation, Rock.

- Costs, Mississippi River, **01**, 2267.

Excavators. (See Dredges.)**Expansion.** (See Cement.)**Exploring.** (See Foundations.)**Explosions.** (See Blasting; Dynamite; Nitroglycerin.)

- Black powder, dynamite and, comparison, **68**, 423; **77**, 26.
 Craters, formulæ, **79**, 36.
 Duration of, **79**, 37.
 Earth waves, **86**, 690, 694, 705, 712.

Explosions—Continued.

- Fine blasting work, tunneling, **94**, 3199.
 Frozen nitroglycerin, results from, **76**, 31.
 Fuses for, Hell Gate, **86**, 687.
 Large charges, adjacent objects unaffected, **76**, 241.
 Methods followed, Hell Gate, **86**, 680, 686.
 Nitroglycerin explosions, discussions of, **66**, iv, 335; **75**, 523.
 Photographing, Flood Rock, **86**, 691, 716.
 Pressure gauges, submarine mines, **95**, 530.
 Rocks, various, effect of nitroglycerin on, **68**, 91; **73**, 776; **77**, 355.
 Rock waves, destructive effect of, **77**, 233.
 Sympathetic explosions, dynamite, **79**, 37.

Explosions, Crater.

- Preventing, rock blasting, **79**, 1507.

Explosions, Deep.

- Rock blasting, **96**, 1932.

Explosions, Premature.

- Dynamite, **75**, 524, ii, 695; **76**, ii, 665; **77**, 1042; **79**, 515.

Explosions, Submarine.

- Pressure gauge, **89**, 496.

Explosions, Sympathetic.

- Dynamite, **80**, 57; **85**, 725, 729, 733; **86**, 686.
 Torpedoes, **80**, 57.

Explosives. (See Dualin; Dynamite; Mica Powder; Nitroglycerin; Powder.)

- Arrangement of, blasting, **75**, ii, 200.
 Blasting with, **91**, 2796.
 Broken rock and, ratio, **68**, 423, 425; **69**, 19, 248; **71**, 733; **72**, 877; **73**, 935; **74**, ii, 39, 160; **75**, ii, 82; **76**, ii, 326, 545; **77**, 352; **79**, 61, 62, 379, 533, 535, 1135, 1508.
 Crater gauge, **88**, 354; **89**, 479; **90**, 403.
 Crater test, **88**, 353.
 Copper cases for, corrosion of, Hell Gate, **86**, 684.
 Echall's patent, **68**, 751.
 Ehrhardt's patent, **68**, 813.
 Ehrhardt's patent, trial of, **68**, 813.
 Energy of, comparison, **79**, 36, 1507.
 Energy of, dynamite, **79**, 36.
 Energy of, gun cotton, **79**, 36.
 Energy of, nitroglycerin, **79**, 36.
 Experiments with, Hell Gate, **83**, 537; **85**, 724, 728.
 Night tests, **89**, 496.
 Placing, river beds, **93**, 1119.
 Power tests, **90**, 417.
 Rock blasted by, ratio to explosive, **80**, 500; **81**, 864; **83**, 541; **86**, 685.
 Sensitiveness of, **90**, 403, 418.
 Small charges, rock blasting, **95**, 925.
 Testing, **81**, 58; **83**, 537, 1486.
 Tests, **81**, 57; **82**, 59; **90**, 402, 413; **91**, 559.
 Tests, torpedoes, **84**, 59.
 Wreck removal, **68**, 591, 607; **75**, ii, 714; **77**, 931; **12**, 1654.

Exports.

- Importance over imports in considering river and harbor improvements, H. D. 545, 59th 1st.

F.

Factories. (See Manufactures.)

Falls of St. Anthony.

69, 210; 70, 278; 72, 299; 79, 1161.

Preservation of, 71, 294; 72, 296; 73, 408; 74, 277; 75, 356.

Rock formation at, 79, 1161.

Tunnel under, building, 70, 283; 71, 294; 72, 304.

Falls, Niagara. (See p. 2041 of this Index.)

Discharge, changes, 11, 3024.

Falls, Ohio.

Making channel through Indiana Chute, peculiar problem, 02, 1964.

Fascines. (See Mattresses.)

Building, 76, ii, 404; 96, 1876.

Mud and, dike material, 71, 825.

Piles and, spur dams, 93, 1562.

Placed on end, 77, 989.

Shore protection, Missouri River, 01, S., 398, 401.

Spur dams, 93, 1562.

Training walls, 93, 1562.

Use of, generally, 71, 825; 77, 989.

Fastenings.

Cribs, 93, 3091; 95, 3119; 96, 2945.

Feeder Lines.

Building, canals, 97, 2859.

Estimates for, canals, 96, 2661.

Surveys, canals, 96, 2656.

Feet.

Meters, conversion of measures to, table, 93, 1995.

Fences. (See Sand.)

Sand movement, checking, 98, 2681.

Ferries.

Types proposed, canals, H. D. 391, 62d, 2d.

Ferry, Aerial. (See pl. 9.)

Duluth-Superior, 05, 1972; 06, 1698.

Operating regulations, 05, 1973.

Ferryboats.

Detroit River, 74, 596.

Fields. (See Gas Fields.)

Field Work. (See Surveys.)

Hydrography, 91, 3481.

Fill. (See Channels; Deposits; Scour; Sediment.)

Causes, canals, 01, 2066.

Channels, 96, 2919.

Channels, dredged, advantage of hydraulic dredges, 02, 495.

Channels, maintenance of, effect on, 98, 2697.

Dredging, rate of fill during, 01, 1781, 1804.

Gauges and, relation, 96, 3484.

Islands, value of, increased by fill, Jamaica Bay, H. D. 1506, 60th, 2d.

Made by cable and brush, banks, Missouri River, H. D. 46, 62d, 1st.

Fill—Continued.

River beds, 68, 307.

Scour and, dredged channels, 93, 3050; 94, 2390; 97, 3041, 3055.

Scour and, jetties, 96, 1536, 3286.

Scour and, platting, 01, S., 232.

Scour and, rock jetties, 93, 3493.

Scour and, surveying, Mississippi River, 01, S., 44, 128.

Training ashore, 02, 1426.

Fill, Annual. (See Fill.)

Channels, 96, 2919.

Fill, Earth.

Cribs, 71, 658; 75, ii, 185; 79, 1044.

Fill, Rock.

Dams, 98, 2825.

Filling. (See Ballast; Canals; Cofferdams; Cribs; Dikes; Dredgings; Hearting; Jetties; Rivers; Rock; Stone.)

Cofferdams, 69, 249.

Colbert Shoals Canal, 99, 2272.

Crib holes, large concrete blocks for, 93, 3159.

Cribs, 72, 162.

Cribs, furnace slag for, 77, 626.

Dredged channels, 95, 1936.

Dredged cut, 94, 2147.

Dredgings for bulkheads, 94, 2609.

Dredgings, dikes, 94, 1061.

Gravelly-loam material, cofferdams, 86, 1451.

Locks, 00, 2926.

Loss of, grillage bottoms of cribs, 69, 146.

Movement of, dikes, 93, 3031.

Pile and brush dams, 93, 3267.

Revetments, brush in, 77, 475.

River channels, sewage in, 95, 2707.

Sediment as, rivers, 95, 3860.

Thrust of, cribs, 63, 238, 242.

Filling Basins. (See Basins.)

Filling, Sand.

Crib dikes, 70, 428, 432.

Placing, mortar battery, 98, 644.

Revetments, 68, 154.

Sheet-pile jetties, 79, 465.

Filtration. (See Canals; Rivers; Water Supply.)
86, 2022, 2034.

Canals, 75, ii, 547, 566; 76, 527; 81, 571, 1152; 86, 1252.

City water supply, 09, 2325; 12, 3468.

Cost of, cities, 08, 2363.

Drinking water, H. D. 342, 61st, 2d.

Drinking water, not a case of hardness, 06, 2106.

Excessive amount of, Florida, 77, 384.

Experiment in Florida on, 76, 535.

Experiments, Washington, D. C., 07, 2294; 08, 2367.

Methods, Washington, 03, 2511.

Rate of, various soils, 76, ii, 67; 79, 1239.

Filtration—Continued.River beds, **69**, 252.Water for domestic use, **80**, 2361; **86**, 2022, 2034.Water supply, canals, **71**, 639; **73**, 1008; **74**, 505, 507, 520, 523, ii, 95; **76**, 519, 526, 534, ii, 67, 97; **77**, 386, 704, 707; **78**, 293.Works, filtration, cost of, **98**, 3656.**Financing.**

Foreign waterways (Merchant), Sen. D. 301, 61st, 2d.

Finders. (See Range.)**Finish.** (See Concrete; Parapets.)**Fire-control System.**Features of, gun batteries, **99**, 13.**Fireplaces.** (See Forts, p. 1797 of this Index.)Concrete work, in, **02**, 2480, 2494.**Fireproofing.**Brick better than tiling, **04**, 3837.Buildings, **04**, 2852.Government Printing Office, **01**, 3811.Steel buildings, **04**, 3839, 3842, 3860..**Fires.**Ceilings, **04**, 3841.Doors to resist, **04**, 3845.Protection from, buildings, **04**, 3850.Steel buildings to withstand, **04**, 3830.Window framing, **04**, 3844.**Fires, Forest.**Yellowstone Park, **02**, 3042.**Firing.**Torpedoes, **89**, 493.**Firing Circuits.**Mortar batteries, **97**, 753.Wiring of, **97**, 753.**Firing, Judgment.**Stations, submarine mines, **98**, 744.**Firing, Proof.**Concrete mortar battery, **94**, 454.**Firing, Volley.**Mortars, tests, **95**, 519.**Fish.**Dams, effect of, **73**, 829.Passage of, dams, **01**, 3515.Propagation of, **82**, 552.**Fish Traps.**Regulations for using, Puget Sound, **05**, 2558.**Fishways.** (See Potomac River.)Building, dams, **96**, 2248.Fox River, **99**, 2793.**Fissure Veins.**Cause of, mines, **72**, 1143.**Flags.**Substitutes for, shore-line surveys, **94**, 2799.**Flanges.**Covering, steel buildings, **04**, 3860.**Flashboards.**Scour augmentation, **01**, 2626.**Flat Cars.** (See Cars.)**Flats.**Reclaiming, dredgings for, **95**, 1206.**Fleet, Coal.** (See pl. 35.)**Flexure.** (See Dams.)Preventing, dams, **94**, 1923.**Floats.**Cords and, resistance to, rivers, **74**, 534; **75**, ii, 369; **76**, 216; **78**, 380.Cross-section soundings, breakwaters, **03**, 2096.Current observations, **76**, iii, 339.Current observations, San Francisco Harbor, **78**, 1305.Currents, velocity of, **70**, 556; **75**, ii, 301, 304; **78**, 259, 262, 305, 1306, 1308, 1315.Discharge measurements, **01**, 2201; **11**, 1947.Discharge observations, **97**, 3662.**Floating Plant, U. S.** (See p. 2137 of this Index.)**Floats, Double.**Currents, observations of, **93**, 3666.**Floats, Pole.**Current observations, **93**, 1624.**Flood Control.** (See Floods, below.)**00**, 2843.

Banks for, H. D. 81, 62d, 1st.

Bridges, H. D. 81, 62d, 1st.

By-pass system, H. D. 81, 62d, 1st.

California Rivers, **07**, 2262.

Channel enlargement, H. D. 81, 62d, 1st.

Channel rectification, H. D. 81, 62d, 1st.

Diversion for, Puyallup River, H. D. 1107, 60th, 2d.

Drainage systems, H. D. 81, 62d, 1st.

Levees, California Rivers, H. D. 81, 62d, 1st.

Leaves for, **00**, 2845.

Main channel system, H. D. 81, 62d, 1st.

Relief openings, **95**, 3894.Reservoirs as factors, **04**, 2270.Reservoirs for, **98**, 2859.

Reservoir system, H. D. 81, 62d, 1st.

Sacramento and Feather Rivers, maps, H. D. 76, 62d, 1st.

Sacramento and other California rivers, H. D. 81, 62d, 1st.

Spillways, California Rivers, H. D. 81, 62d, 1st.

Studies, California Débris Commission, H. D. 81, 62d, 1st.

Tributary control, H. D. 81, 62d, 1st.

Weirs, diverting, H. D. 81, 62d, 1st.

Floods. (See Canals; Discharge; Forests; Rivers.)

(See pls. 63, 64, 65.)

Abutments destroyed by, locks, **03**, 1421.Arkansas River, **69**, 299, 351; **75**, 634; **76**, 616.Arrest of, reservoirs, **69**, 313, 324; **75**, 540, 616, 669.Bank protection, methods and cost, Mississippi River, **12**, 3887, and each annual report of the Mississippi River Commission. (See pp. 1067 and 1142 of this Index.)Banks, effect on, **79**, 1011.Bars, deposits behind dams forming, **11**, 1581.Bars, effect on, **75**, ii, 477, 507; **79**, 1010.Breaks from, repairing, Mississippi River, **03**, S., 210, 218.Cause and prevention, Mississippi River, **01**, 2343.

Cause, Grand River, Mich., H. D. 72, 60th, 1st.

Cause, real, Mississippi River, **01**, 2352.

Floods—Continued.

- Cause, reservoir system not a, Mississippi River, **06**, 1459.
 Causes, river bed rising, **00**, 4553.
 Claims, tide gauge records of value, **04**, 1647.
 Combining of, rivers and tributaries, **98**, 2853, 2887.
 Connecticut River, **68**, 761; **75**, ii, 364; **78**, 265, 273, 372; **80**, 403.
 Crevasses and flood areas, Mississippi River, **12**, 3977.
 Crevasses, effect of, **00**, 4554.
 Damages from, Muskingum River, **98**, 2109.
 Damages from, repairing, canals, **02**, 1736.
 Dams, dikes, etc., effect, **04**, 1297.
 Dams, effect of, **77**, 742.
 Destruction by, causes increasing, **91**, 1107.
 Discharge, California rivers, H. D. 262, 59th, 1st.
 Discharge of, **93**, 3761.
 Discharge of, Mississippi River, **93**, 3761.
 Discharge, siphonage system to accelerate, **04**, 3612.
 Diversion, canal for, H. D. 262, 59th, 1st.
 Effect of, Chippewa River, **95**, 2184.
 Effect of, Mississippi River, **12**, 3713.
 Effect of, rivers, **04**, 3803.
 Embankment, canal, bad effect on, **11**, 2048.
 Forests and, relation, **98**, 2869.
 Frequency of, and forestation, Merrimac River, H. D. 9, 62d, 1st.
 Heights of, basins on, effect of, **95**, 3661.
 Heights of, changes in, Mississippi River, **00**, 4551.
 Heights of, levees, effect of, **94**, 2967; **95**, 3649.
 Ice dams a cause of, **69**, 108.
 Illinois River, **69**, 350.
 Increase of, due to forest destruction, **75**, ii, 172, 510.
 Jetties, effect upon, **04**, 3188.
 Kanawha River (Great), **76**, ii, 163.
 Kennebec River, **70**, 501.
 Lands, bottom, protection of, California, H. D. 262, 59th, 1st.
 Lands, valley, protection of, California, H. D. 262, 59th, 1st.
 Lessening, diversion to, H. D. 493, 60th, 1st.
 Lessons from, Mississippi River, **03**, S., 51.
 Levees, advantages of, and disadvantages of cut-offs, **01**, 2345, 2346.
 Levees, effect of, Mississippi River, **12**, 3723.
 Levees, effect on, **96**, 3649.
 Levees, effect on, lessons from, Mississippi River, **97**, 3453.
 Levees, improvement needed, locks, **11**, 2048.
 Levees, lessons, **12**, 3724.
 Levees, Mississippi River, **12**, 3721.
 Levees, protecting, methods and cost, Mississippi River, **12**, 3916, and each annual report of the Mississippi River Commission (see pp. 1067 and 1142 of this Index).
 Levees, raising, methods, Mississippi River, **12**, 3724.
 Levees, repairs, Mississippi River, **12**, 3724.
 Locks, damages, **11**, 2107.
 Locks, effect on, **95**, 3572; **97**, 2261.
 Locks, effect on, Yamhill River, **99**, 8237.
 Locks and dams, effect, **00**, 2172, 2985.
 Lock walls, effect on, **95**, 3572.

Floods—Continued.

- Mississippi River, **68**, 471; **69**, 313, 321, 327, 329, 336; **70**, 282; **73**, 472, 474, 521; **74**, 644; **75**, 541, 553, 565, 606, 634, 676; **76**, 602, 616; **79**, 1009; **80**, 1560; **85**, 2551, 2567; **93**, 3759; **99**, 3484; **12**, 3713.
 Missouri River, **69**, 350; **75**, 636; **76**, 616.
 Movement of, **92**, 2905, 2907.
 Nile, **69**, 327; **75**, 556.
 Ohio River, **69**, 348; **71**, 398, 407, 417, 422, 435, 443; **75**, 635; **76**, ii, 301; **77**, 644; **78**, 814.
 Planes, Mississippi River, H. D. 50, 61st, 1st.
 Preventing, and relation of water improvements, Sen. D. 301, 61st, 2d.
 Preventing, reservoirs, expensive, **98**, 2860.
 Property in regions formerly flooded, increase due to U. S. improvements, **04**, S., 25.
 Protection against, **91**, 1109.
 Protection against, Mississippi River, **12**, 3887.
 Pulsations of, **79**, 786.
 Railroad construction, barrier to, **08**, 860.
 Railway traffic, hindrance of, St. Louis, H. D. 772, 59th, 1st.
 Red River, **69**, 351; **73**, 642, 650; **75**, 598, 616, 666; **76**, 616.
 Reduction with storage reservoirs, Ouachita system, H. D. 588, 62d, 2d.
 Refugees by reason of, aiding, views, Mississippi River, **12**, 3724.
 Regulation of, study for, Missouri River, H. D. 1120, 60th, 2d.
 Relief work, by U. S. plant, Mississippi River, **12**, 3975.
 Remarks, Mississippi River, **03**, S., 243.
 Remedies proposed, Grand River, H. D. 72, 60th, 1st.
 Reservoirs a cure instead of a cause, Mississippi River, H. D. 42, 61st, 2d.
 Reservoirs, effect of, **98**, 2864, 2878, 2887, 2893, 2894.
 Reservoir system, effect of, **06**, 475.
 Rivers, **88**, 1026; **90**, 1373, 1487, 1489; **91**, 1105, 3413; **98**, 1658.
 Rivers, bars of, effect on, **75**, ii, 477, 507.
 Rivers, basins of, effect of, **95**, 3661.
 Rivers, beds of, effect on, **98**, 2902.
 Rivers, effect on, **98**, 1658.
 Rivers, revetments, effect on, **98**, 1658.
 Rivers, tributaries and, combination of floods, **98**, 2853, 2887.
 Sand, action on, **68**, 366; **72**, 132; **76**, ii, 5.
 Scour, locks, **03**, 1674.
 Sediment, effect on, **76**, ii, 5.
 Susquehanna River, **79**, 1393.
 Tables, Red River of the North, **04**, 2269.
 Tennessee River, **68**, 579; **78**, 756; **80**, 1670; **97**, 2287.
 Velocity of, **92**, 2905, 2907.
 Warehouses, guarding, H. D. 772, 59th, 1st.
 Waterways, relation to, Sen. D. 301, 61st, 2d.
 Yazoo River, **75**, 637.

Floods, Artificial.

00, 3336.

Floods, Combined.

Rivers, tributaries, **98**, 2853, 2887.

Floods, Excessive.

Heights, controlling, **95**, 3649.

Floods, Notable.

Records, St. Louis, H. D. 772, 59th, 1st.

Floods, Sudden.

Damages expensive, Des Moines Rapids Canal, 05, 1650.

Flood Waters.

Control of, rivers, 95, 3639.

Disposing of, rivers, 95, 3639.

Floors. (See Concrete; Locks.) (See pl. 12.)

Arches of, building, 96, 4011.

Brickwork, 04, 3852.

Buildings, steel, 04, 3837, 3846, 3860.

Ceilings and, Government Printing Office, 01, 3812.

Culverts, locks, 94, 2303.

Drains, forts, 01, 912.

Hemlock lumber in, locks, 98, 2207.

Linings, forts, 03, 2380, 2382, and see page 1797 of this Index.

Log sluices, dams, 96, 1836.

Repairing, locks, 06, 1434.

Settlement of, forts. (See p. 1797 of this Index.)

System of, bridges, 02, 2658.

Wood blocks, 04, 3855.

Floors, Brick.

Smoothing, 07, 2473.

Floors, Concrete.

Buildings, steel, 04, 3838.

Flotation.

Rock removal, 70, 465; 74, ii, 222.

Flow. (See Canals; Channels; Sluice.)

Concentration of, jetties for, rivers, 97, 2016.

Concentration of, temporary, rivers, 97, 2016.

Equation, general, H. D. 779, 61st, 2d.

Formula, water conduits, 93, 4277.

Grass, effect of, canals, 73, 1008; 78, 294.

Irregularity of, rivers, 98, 2845.

Measuring, gauges for, dredges, 03, S., 158.

Measuring, Pitot tubes, 03, S., 158.

Open channels, 73, 896; 76, 296.

Resistance to, measuring; increased slope employed, 95, 3668.

Uniformity of, rivers, 98, 2845, 2846.

Water power, amount required for, H. D. 99, 58th, 3d.

Flowage. (See Canals; Reservoirs; Water; Watersheds.)

Damages from, canals, 93, 2763.

Damages from, reservoirs, 00, 2787.

Diagraming, Tennessee River, H. D. 781, 60th, 1st.

Formula, watersheds, 93, 4280.

Flowage Rights.

Reservoirs, vicinity of, 00, 2790.

Flowers. (See Botany; Plants; Grass; Chrysanthemums.)**Fluids, Unlimited.**

Body moving in, resistance to, formula, 74, 534; 76, 216; 78, 383, 532.

Flume, Adams.

Supposed value of, improving rivers, 80, 177; 81, 238; 82, 1755; 83, 242; 84, 244; 93, 2202.

Flumes.

Reservoir dams, 96, 1837.

Flumes, Drop.

Water-supply system, Yellowstone Park, 02, 3044.

Fluvigraph Station. (See pl. 72.)**Flushboards.** (See Dams.)

Dams, 98, 2344; 99, 2790.

Flushing.

Tidal reservoirs, 91, 1156.

Fogs.

Nantucket coasts, H. D. 536, 62d, 2d.

Pacific coast, 95, 3459; 00, 4504.

Piloting in, harbors, 01, 1013.

Sandy Hook, 93, 1080.

Footing Blocks. (See Concrete.)

Setting, concrete breakwaters, 10, 2058.

Strengthening, Marquette, 10, 2088.

Forage.

Cost per horse, 04, 3736.

Forebay.

Filling locks, St. Marys River, H. D. 716, 61st, 2d.

Forest Fires.

Yellowstone Park, 02, 3042.

Forestry.

River improvement and, Tennessee River, H. D. 360, 62d, 2d.

Forests.

Destruction of, flood increase from, 75, ii, 172; 79, 1211.

Evaporation, effect on, 75, ii, 172; 79, 1211.

Floods and, relation, 98, 2869.

Freshets, effect, nil in case of Connecticut River, H. D. 1294, 61st, 3d.

Greater to-day than 40 years ago, Connecticut River, H. D. 1294, 61st, 3d.

Influence of, Merrimac River basin, H. D. 9, 62d, 1st.

Rainfall, effect on, 75, ii, 172; 79, 1211; 84, 662.

Rivers, effect on, 75, ii, 172; 79, 1373.

Snow, melting of, 03, 2446.

Forests, Buried.

Erie Harbor, 98, 2738.

Formations. (See Geology.)**Forms.** (See Concrete; Locks; Gates; Dams.)

Concrete work, forts. (See p. 1797 of this Index.)

Locks and dams. (See Locks; Dams; Canals.)

Forms, Concrete. (See pls. 14, 16, 26, 29.)**Formulæ.** (See Craters.)**Fortieth Parallel.**

Explorations, 71, 1027.

Fortress Commander.

Duty of, 98, 579.

Forts. (See p. 1797 of this Index.)

Appropriations, allotments of, points kept in view, 96, 9.

Building, contract system, objections to, 97, 9.

Building, cost of, decreasing, cause of, 97, 11.

Casemated forts, admirable type, Penobscot River, 02, 621.

Conditions, 82, 411.

Electric-light plant for, 97, 632.

Land of, selling price, 94, 461.

Number that might be dispensed with, investigation, 82, 411.

Forts—Continued.

- Planning, **95**, 4.
- Repair methods, **02**, 2487.
- Sewage reservoirs, **95**, 514.
- Sewage systems, **93**, 642; **95**, 511; **96**, 498.
- Sewage systems, Fort Monroe, **97**, 663.
- Torpedo and defense, close connection, **82**, 58.
- Wharves for, building, **97**, 700.

Fort Sites.

- Public parks, utilization as, **85**, 423.

Foundations. (See Batteries; Breakwaters;

- Bridges; Cribs; Dams; Grillage; Jetties; Levees; Locks; Mortars; Piers; Revetment; Riprap; Rock; Sand; Stone; Timber.)

Aqueduct bridges, **96**, 2670.

Bedrock, depths to, bridge building, **78**, 918, 1059.

Beds, forts, **02**, 2475. (See Forts, p. 1797 of this Index.)

Borings for, gun batteries, **96**, 503.

Borings for, breakwaters, **97**, 3247, 3289.

Boulé dams, **00**, 3482.

Breakwaters, **73**, 353; **75**, 57, 305, 306, 309; **78**, 1209; **99**, 3058; **00**, 4090.

Bridge pier, **96**, 3887.

Brush in, cribs, **66**, iv, 115; **67**, 106; **68**, 121; **69**, 99.

Brush in, failure of, cribs, **69**, 99.

Building, breakwaters, **98**, 2752.

Building, concrete dams, **96**, 2202.

Building, locks, **94**, 1826; **97**, 2516; **98**, 2208, 3542; **99**, 2483.

Building, loose gravel beneath, **98**, 2093.

Building, mortar batteries, **97**, 676.

Building, movable dams, **96**, 2252.

Building, submarine mining casemates, **96**, 471.

Buildings, steel, **04**, 3818.

Clay under, settlement of foundations on, **74**, 829, 830.

Coal under, locks, **94**, 1993.

Compressible soils, **74**, 829, 830; **75**, ii, 621.

Concrete blocks for, breakwaters, **97**, 2619.

Concrete in, breakwaters, **98**, 2752.

Concrete locks, **98**, 2482.

Concrete placing, breakwaters, **96**, 2369; **98**, 2752.

Concrete placing, locks and dams, **88**, 2167; **96**, 1833.

Crib piers, **96**, 2713.

Cribs, **73**, 211, 353; **74**, 209; **75**, 305, 306, 309, 320; **76**, ii, 571; **78**, 1270; **89**, 2365; **90**, 2814; **93**, 3134.

Cribs, effect on, **71**, 548; **72**, 162, 163; **74**, 234; **75**, 305.

Cribs, failure in, **67**, 222; **69**, 99.

Designing, breakwaters, **93**, 3202.

Displacement of, cribs, effect of ice on, **87**, 2058.

Draining, gun batteries, **96**, 509.

Draining, locks, **94**, 2166.

Draining, mortar platforms, **94**, 451.

Dredging abandoned, locks, **94**, 1826.

Dredging, crib and stone dams, **94**, 2107.

Dredgings for, piers, **95**, 1054.

Economical design, jetties, **99**, 3261.

Excavating, breakwaters, **00**, 4120.

Excavating, cofferdams, locks, **94**, 1292.

Excavating, crib breakwaters, **00**, 4120.

Excavating, Government Printing Office, **01**, 3817.

Foundations—Continued.

Excavating, locks, **94**, 1292, 1956.

Excavating, mortar platforms, **94**, 450.

Excavating, reservoir dams, **96**, 1834.

Excavating, stone locks, **96**, 1938.

Exploring, levees, **00**, 4862.

Failing foundations; cribs, masonry super-structure, **67**, 222.

Forts. (See p. 1797 of this Index.)

Grillage, batteries, **96**, 503; **97**, 729; **98**, 748.

Ground, treacherous, concrete piles for, **04**, 3866.

Gun batteries, **97**, 676, 729; **98**, 747.

Jet borings in, locks, **97**, 2068.

Laying mortar for, **00**, 907.

Leakage, preventing, locks, **94**, 2166.

Leakage, reinforcing to prevent, locks, **09**, 1886.

Levees, **95**, 3812.

Lighthouses, pier ends, **00**, 4078.

Locks, **74**, 830, 873; **75**, 469, 888, ii, 621, 623; **79**, 1365, 1370; **96**, 3857; **00**, 4469; **01**, 2302; **04**, 3753.

Locks, dredging, **94**, 1826.

Locks, mattresses, **94**, 1378.

Locks, testing pits, **95**, 2293.

Masonry dams, **98**, 2208.

Masonry superstructures, **67**, 222; **74**, 151; **76**, ii, 390.

Mats for, jetties, **94**, 1378.

Mattresses, building, **94**, 1597.

Mattresses, dams, **89**, 1093.

Mattresses, discarding of, economy of, jetties, **98**, 2954.

Mattresses in, not necessary, jetties, **01**, 1663.

Mattresses, jetties, **94**, 1378, 2518; **95**, 1509; **00**, 4245, 4438.

Mattresses, necessity for, jetties, **94**, 2518; **00**, 4438.

Mattresses, placing, rock jetties, **00**, 4469.

Mattresses, training walls, **95**, 1491.

Monuments, **01**, 3831.

Mortar batteries, **00**, 907.

Peculiar soil movement, locks, **98**, 1472.

Pile driving, dams, **00**, 5002.

Pile driving from derrick, **01**, 922.

Piles in, cribs, **72**, 166; **78**, 1185, 1188; **79**, 1557, 1558, 1590.

Piles in, locks, **94**, 2166.

Piles, unreliable, gun batteries, **96**, 503.

Piling, concrete, brick buildings, **04**, 3866.

Plans, locks, **95**, 2416.

Preparation of. (See Forts, p. 1797 of this Index.)

Protecting, stone jetties, **93**, 3502.

Pumping out, gun batteries, **96**, 510.

Quicksands, control of, locks, **94**, 1826.

Quicksands, pocket of, effect on sheet-pile dams, **98**, 1487.

Revetments, excessive settlement, **72**, 839; **79**, 1051.

Rock, depth to, Mississippi River, **78**, 918, 1058.

Rock in, jetties, **00**, 4245.

Rock in, mattresses, preferred to, jetties, **95**, 1774; **00**, 4245.

Screw piles, iron piers, **71**, 665; **74**, ii, 133; **75**, ii, 174; **76**, 267; **77**, 256.

Sections, piers, **98**, 2676.

Foundations—Continued.

- Settlement of, cribs, **84**, 1865.
- Settlement of, excessive, dikes, **72**, 839; **79**, 1051.
- Settlement of, gun batteries, **97**, 677.
- Settlement of, dry docks, Helder, Holland, **74**, 830.
- Settlement of, mortar batteries, **97**, 677.
- Settlement of, New Orleans customhouse, **74**, 820.
- Sheet-piling, peculiar overturning, **98**, 1472.
- Soft sites, gun batteries, **98**, 747.
- Spur dams, **92**, 1318.
- Statues, **99**, 3841.
- Stone in, cribs, **72**, 122, 161, 164, 165; **73**, 206, 353; **76**, ii, 436.
- Stone locks, **96**, 1938.
- Subsidence of, jetties, **88**, 1323, 1328; **92**, 1508.
- Testing ground, Government Printing Office, **01**, 3803; **02**, 711.
- Thin mattresses, advantage of, jetties, **94**, 2518.
- Timber breakwaters, **00**, 4090.
- Timber for, locks, **00**, 2771.
- Trenches, crib building, **75**, 305; **76**, ii, 571.
- Undermining of, preventing, **02**, 711.
- Various soils, sustaining power of, **72**, 766.
- Water, in, upon material likely to scour, **75**, ii, 621.
- Water jet borings, locks, **97**, 2068.

Foundations, Brush and Timber.

- Dikes, **76**, 315.

Foundations, Concrete.

- Buildings, **04**, 3828.

Foundations, Portable.

- Tents, survey parties, **98**, 1837.

Foundations, Soft.

- Building on, dams, **94**, 2151.

Fountains. (See Electricity.)

- Irrigation, **02**, 3044.
- Mammoth Hot Springs, **03**, 2476.

Fountains, Artificial.

- 98**, 3732, 3733.
- Electric, **98**, 3733.

Frames. (See Iron; Steel.)

- Boulé dams, **00**, 3482.

Framing. (See Cribs.)

- Cribs, **93**, 3091; **95**, 3119.

Franchises. (See Water Power.)**Freezing.**

- Water below, **75**, ii, 203.

Freight. (See Railways; Rates; Waterways.)

- Barges, shipping by barges cheapest, **04**, 1390.
- Charges, Great Lakes, **12**, 2631.
- Docks for, **97**, 3192.
- Handling, economical, study, Chicago Harbor and vicinity, H. D. 710, 62d, 2d.
- Low-rate freight, railroad capacity for, **74**, 610.
- Movement of, impediments, Chicago territory, H. D. 710, 62d, 2d.
- Movement of, Mississippi River, H. D. 50; 61st, 1st.
- Movement of, railway control of, Chicago and vicinity, H. D. 710, 62d, 2d.
- Quantities of, excessive, rates not raised, St. Johns River, H. D. 1111, 60th, 2d.
- Rates, **00**, 2373, 3624.

Freight—Continued.

- Rates, canals, Buffalo to New York, **00**, 2374.
- Rates, canals, rail and, **96**, 3062.
- Rates, comparison of, railroads, etc., **71**, 630, 644.
- Rates, St. Louis to Liverpool via New Orleans, **00**, 2378.
- Remarks upon transportation, coastal traffic, H. D. 391, 62d, 2d.
- Transfer facilities should be provided by localities, Kansas River, H. D. 94, 62d, 1st.
- Transferring, cost of, Detroit River, **74**, 595.
- United States freight, refusal of Central Pacific to conform to regulations for carrying, **73**, 1117.
- Value, determining, **12**, 2461.
- Vessels, freight; characteristics of, **00**, 2441.

Freight Boats.

- Type, best, Mississippi River, **10**, 2976.

Freight House.

- Details, Kansas City, **12**, 2202.

Freight, Low-rate.

- Capacity of, railroads, **74**, 610.

Freight, Package.

- Handling, **97**, 3179.
- Movement of, Great Lakes (Merchant), Sen. D. 301, 61st, 2d.

Freight Rates. (See Rates.)

- Canalized streams, Little Kanawha, **09**, 1800.
- Channels, improved; beneficial effect, **10**, 738.
- Ohio River points, H. D. 492, 60th, 1st.
- River and land rates, Mississippi River, **10**, 1765.

Freshets.

- Bridge piers, deterioration, **12**, 1310.
- Controlling, proposals for, Merrimac River, H. D. 2, 61st, 1st.
- Dams, effect of, Merrimac River, Mass., H. D. 2, 61st, 1st.
- Dikes, effect of, **04**, 1088.
- Forests, effect of, doubtful, Connecticut River, H. D. 1294, 61st, 3d.
- Propagation of, Altamaha System, H. D. 443, 62d, 2d.
- River bars, cause of, **76**, ii, 541.

Fresh Water. (See Salt Water.)

- Salt water and, cement, effect on, **95**, 2918.
- Salt water and, meeting of, deposits at, **80**, 953.
- Salt water and, quantities, determining, harbors, **96**, 979.

Friction.

- Coefficient, lock gates, **76**, ii, 52.
- Coefficient, various surfaces, **75**, ii, 839.
- Easing, lock gates, **11**, 2096.

Frost.

- Effect of, concrete work, **05**, 1987.
- Green stone, deterioration of, **98**, 1916.

Fuel.

- Cost of, dredges, **05**, 3036.
- Dredges, U. S., **12**, 2154.

Fuel, Oil.

- Dredges, U. S., **12**, 2611.

Fuses. (See Blasting.)

- Blasting, **86**, 687.
- Tests, torpedoes, **89**, 495.

Fuses, Platinum.

- Torpedoes, **84**, 60.

G.**Gablons.** (See Jetties.)Bank protection, **99**, 3720.Brush mats and, combination of, **76**, 574; **79**, 911.Failure of, jetties, **86**, 1295.Jetties, **80**, 1208, 1222.

Missouri River. (See p. 1025 of this Index.)

Sand-filled, jetties, **74**, 732.**Galleries.** (See Cables; Shafts.)Shafts and, rock blasting, Hallets Point, **69**, 391; **75**, ii, 200; **77**, 228, 232; **79**, 61, 378, 384.**Gaps.** (See Drift.)

Closing of, jetties and shore, advantageous effect, Aransas Pass, H. D. 639, 61st, 2d.

Gardening.Propagating Gardens, Washington, D. C., **01**, 3716.Views, Washington, D. C., **05**, 2621.**Gardening, Landscape.**Sample, Washington, D. C., **05**, 2655.**Gases.** (See Tunnels.)**Gas Fields.**Big Sandy River, **00**, 3416.**Gas Formation.**Tunnels, **77**, 693.**Gas Torches.**Welsbach lights, preferred to, **00**, 3145.**Gate House.**

Water supply, drinking, H. D. 342, 61st, 2d.

Gates. (See Culverts; Locks.)**Gates, Automatic.**Dry docks, **98**, 1968.Locks, **99**, 2572.**Gates, Bear-trap.** (See Dams.)Failure of, **03**, 1684.Form, heavy wooden, failure of, **11**, 2139.Form, steel, superior to wooden type, **11**, 2139.Improved, dams, **93**, 2265.Leakage, excessive, causes of, **03**, 1684.Leakage, excessive, interference with operation, **06**, 1610.Lifting device, improved, Allegheny River, **11**, 2121.Operation, improved, **08**, 1799.Raising, air bags for, **96**, 1840.Raising, capstans for, **96**, 1840.Reconstructing, cost of, Ohio River, **11**, 2142.Reconstructing, improvements, **05**, 1842.Reversed head, action under, **96**, 1833.Reversible, **92**, 1820.Stiffening factor, steel skin on lower frame, **11**, 2142.**Gates, Boulé.**Suspension from overhead bridge, **03**, 1922.**Gates, Bear-trap Sluice.**Type, reversed Parker, **03**, 1526.Deposit of silt, and condition of rods, Mississippi River, **07**, 1580.**Gates, Drop.**Framing, locks, frames replaced with concrete-steel, **09**, 1706.**Gates, Guard.**Locks, **00**, 2932.Plans, **98**, 1922.**Gates, Head.**Water-supply system, Yellowstone Park, **02**, 3044.**Gates, Hydraulic.**Comparison of, **75**, 910, 920.Movable dams, **69**, 65, 529; **73**, 540; **75**, ii, 608.rains, calculation of, **75**, 911.**Gates, Intermediate Lock Gates.**Designing, **95**, 3029.**Gates, Iron Lock.****74**, 787.**Gates, Lock.** (See pls. 33, 40.)**00**, 4349; **04**, 3759.Acid in water, effect of, destructive, **09**, 1761.Abutments, designing, **00**, 2975.Anchorages, stripping of turnbuckle threads, **11**, 2109.Anchors for, **00**, 2982.Assembling of, **95**, 2902.Axles and wheels, indication for need of heavier construction, **11**, 2138.Breakages, frequent; indicative of general deterioration, **11**, 2138.Bumots, **74**, 407, 475; **75**, ii, 608.Building, **98**, 2018.Caisson type, action of, **97**, 2356.Calking machine, **96**, 2787.Cascades, **78**, 1334.Chittenden drum weir, **02**, 1667.Concrete locks, **00**, 4349.Design, swift-current streams, **01**, 2514.Designing, **00**, 2978.Designing, calculations, **95**, 3034.Designing, novel, **74**, 787, 819; **77**, 581; **78**, 804.Des Moines Rapids, **70**, 299; **76**, 663; **78**, 736.Erecting of, **95**, 2909.Failure of, **72**, 444, 453, 460; **77**, 618.Forms, **91**, 3343, 3352, 3353.Fox River, **76**, ii, 416.Friction coefficient, **75**, ii, 839; **76**, ii, 52.Friction of gates, easing, **11**, 2096.Hanging of, **76**, ii, 416; **77**, 618.Large, **97**, 2976.Large, distortion, **95**, 3041.Largest, U. S., **72**, 452, 460; **78**, 804.Lateral movement, provision for, **93**, 2482.Leakage, causes, **05**, 1767.

Gates, Lock—Continued.

- Life of, **98**, 2187.
- Louisville and Portland Canal, **72**, 452, 460; **77**, 610; **78**, 780.
- Lower, designing, **95**, 3029.
- Material for, **95**, 3028.
- Miter sill, attaching, **72**, 460; **78**, 736, 743.
- Miter sill, failure of, **72**, 452, 460; **78**, 734, 736, 742.
- Movement of, transverse to lock, **78**, 804.
- Movement, vertical, repairs, **12**, 2624.
- Operating, appliance for, **87**, 1742.
- Operating, chains, undesirable, **98**, 1800.
- Operating, machinery for, **75**, 782; **76**, 664; **77**, 539, 540, 618, 734; **78**, 741, 773, 804; **79**, 1152, 1155, 1284, 1294; **96**, 3272; **97**, 2976; **98**, 1305.
- Operating, obstruction of, sediment, **76**, 759; **77**, 611, 618; **78**, 743, 781, 787; **79**, 1294.
- Operating, obstruction of, weeds, **78**, 741.
- Operating, power for, **98**, 1921.
- Operating, steam for, **80**, 1730; **81**, 1904.
- Paint for, best, **00**, 4331.
- Painting, **00**, 4331.
- Plan, wide locks, **78**, 804.
- Plaquemine Locks, **05**, 1450.
- Pressure, **91**, 3351.
- Raising of, repair, **93**, 2482.
- Ramming, effects of, **11**, 2424.
- Rammed by steamship, Poe Lock, **11**, 2424.
- Rapid decay, **95**, 2361.
- Readjusting, **09**, 1472.
- Recesses for, sheathing of, rapid decay, **95**, 2360.
- Recesses, reducing deposits in, **09**, 1779.
- Repairing, **93**, 2482; **04**, 2107.
- Repairing, draining canal, **99**, 2549.
- Repairing, raising for, **93**, 2482.
- St. Marys Falls Canal, **77**, 922.
- Scour, concealed, under gates, **02**, 1892.
- Sills, designing, calculations, **95**, 3040.
- Starting of, facilitating, device for, **95**, 2359.
- Strains, discussion, **72**, 452, 460; **75**, 910; **78**, 734, 742, 1338.
- Stresses, calculating, **95**, 3037.
- Suspended form, **85**, 1757.
- Tests of, **95**, 3587.
- Timber of, preservation, **78**, 780.
- Types of, **95**, 3029.
- Valve, combination, **76**, ii, 416.
- Valve, safety latch, **93**, 1734.
- Valves, details, **02**, 1948.
- Wheels, cast-iron, replaced with forged steel, **09**, 1780.
- Wide lock, **78**, 804.

Gates, Sea.

- To prevent mingling of salt and fresh water, H. D. 836, 61st, 2d.

Gates, Sluice.

- Improvements in operation, **09**, 2010.
- Steam to clear ice from, **09**, 2010.
- Towers for counterpoising, **09**, 2010.

Gates, Steam-Lock.

- Operating, **80**, 1730; **81**, 1904.

Gates, Steel Lock.

- Building, processes, **95**, 3025.
- Designing, **95**, 3028.

Gates, Steel Lock—Continued.

- Distortion, **95**, 3041.
- Erecting, **95**, 3585.
- Inspection of, **95**, 3025.
- Lock, **95**, 3585.

Gates, Tainter.

- Reservoir dams, **01**, 2314.

Gates, Wooden Bear-trap.

- Wooden type a failure, **11**, 2139.

Gauge Bulletins.

- Forms of, **93**, 4222.
- Iron frames for, **97**, 1940.
- Mississippi River, **93**, 3654.
- Plates for, **97**, 1940.

Gauge Readings. (See Elevations.)

- Big Sandy River, **96**, 2318.
- Bulletins, forms, **93**, 4222.
- Cape Fear River, **93**, 1406, 1418; **95**, 1330, 1334.
- Chicago Harbor, **93**, 2805; **94**, 2137.
- Chicago River, **95**, 2700; **96**, 2579; **97**, 2793; **98**, 2421; **00**, 3784.
- Columbia River, **93**, 3514; **95**, 3542.
- Contentnia Creek, **93**, 1386; **95**, 1314.
- Detroit River, **00**, 4003, 5389, 5394.
- Doboy Bar, **97**, 1542.
- Duwamish River, **98**, 3109.
- Fox and Wisconsin Rivers, **98**, 2397.
- Fox River, **00**, 3724.
- Green River, **97**, 2509.
- Hudson River, **95**, 900; **96**, 826.
- Illinois River, **93**, 2827; **94**, 2156; **95**, 2718; **96**, 2602; **97**, 2819; **98**, 2439; **00**, 3802.
- Kalamazoo River, **98**, 2544.
- Lake Erie, **00**, 5357.
- Lake Superior and Mississippi Canal, **96**, 2395, 2430.
- Licking River, **00**, 3181.
- Little River, **93**, 2088.
- Marquette and Copper Harbors, **00**, 3640.
- Mississippi River (See each annual report.)
- Neuse River, **93**, 1392; **95**, 1320.
- Ocracoke Inlet, **94**, 1001; **95**, 1311.
- Ohio River. (See each annual report.)
- Ogdensburg, N. Y., **93**, 4384.
- Osage River, **93**, 2185.
- Oscillation of, Lake Superior, **87**, 1983.
- Quachita River, **93**, 2093; **94**, 1464.
- Pamlico and Tar Rivers, **93**, 1384; **95**, 1312.
- Red River, **95**, 1861.
- Reducing, **99**, 3478.
- Sacramento and Feather Rivers, **95**, 3306; **97**, 3360.
- St. Clair and Detroit Rivers, **00**, 5394.
- St. Francis River, **93**, 1627.
- St. Johns River, **93**, 1624.
- St. Marys River. (See each annual report, also Miscellaneous Index p. 2041.)
- San Joaquin River, **95**, 3296.
- Tennessee River, **96**, 1921; **00**, 2966.
- Trent River, **93**, 1388; **95**, 1316.
- Warrior River, **00**, 2186.
- White River, **96**, 698; **97**, 2491.
- Winyaw Bay, **95**, 1354.
- Yazoo River, **94**, 1502.

Gauges. (See Bench Marks; Crater; Pumping; Rivers; Water.)

- 90**, 1335, 1340, 1415.

Gauges—Continued.

- Arrangement, dam building, **00**, 2788.
- Atchafalaya River, **96**, 3564.
- Comparison of, lakes, **68**, 981.
- Crevasses, effect of, **95**, 3656.
- Data, physical, reduction of, Mississippi River, **01**, S., 126.
- Data relating to, index to, Mississippi River, **95**, 3707.
- Establishment of, Mississippi River, **72**, 426; **73**, 517; **76**, 600; **77**, 493.
- Establishment of, Western rivers, **73**, 517.
- Flow, measuring, U. S. dredges, **03**, S., 158.
- Laws relating to, Mississippi River, **97**, 1938.
- Mississippi River, **93**, 2058, 2235, 3655; **94**, 2793; **96**, 1636, 3536, 3562; **97**, 1937, 3547; **02**, S., 53.
- Missouri River, **93**, 3931, 4221; **94**, 3114.
- Pumping gauges, mortar pits, **94**, 451.
- Readjustment of, flood tides, determining, **96**, 1469.
- Red River, **93**, 1984.
- Rivers, **93**, 2058.
- Staves for, **97**, 1938.

Gauges, Automatic.

88, 1270.

Gauges, Display.

Stage indicator, **04**, 4063.

Gauges, Illuminated.

90, 2178.

Gauges, Permanent.

Building, **83**, 1313.

Gauges, Pressure.

- Discussion, **75**, ii, 823.
- Mines, explosions of, **95**, 530.
- Submarine, explosives, **89**, 496.

Gauges, Self-recording.

Mississippi River, **97**, 3663.

Gauges, Self-registering.

96, 3572; **00**, 5324.

Gauges, Water.

New self-registering, **03**, 2685.

Gauges, Tide.

- Automatic, Mississippi River, **02**, S., 90.
- Old style Saxton self-registering, correcting maregrams, **01**, 1435.
- Self-registering, **02**, 2514.

Gauges, Well.

Piers, **01**, 2851.

Gauging. (See Harbors.)

- Aqueduct flow, **97**, 4014.
- Brunswick Harbor, **95**, 1495.
- Flood tides, ebb and, Savannah River, **94**, 1138.
- Harbors, **96**, 1225.
- Instructions for, **95**, 3691.
- Lakes, **70**, 554.
- Meter wheel, velocity, tests, **02**, 2791.
- Methods, **00**, 2555.
- Methods, Brunswick Harbor, **95**, 1494.
- Methods, discussion of, **68**, 950; **69**, 562; **70**, 554, 616; **76**, ii, 178; **77**, 1008; **78**, 259, 262, 305, 380.
- Methods, Tennessee River, **99**, 2274.
- Mississippi River, **93**, 2289; **94**, 1732.
- Ohio River, **93**, 2458.

Gauging—Continued.

- Ouachita and Black Rivers, **98**, 1610.
- Readings, survey, Lockport to St. Louis, H. D. 253, 59th, 1st.
- Red River, **93**, 1974.
- Rivers, **93**, 2058.
- St. Johns River, **93**, 1623.
- Savannah River, **94**, 1137.
- Southwest Pass, **99**, 1891.
- Tides, **94**, 1138.
- Water conduits, **97**, 4004.

Geographical Positions. (See Bench Marks.)

- Lakes, **76**, iii, 55, 96.
- Mississippi River, **99**, 3375.
- Triangulation, Missouri River, **93**, 3942.

Geography.

- Lake Winnipeg, **75**, 389.
- Mississippi River delta, **75**, 624.
- Mississippi River, headwaters, **70**, 285; **75**, 392, ii, 436; **78**, 909.
- Mississippi River Valley, **75**, 386, 389, 401; **78**, 855.
- North Carolina coast, **76**, 378.
- Rio Grande valleys, **75**, ii, 984.
- Rocky Mountains, eastern slope, **75**, ii, 982.
- St. Francis River, **68**, 468.
- Sierra Madre, **75**, ii, 998.
- Tennessee River, **68**, 561, 578, 579, 584.
- Western rivers, **68**, 307.

Geography, Physical.

Illinois, **68**, 459.

Geology.

- Allegheny River, **99**, 2439.
- Big Sandy Basin, **75**, 764.
- Black Hills, **74**, ii, 630.
- Comstock lode, **72**, 1129, 1140.
- Coosa Valley, **05**, 1379.
- Data concerning, index to, Mississippi River, **95**, 3708.
- Des Moines Rapids, **67**, 286, 305.
- Elk River, **76**, ii, 173.
- Exploration of 40th parallel, **71**, 1027.
- Features, unique, Maumee Basin, H. D. 769, 62d, 2d.
- Lake Winnipeg, **75**, 392.
- Little Tennessee River, **76**, 717.
- Map of, Ohio, **96**, 3083.
- Mississippi River Basin, **78**, 855.
- Mississippi River Delta, **75**, 624.
- Mississippi River, headwaters of, **75**, 392; **78**, 909.
- Ohio River territory, H. D. 492, 60th, 1st.
- Recessions, Minnesota River, falls of, **78**, 915.
- Red River, **73**, 651.
- Utah Mountains, **72**, 1113.
- West of 100th meridian, **75**, ii, 923.

Girders.

Buildings, steel, **04**, 3860.

Gorges. (See Ice.)

Dikes a cause of, rivers, **04**, 1092.

Government Printing Office. (See pl. 70.)

Building, **96**, 4004.

Grader, Hydraulic.

Building, **01**, S., 353.

Grades. (See Bridges; Levees; Sluices.)

Best, levees, **93**, 1918.

Grades—Continued.

- Bridges, effect on, **79**, 1461.
- Levees, **93**, 3850.
- Water conduits, **93**, 4283.

Gradients.

- Roads, **03**, 2453.

Grading. (See Banks.)

- Bank protection, **94**, 2885, 2901.
- Cost of, bank work, Mississippi River, **12**, 3870.
- (See annual reports, Mississippi River Commission, p. 1067 and 1142 of this Index.)
- Machine for, economy of, **01**, S., 350.
- Road scraper, banks, **01**, 2225.

Grading, Bank. (See pl. 61.)

- Machine for, and improvement of, **05**, S., 213.

Grading, Hydraulic.

- 93**, 3734, 3779.
- Banks, **95**, 3774, 3825, 3830; **96**, 3613; **00**, 4913.
- Missouri River, **96**, 3824.
- Nozzle used, **96**, 3613.
- Revetments, **94**, 3145.

Grain.

- Barges for, **76**, 512.
- Cargoes, handling, **97**, 3219.
- Freight, handling, **97**, 3196.
- Shipments, Mississippi River, **93**, 3709; **01**, S., 33.

Granite.

- Crushing strength, **75**, ii, 846.
- Mica in, excess of, effect, **72**, 529.
- Sills of, laying, locks, **00**, 2256.

Grapple.

- Dipper or, dredges working as, **94**, 811.

Grass.

- Flow in canals, effect on, **73**, 1008; **78**, 294.
- Mats, **79**, 1068, 1072, 1074.
- Oats and, bank protection, **98**, 1919.
- Sand movement, checking, **98**, 2964; **00**, 993, 4278.

Grass, Bermuda.

- Satisfactory, **02**, 2465.
- Slopes, protection of, **75**, 773; **76**, 748; **79**, 936.

Grass, Holland.

- Sand dunes, reclamation of, **94**, 2567; **08**, 803.

Gravel.

- Banks, Ohio River, **85**, 1840.
- Ballast, cribs, **99**, 2635.
- Bars, forming of, **78**, 842.
- Concrete in, **00**, 978.
- Rock and, cribs better than, piers, **98**, 1761.
- Stone and, comparison of, concrete, **00**, 978.

Gravel, Boxes of.

- Brush, holding of, **93**, 1720.

Gravel, Loose.

- Foundations, building, **98**, 2093.

Gravel Shoals (See Shoals).**Great Lakes** (Lake Erie; Harbors; see p. 2041 of this Index; Commerce; Surveys.)

- Area, **98**, 2847, 2848, 2860.
- Boats of, not adapted to Mississippi River traffic, H. D. 50, 61st, 1st.
- Bottom, character of, deepest parts, **71**, 1021 **75**, 304, 320.

Great Lakes—Continued.

- Charts, cost to public, **08**, 892.
- Charts, issuance of, **09**, 937.
- Commerce, **96**, 3088; **08**, 1911.
- Commerce, great growth, **06**, 1861, 1710; **07**, 1844, 1859, 2055; **08**, 2088, 2137; **09**, 665; **10**, 2235, 2279.
- Commerce, surveys required by, **07**, 849.
- Commerce, tremendous growth, **07**, 846.
- Commerce with Mississippi River, probable, H. D. 304, 61st, 2d.
- Considered as U. S. transportation system, **07**, 849.
- Currents, direction of, **73**, 261.
- Definition of, **97**, 3132.
- Disasters on, **66**, iv, 141.
- Discharge, **67**, 564; **68**, 931, 958, 965; **70**, 565, 617; **10**, 2714.
- Discharge, measuring, **68**, 950; **69**, 572; **70**, 554.
- Docks, iron ore, **10**, 2097.
- Drainage of, by Wabash, Illinois, and other rivers; evidences of, H. D. 769, 62d, 2d.
- Dredging, results of, fishes, crustacea, **71**, 1020.
- Elevations, etc., St. Marys River, St. Clair River, etc., **01**, 3163.
- Formerly drained into the valley of the Mississippi, **68**, 308, 442; **75**, 396.
- Freight, package, Sen. D. 301, 61st, 2d.
- Gauges, comparison, **68**, 981.
- Levels, effect of Detroit River discharge, H. D. 676, 61st, 2d.
- Levels, fluctuation, **95**, 3088; **98**, 2847.
- Levels, investigation of, **01**, 3770.
- Levels; investigations, formulas, and details, **12**, 3545.
- Levels, regulation of, **07**, 849.
- Levels, variations, **02**, 2779.
- Magnetic variations, and studies, **10**, 2725, 2726.
- Minimum temperature, depth, **71**, 1021.
- Pier, settlement of, **08**, 1902.
- Shipping of, unsuitable for river traffic, H. D. 50, 61st, 1st.
- Shoals, peculiarly dangerous character of, **07**; 847.
- Shore lines, **75**, ii, 857.
- Signaling on, mirage, **67**, 575.
- Storms, force of, **06**, 1700.
- Surfaces, **68**, 961.
- Surfaces, oscillations, **66**, iv, 93; **67**, 100, 599; **68**, 86, 983; **69**, 600; **72**, 116, 1033, 1040; **73**, 1193; **76**, ii, 341.
- Surveys. (See p. 2041 of this Index.)
- Sweep, tension wire, **08**, 2527.
- Temperature, various depths, **71**, 1021.
- Tides, **66**, iv, 93; **71**, 989; **72**, 1035; **73**, 1172.
- Tidewater, height above, **75**, ii, 853; **76**, iii, 5, 71, 80; **77**, 1107, 1189.
- Traffic, ore, **10**, 2097.
- Traffics and routes, H. D. 769, 62d, 2d.
- Triangulation, **10**, 2716.
- Vessels on, dimensions, **67**, 227, 257; **72**, 220; **74**, 592, 614; **76**, ii, 431.
- Vessels on, masts of, height, **74**, 614.
- Water levels, curves, **78**, 1412.
- Watershed of, **68**, 961.

Great Lakes—Continued.

Waterway from, to Gulf, H. D. 1374, 61st, 3d.
Wrecks, 10, 2098.

Grillages. (See Cribs; Foundations.)

Bottoms, cribs, 68, 182, 183; 70, 191.
Bottoms, filling, loss of, 69, 146.
Building, cribs, 95, 3119; 97, 3076.
Buildings, 04, 3828, 3860.
Foundations, gun batteries, 96, 503; 97, 729;
98, 747.

Groins. (See Brush; Concrete; Counterforts;
Hurdles; Jetties; Riprap; Spurs; Timber.)

Bank protection, 99, 3717, 3720.
Building, jetties, 94, 2637.
Revetment better than, jetties, 95, 3315.
Shore-line protection, 05, 3010.
Shores, effect upon, St. Augustine, Fla., H. D.
580, 62d, 2d.

Groins, Bur.

99, 2720.

Groins, Timber.

Dikes, 77, 266.
Jetties, 72, 1007; 76, 180, 188.

Grounds.

Reclaiming, methods, Washington, D. C., 08,
1214.
Testing, foundations, 01, 3803.

Grounds, Parking.

Duluth-Superior, 08, 1901.

Grounds, Public. (See p. 2040 of this Index; see
pl. 62.)

Art commission, D. C., 12, 3517.

Grouting.

Anchor bolts, 00, 2782.

Grubbing.

96, 1622.

Guards. (See Ice Guards.)**Gudgeon.**

Setting, concrete work, 02, 2480.

Gulf of Mexico.

Formerly extended up Mississippi River to
Dubuque, 68, 3f2.
Level, 94, 2794.
Level, changes, 96, 3478.
Littoral currents, 74, 738; 75, 940; 77, 433;
81, 1353, 1369.
Shore lines, unstable character, 79, 929.
Waterway to, from the Lakes, H. D. 1374,
61st, 3d.

Gulf Stream.

Velocity, 76, 379.

Gun Batteries. (See Forts, p. 1797 of this Index.)**Gun Blocks.** (See Forts, p. 1797 of this Index.)**Gunboats.**

Wrecks of, removing, Charleston Harbor, 73,
728.

Guncotton.

Dynamite and, comparison, 81, 58.
Explosive energy, 79, 36.
Use of, New Haven, 71, 773.

Gunfire. (See p. 1797 of this Index.)**Gun Lifts.** (See p. 1797 of this Index.)**Gun Platforms.** (See Concrete, and p. 1797 of
this Index.)**Guns.** (See p. 1797 of this Index.)

Magnets, improvised, 88, 354.
Raising, device for, 93, 616.

H.**Hammers.** (See Piles.)

Pile-driving, 93, 4241.

Hammers, Drop.

Pile-driving, 83, 1185.

Harbor Lands.

City should own, Jamaica Bay, N. Y., H. D.
1506, 60th, 2d.

Harbor Lines. (See p. 2137 of this Index.)

Precautionary publicity, 02, 1912.

Harbors. (See Anchorage; Basins; Breakwaters;
Channels; Discharge; Ice; Jetties; Piers;
Rivers.) (See pls. 5, 8, 9, 10.)

Area of, Boston, 71, 882, 884; Cherbourg, 71,
884.

Bars, movement of, 96, 1190.

Bars, tides, effect of, 96, 1190.

Basins, plans, Jamaica Bay, N. Y., H. D. 1506;
60th, 2d.

Breakwaters at, 98, 2725.

Breakwaters (see Breakwaters), auxiliary, 03,
2084.

Harbors—Continued.

Bulkheads, plans, Jamaica Bay, N. Y., H. D.
1506, 60th, 2d.

Capacities, Duluth-Superior, 10, 2061.

Channels, cross sections, Mobile, 97, 1666; 98,
1426; 00, 2166.

Commerce; kinds employing harbors (King-
man), H. D. 634, 61st, 2d.

Contraction works, effect of, Savannah, H. D.
181, 59th, 1st.

Cross sections, Sandusky Harbor, 95, 3090.

Cross sections, Savannah Harbor, 96, 1237.

Currents in, Great Lakes, H. D. 82, 59th, 2d.

Currents, velocity of, determining, 96, 1237.

Deep channels, breakwaters necessary for,
Lakes, 00, 3773.

Deep channels, planning, 97, 1257.

Deepening, intracoastal waterways to take
place of harbors, Florida, H. D. 675, 62d, 2d.

Depths and widths, proper, for modern com-
merce, Mobile Harbor, Ala., H. D. 657,
61st, 2d.

Harbors—Continued.

Depths, increased; source of demand for, Portland, Me., H. D. 489, 62d, 2d.

Depths in; wind, effect of, **67**, 218; **68**, 154, 171; H. D. 62, 59th, 1st.

Depths in, determining, **96**, 1237.

Depths in, great increase of, **00**, 4200.

Depths in, required in lake harbors, **67**, 17, 34, 252, 255; **73**, 343; **74**, 213; **76**, ii, 543; **77**, 113, 947, 953.

Design, Great Lakes, Chicago Harbor, and vicinity, H. D. 710, 62d, 2d.

Destroyed by moving sands, Greytown, Nicaragua, report, Isthmian Comm., 1899-01.

Deterioration of, causes, **97**, 2771, 2779.

Development, Duluth-Superior, H. D. 1506, 60th, 2d.

Dikes for, **89**, 764.

Discharge, Charleston, **96**, 1189.

Discharge, Savannah, **96**, 1222.

Dividing line between U. S. and other authorities, **76**, ii, 556.

Dredges suitable for, Wilmington, Del., H. D. 359, 62d, 2d.

Dumpings, regulation of, Duluth-Superior, **10**, 2061.

Entrance, advisability of private interests reconstructing, Indiana Harbor, Ind., H. D. 690, 62d, 2d.

Entrances, bars, **97**, 2779.

Entrances, breakwaters for protection, proper types, **09**, 1966.

Entrances, covering, breakwaters for, **74**, 235.

Entrances, deepening, methods, Great Lakes, **04**, 3067.

Entrances, forces acting on, **97**, 2777.

Entrances, funnel shape of, correcting, **97**, 2771.

Entrances, navigating through, difficulties, Great Lakes, H. D. 62, 59th, 1st.

Entrances, piers, effect of, **97**, 2775.

Entrances, sand closure of, dikes to prevent, **96**, 3101.

Expansion basins, need of, Great Lakes, H. D. 62, 59th, 1st.

Expansion basins, pier harbors, Great Lakes, **06**, 1821.

Extension, planning, Great Lakes, H. D. 538, 61st, 2d.

Factors of a good harbor, H. D. 1067, 61st, 3d.

Freight handling, economical method, Chicago, Ill., H. D. 710, 62d, 2d.

Gauging in **96**, 1225.

Hawaiian Islands, H. D. 609, 62d, 2d.

Ice in, formation of, **87**, 2353.

Improvement of, effect, H. D. 1067, 61st, 3d.

Improvement should be confined to general area, H. D. 1067, 61st, 3d.

Improving, jetties for, Baltic harbors, **81**, 1060.

Improving, pier extension, economy of, **95**, 3109.

Injury of, artificial deposits, **81**, 1679, 2485; **83**, 1696; **85**, 1820; **86**, 1092; **87**, 724, 1983.

Injury of, city dumping in, **76**, ii, 429; **77**, 928.

Injury of, obstructing and dredging rivers at harbors, **75**, 287.

Injury of, private dredging, **72**, 205; **73**, 291; **74**, 46, 207.

Harbors—Continued.

Injury of, private encroachments, corporate and, **74**, 202, 207; **76**, ii, 535; **77**, 828, 928.

Jetties, effect of, in 20 years, Aransas Pass, H. D. 639, 61st, 2d.

Jetties and breakwaters for forming, H. D. 1067, 61st, 3d, and report of Isthmian Canal Comm., 1899-01.

Jurisdiction over, **73**, 828, 887; **74**, 203; **75**, 512, 826; **76**, 436; **77**, 828, 928, 940; **79**, 498, 1362, 1721; **81**, 742, 766, 2422; **82**, 2045; **83**, 1696; **87**, 724; **88**, 623.

Lack of, retarding development of Hawaiian Islands, H. D. 593, 61st, 2d.

Lines of, locating, **95**, 2423; **96**, 2130.

Locations, bays, Monterey Bay, Cal., H. D. 1084, 61st, 3d.

Locks, at, **99**, 2268.

Navigation through aided by outer breakwater, **03**, 2034.

Patrol, need for in large harbors, **05**, 1976.

Pier extension, economy of, **95**, 3109.

Piers in, plans, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.

Piers, proper length, Indiana Harbor, H. D. 690, 62d, 2d.

Pilotage rates, effect of, Charleston, H. D. 288, 62d, 2d.

Piloting, fogs, **01**, 1013.

Planning, Hawaiian Islands, H. D. 833, 61st, 2d.

Protection, detached breakwaters for, **99**, 2813, 2816, 2818.

Providing, small lakes, Lake of the Woods, H. D. 1276, 61st, 3d.

Railroad connections, new harbors, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.

Regulations, Duluth-Superior, **09**, 1909.

Regulations, San Juan, P. R., H. D. 914, 59th, 1st.

Remarkable improvement of, San Pedro, Cal., **00**, 4200.

Rivers and, defense of, planning, **95**, 4.

Salt water, fresh and, quantities determining, **96**, 979.

Sand deposits in sheltered harbors, **03**, 2087.

Sand movement, **96**, 1190.

Selection of, factors, St. Andrews Bay, Fla., H. D. 12, 61st, 1st.

Sewage, settlement of, **98**, 2669.

Shoaling sewage a cause, **97**, 1251.

Swells in, preventing, Duluth, H. D. 82, 59th, 2d.

Terminals, responsibility for, H. D. 288, 62d, 2d.

Tides, range of, **96**, 1189.

Tides, Savannah Harbor, **96**, 1222.

Traffic and dumping, supervision. (See Miscellaneous, p. 2111 of this Index.)

Various countries, bridging, **96**, 3900.

Wave action, controlling, H. D. 62, 59th, 1st.

Wave action, control of, temporary works of doubtful value, Great Lakes, H. D. 46, 61st, 2d.

Wave action, Great Lakes, **05**, 1821.

Wharfage areas, **11**, 2265.

Widths, necessary, Great Lakes, H. D. 82, 59th, 2d.

Harbors—Continued.

Winds, effect of, on ice movement, New York Harbor, H. D. 65, 59th, 1st.

Harbors, Artificial.

Details, Indiana Harbor, Ind., H. D. 721, 59th, 1st.

Entrances, widening, planning, Duluth, H. D. 221, 60th, 1st.

Jetties, design of parallel, New Jersey coast, H. D. 388, 59th, 2d.

Stilling basins, entrance of vessels helped by, Duluth, H. D. 221, 60th, 1st.

"Undeveloped port with large possibilities," Cold Spring Inlet, N. J., H. D. 388, 59th, 2d.

Harbors, Atlantic.

Fœ'ures, H. D. 1067, 61st, 3d.

Harbors, Breakwater.

Designing, entrance channels, Hawaiian Islands, H. D. 593, 61st, 2d.

Sand drift, Hawaiian Islands, H. D. 593, 61st, 2d.

Shore connections to prevent siltage, San Pedro, H. D. 969, 60th, 1st.

Harbors, Deep.

Making, Pacific coast, 00, 4203.

Possible locations, Pacific coast, 93, 3244.

Harbors, Deepened.

Commerce probably not increased by, Charleston, S. C., H. D. 288, 62d, 2d.

Harbors, Deepwater.

Selecting, Texas, H. D. 1094, 61st, 3d.

Harbors, Great Lakes.

Basins, interior; cost of enlarging, Grand Marais, H. D. 939, 60th, 1st.

Concrete piers, details, 05, 1974.

Deepening, methods considered, Two Rivers, H. D. 730, 59th, 1st.

Depths, effect of winds, H. D. 62, 59th, 1st.

Entrance piers, cost of rebuilding, Grand Marais, H. D. 939, 60th, 1st.

Entrances, plan for, Manistee, Mich., H. D. 599, 62d, 2d.

Features, H. D. 1067, 61st, 3d.

Private improvements and U. S. cooperation, H. D. 1067, 61st, 3d.

Shoaling and silting, preventing, Harbor Beach, H. D. 900, 59th, 1st.

Harbors, Gulf.

Breakwaters, value of, 03, 1348.

Features, H. D. 1067, 61st, 3d.

Storms, protecting from, Galveston, 03, 1348.

Harbors, Ice. (See Ice.)

Artificial, details, 01, 2676.

Cost of, Mississippi River, 05, 1637.

Harbors, Improved.

Commerce, effect on new, 09, 1329.

Consents, obtaining from abutting property owners, 06, 2034.

Damages, waiver of right to, Manistee, Mich., H. D. 599, 62d, 2d.

Docks and wharves, ownership of, Sen. D. 301, 61st, 2d.

Great Lakes, H. D. 710, 62d, 2d.

Jetties for, Baltic harbors, 81, 1060.

Parking grounds, Duluth-Superior, 08, 1901.

Harbors, Improved—Continued.

Pier extension, economy of, 95, 3109.

Plan, general; Jamaica Bay, H. D. 1506, 60th, 2d.

Plan, small or probational, Ontonagon, Mich., H. D. 602, 61st, 2d.

Policy relating to, Sen. D. 301, 61st, 2d.

Harbors, Inner.

Waves, preventing, piers, 73, 204.

Harbors of Refuge. (See Piers.)

Advantages from, Neah Bay, H. D. 472, 62d, 2d.

Benefits, national, North Atlantic, H. D. 911, 60th, 1st; H. D. 935, 60th, 1st.

Character of craft requiring, Neah Bay, H. D. 472, 62d, 2d.

Cleveland, 74, 232; 77, 963.

Commerce, character of, employing them, Newport, R. I., H. D. 610, 61st, 2d.

Conditions, calling for, Neah Bay, H. D. 472, 62d, 2d.

Delaware Breakwater, 73, 879, 881.

Dublin, Ireland, 81, 1057.

Enlarging, factors governing, Harbor Beach, H. D. 900, 59th, 1st.

Exterior harbors of refuge, advantages of, 82, 2295.

Facilities, additional, Point Judith, H. D. 911, 60th, 1st.

Holding power, experiments, Lake Huron, 72, 210, 219; 73, 292.

Ice, protecting from, 04, 1222.

Jurisdiction over, 77, 928.

Kurrachee, East Indies, 81, 1062.

Lake Winnebago, 98, 2349.

Landing places, designing, Point Judith, H. D. 911, 60th, 1st.

Life-saving facilities, increasing, Point Judith, H. D. 911, 60th, 1st.

Lighting and other signals, Point Judith, H. D. 911, 60th, 1st.

- Mooring buoys in, 73, 293; 74, 210.

Necessity for, 66, iv, 141; 70, 486, 488.

Necessity for, Lake Huron, 72, 209, 217; 73, 292; 74, 209; 76, ii, 538; 77, 926; 78, 1219; 79, 1645.

Necessity for, Lake Superior, 76, ii, 328.

Necessity for, Pacific coast, 77, 1049, 1055; 79, 1801, 1805.

Need for, factors determining, 04, 1581.

Parallel piers at entrance, dangerous, 80, 2021; 82, 2296.

Piers, building, 97, 2071.

Planning, Keweenaw Canal, H. D. 325, 60th, 1st.

Planning, points to be considered, 93, 8253.

Planning, Point Judith, 96, 656.

Requirements, 72, 211; 77, 1050.

Requisites, essential; North Carolina coasts, H. D. 528, 62d, 2d.

Sand movement in, breakwaters to govern, Point Judith, H. D. 911, 60th, 1st.

Sites, factors governing, Lake Superior, H. D. 450, 60th, 1st.

Site for, North Carolina coasts, selecting, H. D. 528, 62d, 2d.

Sites, selecting, 04, 952.

Harbors of Refuge—Continued.

Size of, increasing; Keweenaw Waterway, H. D. 40, 62d, 1st.
Sturgeon Bay, **76**, ii, 344.
Surveying, **97**, 1432.

Harbors of Refuge, Exterior.

Interior breakwaters, advantages over, **82**, 2295.

Harbors, Outer.

Improving, methods, **97**, 2899.

Harbors, Pacific Coast.

Few, H. D. 1067, 61st, 3d.

Harbors, Privately Built.

Improvement, point where U. S. assumes; Indiana Harbor, Ind., H. D. 1113, 60th, 2d.

Harbors, Small.

Small type of dredge recommended, Absecon Inlet, N. J., H. D. 1395, 61st, 3d.

Harbor Works.

Accidents, vessel owner liable, Agate Bay, **07**, 1825.

Hardpan.

Dredging, **69**, 417; **70**, 212; **74**, 165.
Dredging, blasting and, **95**, 3201.

Harrowing.

Dredging and, **88**, 1042.

Hawaiian Islands. (See p. 1683 of this Index.)

Harbors, study for, H. D. 609, 62d, 2d.

Heads. (See Guard Lock; Jetties.)**Heads, Breakwater.**

Concrete work, **11**, 2259.

Heads, Pier.

Concrete molds, **04**, 3802.

Heads, Solid.

Dikes, repairing, **95**, 4020.

Headwaters.

Reservoirs, Mississippi River, **01**, 444, 2313.
Dams, Mississippi River, **03**, 1534.

Hearting. (See Dredgings; Filling; Jetties; Rubblestone.)**Heat.**

Mortars, materials of, effect on, **94**, 2353; **96**, 2803.

Heat, Artificial.

Batteries, drying, **93**, 656.

Heating.

Buildings, Government Printing Office system, **01**, 3817.
Buildings, steel, **04**, 3847, 3856.

Heliogravure.

Chart production by, **08**, 2517.

Hellotrope.

Surveying, **67**, 564; **78**, 1397.

High Water. (See Elevations; Water Heights.)

Discharge, Mississippi River, **94**, 2948.
Discharge, river channels, improving, **98**, 1748.
Gauge, **97**, 3664.
High-water marks, Mississippi River, **94**, 2787.
Low water and, Atchafalaya River, **96**, 3564.
Low water and, data concerning, index to, Mississippi River, **95**, 3708.

High Water—Continued.

Low water and, Mississippi River, **93**, 2236; **96**, 3562.
Low water and, Missouri River, **93**, 2236.
Low water and, slopes of, **75**, ii, 501.
Mean low and, St. Johns River, **93**, 1624.
Mississippi River, **93**, 2843, 3725; **94**, 1526, 2756; **95**, 3747, 3877; **96**, 3477; **97**, 3667; **00**, 2543.
Red River, **93**, 1978; **94**, 1451; **00**, 2498.
River bars, effect on, **72**, 132.
River beds, rising of, **75**, ii, 477.
White River, **97**, 2491.
Youghiogheny River, **00**, 3299.

Highways. (See Bridges.)**Hills.**

Stripping. (See pl. 50.)

Hire.

Dredges difficult to hire, Ohio River, **01**, 2601.

Holster.

Plans, **95**, 1394.

Holsting Machine.

Levee building, **99**, 3558.

Holsting Plant.

Brush and stone dams, **94**, 2893.

Holsts. (See Cables; Cranes.)

Ammunition handling, **97**, 631; **99**, 795; **00**, 853, 857, 898.

Holes. (See Drills.)

River beds, **97**, 2249.

Horns. (See Crib.)

Objections to, on cribs, **68**, 240; **70**, 204.

Horsepower.

Cost of, water power of navigable streams, H. D. 781, 60th, 1st.

Horses.

Cost of teaming, **04**, 3735.

Horticulture.

See annual reports, Public Buildings and Grounds, page 2040 of this Index.

Hot Air.

Plant. (See Forts, p. 1797 of this Index.)

Hot Water.

Cement, effect on, **94**, 2351.

Hudson River. (See p. 191 of this Index.)

Attitude of State of New York toward U. S. waterway improvements, Sen. D. 887, 62d, 2d.

Hulls.

Hydraulic dredges, **04**, S., 103.

Hulls, Iron.

Wooden and, comparison, snag boats, **74**, 369.

Hulls, Metal.

Economy, snag boats, **97**, 1951.

Hurdles. (See Dikes; Groins; Spurs.) (See pl. 17.)

Bank building, **98**, 1698.
Bank erosion, preventing, **98**, 1704.
Building, **93**, 2153, 2161; **94**, 1596, 1602; **95**, 2059; **96**, 1718; **97**, 2012; **98**, 1698, 1703.
Details, **01**, 2192.
Dikes, **85**, 1657; **87**, 1564; **89**, 1687; **90**, 1975; **91**, 2111; **92**, 1720; **99**, 2058.

Hurdles—Continued.

- Disk anchor, **01**, 2223.
- Drift, utilization of, **94**, 1581.
- Effect of, **95**, 2059.
- Mattresses, **94**, 1602.
- Protection of, pile buttresses for, against ice, **95**, 2078.
- Restoration, method, **02**, 1605.
- River contraction, **94**, 1593.
- Scour at, **94**, 1594.
- Silt, arrest of, **94**, 1577; **96**, 1717; **97**, 2012.

Hurricane.

- Channels, effect on, Charleston, **12**, 1806.
- Features, peculiar, Galveston, **02**, 1396.
- Forts, effect on, Galveston, **01**, 850.
- Jetties, effect on, Brazos River, **01**, 1946.

Hyacinth, Water. (See p. 572 of this Index.)

- Boat for crushing, **01**, 341, 395.
- Chemicals superior to machines, destroying, **01**, 1748.
- Experiments for destroyal, **06**, 1235.
- Obstructions, rivers, **97**, 1754.
- Plans for destroying, **01**, 1746; **06**, 330; **10**, 524.

Hydrants.

- Forts. (See Forts, p. 1797 of this Index.)

Hydraulic Dredging. (See Dredging.)**Hydraulic Mining.** (See Mining.)**Hydraulics.** (See Currents; Discharge; Rivers; Surveys; Waves.)
Formulas, **82**, 2481.**Hydraulics—Continued.**

- Mississippi River, P. P. No. 13, C. E.
- Study of, Red River, **00**, 2489.

Hydraulics, Waterway. (See pl. 72.)**Hydroelectric Power.**

- Muscle Shoals Canal, H. D. 781, 60th, 1st.

Hydrographs. (See Surveys.)

- Mississippi River, **01**, S., 232; H. D. 50, 61st, 1st.

Hydrography. (See Surveys.)

- Camps, **95**, 4248.
- Data concerning, index to, Mississippi River, **95**, 3709.
- Field work, **91**, 3481.
- General instructions, **03**, 1911.
- Methods, **93**, 1974; **94**, 2802; **95**, 3700, 4170; **96**, 3520; **00**, 2555.
- Methods, Lockport to St. Louis, H. D. 263, 59th, 1st.
- Methods, Ouachita and Black Rivers, **98**, 1610.
- Methods, Southwest Pass, **99**, 1886.
- Mississippi River. (See p. 1067 of this Index.)
- Missouri River. (See p. 1025 of this Index.)
- Pacific coast, **93**, 3242.
- Recording, details, **02**, 2818.

Hydrometric Pendulum.

- Current measuring, **97**, 4094.

Hypsometry.

- Methods, Lockport to St. Louis, H. D. 263, 59th, 1st.

I.**I-Beams.**

- Ceilings, batteries, **97**, 630.
- Leveling dredged areas, **05**, 1041.

Ice. (See Anchors; Canals; Channels.) (See pls. 7, 60, 61.)

- Action of, Rock Island Rapids, **67**, 358.
- Action, Wisconsin River, **76**, ii, 419.
- Barriers against, Delaware River, **73**, 874, 877.
- Boring through, alger for, **93**, 2964; **95**, 4240.
- Bridge piers, closing rivers with, **71**, 716.
- Channels, boats for freeing, **73**, 874.
- Cleared from sluice gates with steam, **09**, 2010.
- Concrete breakwaters, effect on, **97**, 2626; **98**, 2256.
- Cribs, destruction of, **75**, 310, 354; **76**, 258, ii, 533.
- Cribs displaced by, **87**, 2058.
- Cribs, effect on, **68**, 231; **69**, 108; **73**, 294, 296; **74**, 210, 220, 228, ii, 135; **75**, 57, 310, 354; **76**, 258, ii, 533; **77**, 251.
- Cribs, impact against, **68**, 231.
- Cribs, protection of, **68**, 231; **73**, 294, 296; **74**, 210, 220, 228, ii, 135; **75**, 310, 354; **76**, 258, ii, 533; **79**, 1481.
- Cribs, stone removed from, **79**, 1735.

Ice—Continued.

- Crushing strength of, **82**, 786, 788.
- Current flow, effect on, **02**, 2809.
- Damages from, vessels, **77**, 111.
- Dams, lowering, **11**, 2136.
- Dikes, protecting, **74**, ii, 155, 159; **77**, 224; **93**, 2943.
- Formation, **88**, 409, 410.
- Formation, Allegheny River, **80**, 1771.
- Formation, Buffalo Harbor, **87**, 2353.
- Formation, Delaware and Chesapeake Canal, **82**, 955.
- Formation, Delaware River, **81**, 822; **82**, 732, 959; **83**, 744.
- Formation, Great Lakes harbor piers, **10**, 2092.
- Formation, Mississippi River (Upper), **84**, 1620.
- Foundations, effect on, cribs, **87**, 2058.
- Hurdles, protection of, **95**, 2078.
- Jetties, effect on, **04**, 3188.
- Mattresses on, weaving, **95**, 3960; **11**, 2008.
- Movement, **91**, 2130.
- Movement, ice piers, effect of, **90**, 921.
- Movement, protecting against, New York, H. D. 65, 59th, 1st.

Ice—Continued.

- Movement, stone superstructures, effect on, **89**, 2073.
- Piers and breakwaters, protecting, **73**, 294, 296; **74**, ii, 135; **75**, 57, 320.
- Piles, lifting of, **81**, 618.
- Pressure, calculating, breakwaters, Marquette, H. D. 573, 61st, 2d.
- Pressure, piers, against, **82**, 785; **87**, 2076.
- Protection against, harbor of refuge, **04**, 1222.
- Protection against, piles for, Mississippi River, **05**, 1637.
- Resistance to, pile dikes, **89**, 851.
- River beds, changes in, **80**, 1771; **82**, 695.
- Rivers, conditions in North American; S. D. 215, 59th, 2d.
- Seasons, Connecticut River, H. D. 1294, 61st, 3d.
- Vessels, protecting, sheer booms, **78**, 828; **79**, 1363.
- Winds, effect of, New York Harbor, H. D. 65, 59th, 1st.

Ice, Anchor.

- 76**, ii, 419.

Ice Boats.

- Baltimore Harbor, **82**, 956.
- Delaware River, **83**, 600.

Ice Borings.

- 94**, 2263; **95**, 4240.
- Machine for, **93**, 2963; **95**, 4240, 4241.

Ice Dams.

- Floods cause of, **69**, 108.
- St. Clair River, **70**, 164.

Ice Dikes.

- Currents, effect on, **93**, 1146.

Ice Gorges.

- 89**, 1811.
- Dikes, effect of; on ice gorges and freshets, **04**, 1088.
- Susquehanna River, **95**, 1170.
- Views, Missouri River, **10**, 1826.

Ice Guards.

- Cribs, **97**, 2809.

Ice Harbors.

- Building, rivers, **95**, 2233; **97**, 2206.
- Chester, Del., **75**, ii, 183; **77**, 262.
- Chester, Pa., **88**, 2690.
- Cost of, Mississippi River, **05**, 1637.
- Delaware River, **71**, 693, 705; **73**, 882; **74**, ii, 134, 151; **78**, 434, 437; **79**, 429.
- Essentials of, Mississippi River, **82**, 1769.
- Floating pontoons for, **86**, 834; **87**, 804.
- Iron barriers for, Delaware Bay, **82**, 786; **85**, 842.
- Marcus Hook, Pa., **88**, 2690; **02**, 1046.
- Mooring posts, **94**, 1771.
- Muskingum River, **96**, 2103.
- New Castle, Del., **94**, 874.
- Ohio River, **78**, 814, 820, 828; **79**, 1355, 1366.
- Pile dikes for, **00**, 4989.
- Planning, rivers, **95**, 2219.
- St. Louis, **77**, 506; **78**, 679.

Ice Piers.

- 88**, 702; **90**, 2166; **92**, 948, 1963.
- Designs, rivers, **93**, 2446.

Ice Piers—Continued.

- Ice, effect on, **90**, 921.
- Ice, movement, effect on, **90**, 921.
- Tests, New Castle, Del., **93**, 1196.

Ice Surveys.

- 94**, 2263; **95**, 4229, 4237.
- Equipment for, **95**, 4245.
- Party organization, **95**, 4236.
- Precautions, **95**, 4229.
- St. Marys River, **95**, 4235, 4240.
- Sounding, precaution, **95**, 4229.

Imports.

- Exports more important, H. D. 545, 59th, 1st.

Improvement.

- Works of, small, informal contracts for, **98**, 2613.
- Works of, inspecting, steamboat for, **98**, 2759.

Improvement of Rivers and Harbors. (See Vol. I, p. 17 of this Index.)**Improvements, Continuous.**

- Imperative necessity for, **03**, 424.
- Necessary and economical, on large rivers, etc., **04**, 453.

Improvements, Detached.

- Defective, Missouri River, H. D. 1120, 60th, 2d.

Improvements, Federal (U. S.).

- Justified by importance of coastwise trade, Nantucket coasts, H. D. 536, 62d, 2d.

Improvements, Harbor.

- Rules, Great Lakes and elsewhere, H. D. 1067, 61st, 3d.

Improvements, Private.

- Aided by U. S., H. D. 781, 60th, 1st.
- Cooperation of U. S., Great Lakes and elsewhere, H. D. 1067, 61st, 3d.
- Repair, by U. S., expensive, Arcadia Harbor, Mich., H. D. 10, 61st, 2d.
- Value, determining, **00**, 4381.

Improvements, Waterway. (See Canals; Harbors; Rivers.)

- Affecting single firms only, propriety of, left to Congress (Gary Harbor, Ind.), H. D. 955, 60th, 1st.
- Appropriations apportioned by States illogical, **01**, 1996.
- Appropriations should be somewhat in proportion to local enterprise, H. D. 1067, 61st, 3d.
- Appropriations, U. S., and private corporations, **04**, 1282.
- Areas, general; should be confined to, H. D. 1067, 61st, 3d.
- Assessments, local, laws to aid, **10**, 983.
- Benefits from, **01**, 2149.
- Claims, U. S. guaranteed against; methods, Bayou Teche, **09**, 1466.
- Commerce, new, attracted by, reasons, **09**, 1329.
- Commerce, relation to improvements, Great Lakes, **09**, 1942.
- Commercial benefits, study of, Arcadia, Mich., H. D. 701, 62d, 2d.
- Commercial factors, to be considered, **03**, 1427.
- Competition, preserving principle of, **12**, 810.

Improvements, Waterway—Continued.

Competition, recommending improvements because of hope of providing, H. D. 231, 58th, 3d.

Cooperation of locality; improvements recommended because of, H. D. 712, 62d, 2d.

Cost and commerce concerned, Great Lakes, **09**, 1942.

Cost, Great Lakes, annually, **09**, 1943.

Cost one-sixth of 1 per cent of freight value, Duluth, **12**, 953.

Cost small compared with benefits, **11**, 795.

Depots, need of U. S. storage, **03**, 2073.

Effect of, favorable to commerce, instances, **08**, 717.

Effect of U. S. work, Mississippi River, **11**, 1913.

Expense, how much of expense should U. S. bear, Arcadia Harbor, H. D. 701, 62d, 2d.

Expenses of, should property owners contiguous contribute, Black Rock Harbor, N. Y., H. D. 913, 59th, 1st.

Expense of U. S., work which should be at, H. D. 700, 59th, 1st.

Harbors privately built, point where U. S. assumes further improvement, H. D. 1113, 60th, 2d.

Hindrance, private rights a, H. D. 818, 61st, 2d.

Hindrance, corporate ownership of water rights, **05**, 910.

Investment, a good, **01**, 1965.

Justification for, factors determining, **01**, 1978.

Manufacturing following, Ohio River, **03**, 1692.

Manufacturing, effect on, **05**, 2497.

Methods. (See Canals; Harbors; Rivers.)

Old works, condition, Cape Fear River, H. D. 287, 62d, 2d.

Permanency, degree of, Missouri River, H. D. 1120, 60th, 2d.

Policy of U. S., H. D. 262, 59th, 1st.

Private interests, improvement should not be to benefit, H. D. 1067, 61st, 3d.

Railroads due to; alluvial valley of Mississippi River, **04**, S., 24.

Rates after improvement, **10**, 562.

Rates depressed by, **11**, 796.

Rates, coal, lowered by, **03**, 1692.

Rates on Great Lakes lower because of, **01**, 3281.

Rates lower through, **09**, 556.

Rates, large saving of, **03**, 1354.

Rates saved by, **10**, 955.

Reasons for, commercial principles governing Connecticut River, H. D. 231, 58th, 3d.

Recommendation for, the benefit of one or a few corporations not good reason, H. D. 139, 59th, 1st.

Save 2.33 mills per ton-mile, Great Lakes, **12**, 954.

States; Michigan constitution prohibits contribution, H. D. 537, 59th, 1st.

State works, interference of, Sen. D. 887, 62d, 2d.

Trade, foreign; growth of, due to improvements, Boston, **08**, 956.

Vessel size, increase of, due to improvements, **08**, 717.

Water power, effect, Willamette Falls, **05**, 2497.

Increasing Depths. (See Jetties.)

Index. (See p. 9, and each annual report, Mississippi River Commission, p. 1142 of this Index.)

Indicators.

Gauges, depths, **04**, 4063.

Water levels, **04**, 4063.

Industries.

Development of, probable, canal, Great Lakes to Mississippi River, H. D. 304, 61st, 2d.

Infiltration. (See Concrete, and Forts, p. 1797 of this Index.)

Wells, **76**, 535.

Inlets.

Bridges, **09**, 2357.

Channels, forming, theories, Jamaica Bay, H. D. 1506, 60th, 2d.

Inlet Wall.

River barriers, Yuba River, **06**, 2078.

Inspection. (See Dredging.)

Dredging, **98**, 2224, 2751.

Rock, removing, **98**, 2751.

Steamboat for, river and harbor improvement, **98**, 2759.

Instruments.

Error, determining, lake survey, **72**, 1048, 1103; **76**, iii, 64.

Magnetic variation observations, **04**, 4133.

Precise leveling, Mississippi River, **01**, S., 69.

Insulation.

Multiple cable, tests, **90**, 419; **93**, 656.

Intakes.

Levees, **02**, 1642.

Integration.

Discharge, observations, **00**, 5385.

Interior Basins. (See Basins.)

Intracoastal Waterways. (See Waterways.)

Inverts.

Rivers, under, California, H. D. 262, 59th, 1st.

Iron. (See Steel.)

Cleaning. (See Forts, p. 1797 of this Index.)

Corrosion of, lake water, **68**, 156.

Deposits of, Cumberland River, **71**, 482; **79**, 1429.

Deposits of, Elk River, **76**, ii, 172.

Deposits of, Green River, Ky., **80**, 1810.

Deposits of, Virginia, **74**, ii, 104.

Salt water, effect of, **79**, 447.

Iron Barriers.

Ice harbors, **82**, 786; **85**, 842.

Iron, Cast.

Forged steel wheels preferred, lock gates, **09**, 1780.

Iron Framework.

Changes, Washington Monument, **98**, 3716.

Iron Industries.

Location, causes for, Coosa Valley, **05**, 1381.

Ohio, **96**, 3081.

Iron Ore.

Big Sandy River, **00**, 3413.

Iron Ore Docks.

Capacity and shipments, **12**, 2488.

Iron Railroad.

Embedded in concrete to prevent cracks, **99**, 995, 1002.

Ironwork. (See Bridges.)

Buildings, **04**, 3855.
Cleaning, buildings, **04**, 3854.
Concrete and stone locks, **94**, 1996.
Strength of, bridges, **72**, 286, 291.

Ironwork, Rusty.

Cleaning, improvised sandblast, **98**, 1926.
Cleaning, sandblast, efficiency, **98**, 1801.

Irrigation. (See Arid Regions.)

Fountain, **02**, 3044.
Navigation interests and, conflict, rivers, **93**, 3292.
Nile, **75**, 556.
Reservoirs, **98**, 2852, 2864, 2878; H. D. 262, 59th, 1st.
San Joaquin Valley, H. E. D. 290, 43d, 1st.
River and harbor improvements, relation to,

Irrigation—Continued.

Sen. D. 301, 61st, 2d.
Works for, **98**, 2871.

Islands.

Artificial islands, for dredgings, **00**, 1619.
Filling in, value increased by, Jamaica Bay, H. D. 1506, 60th, 2d.
Forming of, **75**, ii, 447.
Harbors for, planning, Hawaiian Islands, H. D. 833, 61st, 2d.
Removed, Philadelphia Harbor, **99**, 1330.
Shores, revetment, Jamestown Islands, Va., **02**, 218.
Wearing away of, Boston Harbor, **71**, 885.

Islands, Artificial. (See pl. 53.)

Channel contraction, **02**, 1033.
Dredgings, disposal of, **00**, 1619.

Jams. (See Drifts; Logs.)

Breaking, river drift, **97**, 1885.

J.**Jams, Log.**

Breaking, **04**, 3605.

Jet. (See Water.)**Jetties.** (See Breakwaters; Dikes; Piers; (See pls. 2, 4, 5, 12, 13, 14, 46.)

Absorption, advancing shore line, **94**, 2474.
Advance scour, controlling, **94**, 2517.
Baltic harbors, **81**, 1060.
Bars between, **97**, 2016; **99**, 1595.
Bars between, St. Johns River, **95**, 1601.
Bars, effect on, **94**, 2568; **95**, 1798; **00**, 4470; **01**, 1664; **05**, 802; H. D. 29, 61st, 2d; **11**, 2611; H. D. 349, 62d, 2d.
Bars, movement of, Galveston, H. D. 340, 59th, 2d.
Bars, not successful on, South Atlantic coast, **01**, 1662.
Benefit from, river mouths, **93**, 3459.
Blasting and, channel forming, **98**, 1539.
Breakwaters and, channel deepening, **96**, 574.
Breakwaters and, for harbor formation, H. D. 1067, 61st, 3d.
Brush in, **73**, 444, 448; **74**, 336; **75**, 219; **76**, 189, ii, 403; **79**, 732.
Brush in, delivery of, **00**, 4243.
Brush in, filling of, **93**, 1885.
Brush in, stone and, **80**, 596, 922, 924, 964, 1228, 1271; **81**, 502, 1044, 1052, 1061, 1101, 1114, 1179, 1328; **82**, 1147, 1201, 1445, 1468; **83**, 879, 895, 907, 1048, 1052, 1074, 1440; **84**, 1162, 1163; **85**, 824, 1251, 1423; **86**, 1069.
Building, **00**, 2294.
Building, plant for, **98**, 2964; **99**, 3261; **04**, 1884.
Building, plant for, Galveston Harbor, **96**, 1532.

Jetties—Continued.

Building, scour, preventing, piles omitted, **98**, 2955.
Building, tramway, **94**, 2564.
Building, trestle, extension of, **98**, 2954.
Building, trestle, repairing, **98**, 2952.
Building, Winyah Bay, **95**, 1349.
Canal boats filled with stone used, **66**, ii, 36; **75**, ii, 103.
Caps, concrete, for heavy seas, **12**, 2771.
Careless arrangement, effect of, **74**, 345.
Channels, changes in, **93**, 1507, 1616, 1618, 1802; **96**, 1196, 1310; **97**, 1478, 1534; **00**, 4434.
Channels, deepening of, **93**, 3571; **94**, 1110.
Channels, depths in, fluctuation of, **93**, 1802.
Channels, effect, Galveston, H. D. 340, 59th, 2d.
Channels, effect on, Charleston, **02**, 1170.
Channels, formation of, **00**, 2293.
Channels, forming, theory, Jamaica Bay, H. D. 1506, 60th, 2d.
Channels in vicinity, profiles, St. Johns River, H. D. 611, 61st, 2d.
Channels maintained without, Atchafalaya River, H. D. 17, 61st, 2d.
Channels, multiplication by single jetties, **10**, 2407.
Channels, profiles between jetties, mouth of Mississippi River, **05**, 1432.
Channels, sand movement, **94**, 2468.
Channels, south. (See South Pass, p. 1067 of this Index.)
Channels, unattributable to jetties, St. Johns River, **95**, 1591.
Concrete in, **66**, ii, 36; **68**, 500, 512; **71**, 545; **79**, 806, 926; **80**, 1126; **81**, 1064; **82**, 1480, 1486; **87**, 818; **89**, 1319; **00**, 2294.

Jetties—Continued.

- Concrete, blocks of, **80**, 1126.
- Concrete, caissons filled with, **79**, 926.
- Concrete work, materials, **03**, 2070.
- Construction, Cold Spring Inlet, N. J., **11**, 1382.
- Construction, progress on, method of showing, **06**, 1296.
- Construction, rate of, Grays Harbor, Wash., **04**, 2248.
- Coring, **01**, 1113.
- Cost, **72**, 358; **76**, 677, 685; **78**, 466, 1195.
- Cost, Mississippi River, 1067, 1923.
- Costs, where difficult to estimate, **06**, 758.
- Costs, estimating, **06**, 758.
- Cross section, **89**, 1316, 1318.
- Cumberland Sound, **76**, 459.
- Currents, control over, **93**, 3315.
- Curves of, pile driving in, **94**, 2544.
- Danube, **75**, 219.
- Deepening by, greater than expected, **00**, 4298.
- Deep-water mattresses, **91**, 3187.
- Depth, securing; very effective, Humboldt Harbor, H. D. 950, 60th, 1st.
- Depths obtained by, increasing by dredging, Coos Bay, H. D. 958, 60th, 1st.
- Designs, **00**, 2294.
- Deterioration, Connecticut River, **98**, 950.
- Difficulties, remarkable, Columbia River, **06**, 757.
- Dredges and, effect on channel development, **07**, 1401.
- Dredging and, comparison, **95**, 1636.
- Dredging, preferable, Pensacola Harbor, **95**, 1657.
- Dredging required also, mouths of Columbia River, H. C. D. 2, 59th, 2d.
- Drift, effect of, **94**, 2636.
- Drifts, sand, removal with jetties, Biscayne Bay, Fla., **08**, 1372.
- Dynamite, efficacy of, **01**, 1664.
- Effect of, **93**, 1600; **94**, 2568.
- Effect of, Aransas Pass, **05**, 1512.
- Effect of, channel deepening, **94**, 1110.
- Effect of, Charleston Harbor, **95**, 1424.
- Effect of, Coos Bay and Harbor, **94**, 2562.
- Effect of, Coquille River, **94**, 2556.
- Effect of, Cumberland Sound, **02**, 2502.
- Effect of, deltas, **74**, 785; **75**, 980.
- Effect of, Grays Harbor, Wash., H. D. 29, 61st, 2d.
- Effect of, on movement of material, Savannah, Ga., **03**, 1150.
- Effect of, profiles showing, **06**, 1296.
- Effect of, St. Johns River, **95**, 1592.
- Effect of, sand drift, arrest of, **68**, 830; **70**, 457; **72**, 936.
- Effect of, sand movement, controlling, **75**, 320; **98**, 3011.
- Effect of, shoals, seaward movement of, **98**, 1283.
- Efficiency, remarkable, St. Johns River, **02**, 1202.
- Ends, bar formation at, **94**, 2578.
- Ends, depths at, **95**, 1735.
- Ends, distances apart, **95**, 3531.
- Ends, distance between, Siulaw River, H. D. 648, 61st, 2d.

Jetties—Continued.

- Ends, large stones for, objectionable, **01**, 1431.
- Ends, shoaling, **84**, 1245.
- Ends, shoaling, beyond, method of studying, **98**, 1458.
- Enrockment, planning, **00**, 4450.
- Enrockment, profile, **94**, 2564.
- Enrockment, settlement, **00**, 4474.
- Enrockment work, hindered by trestle destruction, Columbia River, **08**, 2271.
- Erosion, dangerous, Brazos River, H. D. 27, 61st, 2d.
- Erosion, controlling, beaches, Bridgeport, Conn., H. D. 89, 62d, 1st.
- Estimates, Savannah, H. D. 181, 59th, 1st.
- Extension, **94**, 2654; **00**, 2428, 4445.
- Extension of proposed, estimated, Humboldt Harbor, H. D. 950, 60th, 1st.
- Extension of, to deepen channel, Galveston, H. D. 328, 61st, 2d.
- Extension, plant for, **00**, 4449.
- Extension, sand impounded by, **94**, 2562.
- Extension, sand movement, preventing, **98**, 1328.
- Extension, scour, **00**, 4288.
- Extension, two methods, after wreck of trestle, Columbia River, **07**, 2198.
- Failure of, shore protection, **75**, 490; **79**, 997.
- Failure of, Vistula River, **74**, 837, 848.
- Favorable effect of, Sabine Pass, **94**, 1377.
- Filling of, bundles of brush, **93**, 1885.
- Floods and ice, effect of, **04**, 3188.
- Flow concentration, **97**, 2016.
- Forms, various; cost, **80**, 928; **81**, 1067, 1123, 1132, 1356; **83**, 688.
- Foundations, **00**, 4469.
- Foundations, economy in, **90**, 3261.
- Foundations, mats for, **94**, 1378; **95**, 1509; **94**, 1378, 2518.
- Foundations, mattresses, **00**, 4245, 4438.
- Foundations, mattresses, Cumberland Sound, **95**, 1509.
- Foundations, mattresses, discarding, economy in, **98**, 2954.
- Foundations, mattresses, necessity doubtful, **00**, 4438.
- Foundations, mattresses, needful, Pacific coast, **94**, 2518.
- Foundations, mattresses, rock and, mattresses preferable, **95**, 1774.
- Foundations, mattresses, rock and, rock preferable, **00**, 4245.
- Foundations, mattresses in, unnecessary, **01**, 1663.
- Foundations, subsidence of, **88**, 1323, 1328; **92**, 1508.
- Foundations, thin mattresses, advantages of, **94**, 2518.
- Gabions, **80**, 1208, 1222.
- Gabions, Galveston, **86**, 1295.
- Gales, northeast, effect of, Winyah Bay, **03**, 1126.
- Gap between jetties and shore, effect of closing, Aransas Pass, H. D. 639, 61st, 2d.
- Government plant for building, rent of, **98**, 2964.
- Groins, building, **94**, 2637.

Jetties—Continued.

Harbor construction, Nicaraguan coast, report Isthmian Canal Comm, 1899-01.
 Harbor improving, Baltic, **81**, 1060.
 Harbors, effect on, after 20 years, Aransas Pass, H. D. 639, 61st, 2d.
 Harbors, formation, breakwaters an auxiliary, advantages of, **03**, 2084.
 Heads of, designs, **00**, 2296.
 Hearting, oyster shells expensive, **97**, 1328.
 Height, **92**, 1359.
 Height, proper, Columbia River, **03**, 2299.
 Holland rivers, **80**, 1271.
 Hurricanes, effect, Brazos River, **01**, 1947.
 Incomplete jetties, deterioration, **98**, 950.
 Lakes, **75**, 966, 972.
 Large bars, effect on, **93**, 3316.
 Large stone, derrick scows for handling, **94**, 1102.
 Length, determining, **79**, 782.
 Location, factors governing, rivers, **03**, 2232, 2242.
 Locations, Mississippi River mouth, **07**, 1402.
 Maintenance, South Pass, Mississippi River, **02**, 316.
 Materials for, placing, **94**, 1101.
 Materials for, sheet piles, **83**, 437.
 Materials for, storage platform, **00**, 4448.
 Mats, teredo attacks, **82**, 1188; **86**, 1312.
 Mattresses, building, **94**, 2514, 2566.
 Mattresses, deep-water mattresses, **91**, 3187.
 Mattresses, foundation. (See above.)
 Mattresses, necessity for, doubtful, **00**, 4438.
 Mattresses, placing, **00**, 4287, 4469.
 Mattresses, planning, **00**, 4450.
 Mattresses, teredo attacks, **82**, 1188; **86**, 1312.
 Objectionable, tidal rivers, **71**, 749, 751.
 Oblique to current, effect, **79**, 524.
 Obstructions, **99**, 1158.
 Old Haupt jetty, as a nucleus, Aransas Pass, H. C. D. 5, 59th, 2d.
 Oyster-shell hearting, **97**, 1328.
 Piles, concrete substituted, **95**, 509.
 Piles, deterioration, **00**, 4475.
 Piles, drift, injury from, **94**, 2556.
 Piles, pile driving, **94**, 2543.
 Piles, teredo attacks, **00**, 4475.
 Plans, preferable, Pacific coast, H. C. D. 29, 61st, 2d.
 Profile sections and, Aransas Pass, **06**, 1348.
 Profiles, **95**, 3366, 3560.
 Profiles, Aransas Pass, **05**, 1512.
 Profiles, Key West, **93**, 1658; **96**, 1326.
 Profiles, St. Johns River, **96**, 1310.
 Progress, difficult to make, Columbia River, **08**, 823.
 Proper heights, **96**, 1310.
 Proper heights, discussion of, **00**, 4437.
 Proper location, study of, **96**, 1191.
 Protecting cribs for, **93**, 1799.
 Rapid effect of, Charleston Harbor, **94**, 1105.
 Rebuilding, details, **12**, 2770.
 Repairing, **00**, 1730.
 Repairing, mattresses, **93**, 1576.
 Repairing with cement in bags; unsatisfactory, **02**, 2283.

Jetties—Continued.

Revetment of, advantages, **95**, 3315.
 Revetment of, groins better than, **95**, 2217.
 Riprap, handling, **97**, 1799.
 Rivers, effect on, **73**, 232; **74**, 785; **75**, 218; **76**, 459; **79**, 1173.
 Rivers, improving, Holland, **80**, 1271.
 Rivers, mouths of, **74**, 833, 878; **75**, 951, 953, 980.
 Rivers, mouths of, Brazos River, **75**, 938.
 Rivers, mouths of, effects, Columbia River, **03**, 2300.
 Rivers, mouths of, Rhone, **75**, 965.
 Rivers, shallow, improvement of, **72**, 139, **76**, ii, 399.
 Rivers, tidal, effect on, **85**, 681.
 Rock, **95**, 1424.
 Rock, delivery of, **00**, 4242.
 Rock, distribution of, Charleston Harbor, **95**, 1424.
 Rock, dumping, **00**, 4476.
 Rock, dumping, arrangements for, **96**, 3253.
 Rock for, cost of obtaining, Aransas Pass; H. D. 639, 61st, 2d.
 Rock, handling, **94**, 2567.
 Rock, placing, tramway, **94**, 2544.
 Rock, tests, **96**, 3217.
 Rubblemound versus cribs, advantages of former, **04**, 3216.
 Sand deposits between, **99**, 1598.
 Sand drift, arrest of, **68**, 830; **70**, 457; **75**, 320.
 Sand formations near, **95**, 3276.
 Sand movement, control, **98**, 3011.
 Sand movement, effect, **03**, 2287; **10**, 2407; **05**, 1433.
 Sand movement, effect on, **98**, 1127.
 Sand movement near, **00**, 4201.
 Scour, **93**, 1441; **99**, 1553; **00**, 4181, 4288.
 Scour, advance, **94**, 2515.
 Scour, Columbia River, **10**, 2407.
 Scour, control of, **94**, 2545; **03**, 1169, 1175.
 Scour, fill and, **96**, 3286.
 Scour, preventing, mattresses discarded, **98**, 2949.
 Scour produced by, channels, **07**, 1272.
 Settlement of, **97**, 1801.
 Sheet piling in, **83**, 437.
 Shoals, scour through, **97**, 2016.
 Shore ends, small stone for, **02**, 1159.
 Shore line, protection, **05**, 3010.
 Shore line, recession, **04**, 3168.
 Shore protection, **71**, 893; **74**, ii, 325.
 Shore protection, relation to, **73**, 453; **74**, 332; **76**, 629.
 Shore recession, South Pass, **99**, 1819.
 Shores protected by, length, **72**, 139, 357; **74**, 332; **76**, 629, ii, 406.
 Shores, protection, Galveston, H. D. 328, 61st, 2d.
 Shore wall, protection. (See Forts, p. 1797 of this Index.)
 Sides of, scour, **82**, 1196.
 Slopes, revetting, advantages from, **95**, 3315.
 Spurs, **00**, 4451.
 Spurs, effect of, **94**, 2548.
 Stone barges, **97**, 1799.

Jetties—Continued.

- Stone for, breakage of, **98**, 2953.
- Stone for, chips useful, **94**, 1231.
- Stone for, delivery of, **94**, 2503.
- Stone for, deterioration in jetty, **95**, 3314.
- Stone for, dumping, **95**, 3360.
- Stone for, handling, **94**, 1102; **97**, 1799.
- Stone for, placing, **96**, 1194.
- Stone for, placing, trestlework, **94**, 2517.
- Stone for, sizes of, **98**, 2964.
- Stone for, sizes of, as quarried, **98**, 2959.
- Stone for, three classes, **93**, 1615.
- Stone for, weighing, **94**, 1392.
- Stonework, Charleston Harbor, **94**, 1108.
- Storage platforms, **00**, 4448.
- Storms, effect of, **97**, 1796; **00**, 1277.
- Storms, effect of, Galveston, **01**, 403.
- Storms, withstanding of most terrific, Galveston, **01**, 1926.
- Subsidence, **99**, 1597.
- Subsidence, mouth, Mississippi River, **07**, 1401.
- Subsidence, Sabine Pass, **94**, 1377.
- Substructure, core of sand for, **04**, 3216.
- Substructure, crib; fine example, Lorain, **03**, 2066.
- Successful jetties, Charleston Harbor, **95**, 1426.
- Superstructure, concrete, Erie, **04**, 3818.
- Superstructure, timber crib and, Erie Harbor, **04**, 3818.
- Supplemental dikes, **97**, 1393.
- Teredo attacks, Columbia River, **07**, 2199.
- Tests, storm, **94**, 2636.
- Tests, storm waves, Charleston Harbor, **94**, 1105, 1110.
- Thirty-five foot channel, Southwest Pass, **99**, 1867.
- Tidal rivers, effect, **71**, 749, 750; **72**, 830; **76**, 477; **78**, 551, 558; **85**, 681.
- Tidal range at various jetties, **95**, 3531.
- Tides, effect of, Biscayne Bay, Fla., H. D. 554, 62d, 2d.
- Timber capping, deterioration, **95**, 1728.
- Tombigbee River, **76**, 496.
- Tramways, **00**, 4278.
- Tramways, extending, **94**, 2566; **95**, 3362.
- Tramways, repairing, **94**, 2635.
- Trestles, considerations governing construction of, **08**, 823.
- Trestles, repairing, **98**, 2952.
- Types, canal entrances, Delaware & Chesapeake Canal, S. D. 215, 59th, 2d.
- Undermining, preventing, revetment and groins, the first preferable, **95**, 3315.
- Undermining, preventing, spurs for, **94**, 2548.
- Undermining, preventing, stone, placing, **95**, 3312.
- Various jetties, ends, distances apart, **95**, 3531.
- Various jetties, physical data concerning, **95**, 3531.
- Various jetties, tidal range, **95**, 3531.
- Vernon Harcourt on, **88**, 1136.
- Vicinity of, accretions, **97**, 3372.
- Vicinity of, current changes, **96**, 1195.
- Vicinity of, deepening progressive, **99**, 1959.
- Vicinity of, depths, increase of, **95**, 1798.
- Vicinity of, enormous accretions, **93**, 3141.
- Vicinity of, extensive erosion, **93**, 3288.

Jetties—Continued.

- Vicinity of, sand formations, **95**, 3276.
 - Vicinity of, sand movement, **94**, 2637; **00**, 4201.
 - Vicinity of, scour and fill, **96**, 1536.
 - Vicinity of, shoaling, **94**, 2633.
 - Vicinity of, shore revetment, **96**, 3255.
 - Vistula River, **79**, 1012.
 - Voids in, effect, **82**, 1434.
 - Waterways, intracoastal, H. D. 391, 62d, 2d.
 - Waves, effect of, **90**, 1563.
 - Wing dams, **94**, 1336.
 - Wisconsin River, **76**, ii, 399.
 - Work of, supplemented by dredging, **97**, 1393.
- Jetties, Brush and Rock.**
Brush, disappearance of, **95**, 1774.
- Jetties, Brush and Stone.**
Building, **94**, 2514; **97**, 1371.
Sections, **93**, 1418.
- Jetties, Curved.**
Charleston H., **79**, 732.
Plans, **95**, 3220.
Scour, cessation of, **96**, 628.
Bars, effect on, **01**, 1664.
Effect of single-curved jetties, Aransas Pass, **02**, 1388.
- Jetties, Decayed.**
Protection, **02**, 496.
- Jetties, Double.**
Single and, advantages of each, **95**, 3529.
- Jetties, Floating.**
67, 427.
- Jetties, High-tide.**
Necessity for, Pacific coast, **93**, 3357.
- Jetties, Longitudinal.**
Transverse and, comparison, **77**, 508.
- Jetties, Old.**
Nucleus for new work, Aransas Pass, H. C. D. 5, 59th, 2d.
Removing, expensive, Aransas Pass, H. C. D. 5, 59th, 2d.
- Jetties, Parallel.**
Artificial harbor; design, New Jersey coast H. D. 388, 59th, 2d.
Wave action between, disastrous in storms to vessels, H. D. 221, 60th, 1st.
- Jetties, Pile.**
78, 458, 464, 466.
Building, **94**, 1404.
Concrete substituted, **95**, 509.
- Jetties, Pile and Brush.**
Economical, **97**, 1393.
- Jetties, Pile and Stone.**
83, 437, 584.
- Jetties, Portable.**
96, 1738; **98**, 1706.
Advantages of, **95**, 2062.
Bars, effect on, **97**, 2016.
Building, **96**, 1738; **97**, 2016.
Channel contraction, **95**, 2062.
Rivers, effect on, **97**, 2016.
Scour from, **95**, 2077.
Shoals, scour through, **97**, 2016.
- Jetties, Random Stone.**
78, 1284; **79**, 807.

Jetties, Reverse Curve.

- Design, **98**, 1537.
- Effect of, **98**, 1540.
- Supposed effect of, Aransas Pass, **98**, 1536.

Jetties, Rock.

- Building, **95**, 1424; **01**, 1663.
- Building, methods, **96**, 3211; **00**, 4452.
- Building, rock placing, Humboldt Bay and Harbor, **99**, 3185.
- Foundations of, mattresses, omission of, **96**, 3216.
- Foundations of, mattresses, placing, **00**, 4469.
- Spurs for, **00**, 4451.
- Trestles of, repairing, **97**, 3370.
- Trestles of, strengthening, **96**, 3212; **97**, 3373.
- Vicinity of, scour and fill, **93**, 3493.

Jetties, Seacoast.

- Effect of, **98**, 1126.

Jetties, Sheet-pile.

- 73**, 814; **79**, 705, 707; **83**, 437.
- Building, **96**, 1129.
- Sand filling, **79**, 465.

Jetties, Single.

- Double and, advantages of each, **95**, 3529.

Jetties, Stone.

- Brush mattresses, making, **93**, 3339.
- Building, **95**, 3556; **96**, 1192; **98**, 2949; **00** 4278.
- Building, plant for, **93**, 3350; **96**, 1194.
- Building, tidal currents, effect on, **93**, 3501.
- Dimensions and form of, proper, **93**, 3502.
- Effect of, **93**, 3500.
- Flattening of, preventing, **95**, 3360.
- Foundations, protecting, **93**, 3502.
- Great Salt Pond, **96**, 621.
- Natural slopes, **93**, 3490.
- Pile and, **83**, 437, 584.
- Planning, **95**, 3521.
- Profiles, **00**, 4476.
- Profiles, Charleston Harbor, **96**, 1204.

Jetties, Stone—Continued.

- Profiles, Columbia River, mouth, **93**, 3496.
- Quarry chips, usefulness of, **94**, 1231.
- Scour, **00**, 4181.
- Settlement, **91**, 1834.
- Sizes, **98**, 2953, 2959, 2964.
- Spreading, preventing, **95**, 3360.
- Subsidence, **96**, 1535.
- Tramways for, **00**, 4278.
- Tramways for, building, **93**, 3352.
- Tramways for, extending, **93**, 3334.
- Tramways for, strengthening, **93**, 3492.
- Undermining of, protecting against, **93**, 3490.
- Vicinity of, accretions, **93**, 3494.

Jetties, Submerged.

- 76**, 477; **78**, 569.

Jetties, Temporary.

- Disk anchor, **01**, 2221.

Jetties, Timber Crib.

- Superstructure, concrete shell, **04**, 3818.

Jetties, Transverse.

- Distances between, **72**, 139, 357; **74**, 332; **76**, 629, ii, 406.
- Longitudinal and, comparison, **77**, 508.
- River improvement, **76**, ii, 406.

Jetties, Twin.

- Bars, effect, **01**, 1664.

Jetties, Wattled Pile.

- 79**, 709, 710, 1023, 1039.

Jet, Water.

- Pile driving, **05**, 2591.

Jointer.

- Torpedo wires, **89**, 494.

Joints.

- Asphalt for, concrete work, **02**, 2494. (See Forts, p. 1797 of this Index.)
- Brickwork, **04**, 3866.
- Vertical joints necessary in concrete walls, **05**, 1987.

K.**Kidwells Meadows.**

- Potomac River, **95**, 1207.

L.**Labor.**

- Contract, hired and, comparison, **66**, 14; **67**, 97, 470; **70**, 182; **71**, 174; **75**, 243, 460, 685; **76**, 657, 659, 661, 671, ii, 524, 557; **77**, 514, 544; **78**, 508, 709, 758, 770, 1139, 1164, 1191; **79**, 1520; **92**, 2591.

Labor—Continued.

- Eight-hour day, increases costs, **08**, 2271.
- Scarce because of circus, Southern levees, **05**, S., 215.

Labor, Hired.

- Contract system and, comparison, **92**, 735.

Lake Champlain. (See pp. 201, 2041 of this Index.) Stages, H. D. 759, 61st, 2d.

Lake Erie. (See p. 2041 of this Index.)

Regulation, International Waterways Commission, 1910, H. D. 779, 61st, 2d.

Lakes. (See Channels; Discharge; Great Lakes.)
Bed, character of, Lake Michigan, 89, 2035, 2162.

Breezes, land and lake, Great Lakes, 67, 600.

Connecting different levels with locks, Puget Sound, H. D. 953, 60th, 1st.

Depth of, Lake Erie, 68, 966.

Discharge, rainfall and, ratio, Great Lakes, 68, 962.

Elevation of, Lake Winnipeg, 68, 309.

Forming of, Mississippi River, 78, 912; 79, 1010.

Geographical positions, Great Lakes, 76, iii, 55, 96.

Harbor extension, planning, Great Lakes, H. D. 538, 61st, 2d.

Harbors, jetties, Great Lakes, 75, 966, 972.

Harbors, piers, proper width between, 66, 26, 27.

Height of, variation of, investigation, 98, 3774.

Latitude, determining, 75, ii, 864.

Latitude, determining, probable error, Great Lakes, 73, 1178.

Longitude, determining, 71, 1014; 72, 1054, 1118; 76, iii, 92.

Natural reservoir sites, 98, 2821, 2846.

Origin of, coasts, Gulf and Atlantic, 76, 393.

Outlets of, current velocity, Great Lakes, 68, 961; 70, 556.

Outlets of, deepening, Great Lakes, 82, 2470.

Physical characteristics of, 75, 389.

Precise levels, Great Lakes, 76, iii, 70; 77, 1106, 1189; 78, 1408.

Reservoir sites, 98, 2821, 2846.

Rivers, effect on, 98, 2849.

Rivers, generally shallower than, 78, 912.

Shores of, surveys, 93, 4372.

Steamboats, earliest, Great Lakes, 67, 225.

Surfaces, range of, Lake Champlain, 71, 1019.

Surfaces, winds, effects of, 97, 2777.

Tonnage, Great Lakes, 74, 590.

Vessels, dimensions, Great Lakes, 67, 227, 257; 72, 220; 74, 592, 614; 76, ii, 431.

Vessels, tonnage, Great Lakes, 74, 590.

Water of, iron, corrosion of, Great Lakes, 68, 156.

Lakes, Great. (See p. 2041 of this Index; Channels.)

Lakes, Natural.

Reservoir sites, 98, 2821, 2846.

Lakes, Small.

Harbors, providing, Zippel Bay and Lake of the Woods, H. D. 1276, 61st, 3d.

Lampblack.

Removing glare of concrete work, 04, 3727.

Land. (See Sites.)

Acquirement for canals, etc., 11, 2282.

Breezes, lake and land, 67, 600.

Condemnation, levees, 03, 1387.

Cost of, canals, 96, 2416, 2447.

Land—Continued.

Damages, excessive, needed lands, Mississippi River levees, 04, S., 149.

Floods, protection against, California, H. D. 262, 59th, 1st.

Leases of, canals, 96, 3046.

Leases of, Green and Barren Rivers, 96, 2274.

Leases of, Muskingum River. (See Vol. I, p. 974.)

Locating, canals, 98, 2483.

Locks, Muskingum River, 97, 2371; 00, 3309.

Occupation of, canal construction, 05, 1764.

Reclaiming, 96, 1027.

Reclaiming, dredgings for, 95, 1206, 3419.

Reclamation of, levees, Altamaha system, H. D. 443, 62d, 2d.

Sale of, forts, 94, 461.

Southern, richer than Holland's, 00, 1898.

Surveys, 01, 1833.

Water and, evaporation on, 69, 603; 70, 570.

Land Sheet.

Lock and dam sites, 00, 2786.

Lands, Arid.

Projects for reclamation, examination by special board of engineer officers, H. D. 1262, 61st, 3d.

Lands, Bottom.

Reclamation, California, H. D. 262, 59th, 1st.

Drainage, pumping plant, California rivers, H. D. 262, 59th, 1st.

Protection of, against floods, California, H. D. 262, 59th, 1st.

Lands, Overflowed.

Drainage of, Altamaha system, H. D. 443, 62d, 2d.

Lands, Public.

Reservoirs, effect of, 98, 2870.

Landings.

Designing, Point Judith Harbor of Refuge H. D. 911, 60th, 1st.

Types, Altamaha system, H. D. 443, 62d, 2d.

Landowners.

Objection of, to near-by reservoirs, Mississippi River, 03, 1530.

Lands, Reclaimed.

Parks, utilized as, 97, 1319; 99, 1416; 00, 1702.

Potomac Park, D. C., 03, 1036.

Potomac River, 95, 1207; 96, 1021.

Title to, 96, 1023.

Title to, District Columbia, H. D. 194, 59th, 1st.

Lands, Swamp.

Drainage of, 77, 392.

Draining, Altamaha system, H. D. 443, 62d, 2d.

Reservoirs, 98, 2895.

Reservoirs, Mississippi River, 98, 2904.

Lands, U. S.

Railroads in, controlling, 93, 4233.

Lands, Waste.

City refuse for reclaiming, 09, 2234.

Landscapes.

Small parks, District Columbia, 12, 3492.

Latch, Safety.

Valves, locks, 93, 1734.

Lateral Canals. (See Canals, Lateral.)

Lateral Movement.

Locks, gates, **93**, 2482.

Latitude. (See Astronomical Observations; Longitude.)

Determining, P. P. No. 11, C. E.

Determining, Colorado, **73**, 1224.

Determining, Dakota, points in, **74**, ii, 609.

Determining, probable error, surveys, **73**, 1178.

Determining, surveys, **75**, ii, 864.

Magnetic variations, and, **04**, 4133.

Observations, **94**, 3329.

Stars, **94**, 3391.

Latrines.

Batteries, **99**, 798; **00**, 898.

Launching. (See Cribbs.)

Lava.

Stone for breakwater, Hawaii, H. D. 407, 59th, 2d.

Laws. (See Act of Congress, and p. 2137 of this Index.)

Bridges, **82**, 2008.

Contracts, unfavorable effect on, **67**, 56, 97, 156, 168, 183, 268, 377, 394, 416, 423, 431.

Mississippi River Commission, **97**, 3572; **99**, 3351.

Riparian rights, **00**, 4414.

Lead Sheets.

Stone, placed between, effect of, **75**, ii, 826.

Leakage. (See Bins; Dams; Foundations; Reservoirs; Locks; Seepage; Sills; Water Supply.)

Bear-trap gates, excessive leakage at, **03**, 1684.

Cofferdams, preventing at, **01**, 2318; **02**, 1663; **09**, 2157; **11**, 2030.

Concrete laying, **05**, 3004.

Concrete platforms, stopping. (See Forts, p. 1797 of this Index.)

Galleries, shot. (See Forts, p. 1797 of this Index.)

Levees, Mississippi River, **03**, S., 315.

Lockage, operation of, interfered with by leakage, **06**, 1610.

Lock gates, causes, **05**, 1767.

Preventing, forts. (See Forts, p. 1797 of this Index.)

Prevention, locks, **04**, 2381; **09**, 1886.

Stopping, cofferdams, **11**, 3049.

Stopping, lock walls, **09**, 1706.

Leaks. (See Cofferdams; Embankments; Levees; Seepage.)

Batteries, **00**, 898.

Cofferdams, **93**, 1726; **94**, 1956; **98**, 2093.

Cofferdams, countercoffers in, **98**, 2125.

Concrete surfaces, **00**, 1025.

Dams, **92**, 2075.

Dredge bins, **93**, 1498.

Embankments, **93**, 2433.

Foundations, locks, **94**, 2166.

Levees, **97**, 3821.

Locks, **73**, 287; **98**, 1886.

Miter sills, locks, **98**, 1432; **99**, 1704.

Needle dams, **98**, 2146.

Reservoirs, **96**, 3965.

Leases. (See Water Power.)

Land and water. (See Muskingum River, p. 974 of this Index.)

Water from waterways, H. D. 719, 61st, 2d.

Water power, **11**, 2184.

Water power, Green and Barren Rivers, **96**, 2274.

Water power rights, Puget Sound, reducing cost of canal works, H. D. 953, 60th, 1st.

Water power, St. Marys River, H. D. 261, 59th, 2d.

Legal Proceedings. (See Vol. I, p. 21 of this Index.)

Legislation. (See Bridges; also Vol. I, p. 21 of this Index.)

Levees. (See Banks; Capping; Concrete; Crevasses; Dikes; Embankments; Revetment; Sloughing.) (See pls. 63, 64, 65.)

91, 3409.

Abandoned levees, list of, **04**, S., 295; **05**, S., 297.

Abandonment, losses through, Mississippi River, **05**, S., 20.

Advantages of, **01**, 2345.

Aid of U. S., Mississippi River, **04**, S., 25.

Banquettes, **99**, 3575.

Best cross section, **91**, 3648.

Best designs of, **98**, 3353.

Best grades, **93**, 1913.

Board work, local, Mississippi River, **06**, 2569.

Breaks in, details of emergency repairs, **03**, S., 205.

Breaks in, due to city sewage, Mississippi River, **05**, S., 212.

Breaks in, movement of water through, Mississippi River, **12**, 3725.

Building, **90**, 3289, 3317; **91**, 3704; **92**, 3241, 3246; **95**, 3813; **96**, 3703, 3721; **98**, 3353, 3449.

Building, costs, **97**, 3787.

Building, costs, decrease, **95**, 3377.

Building, costs, varying, **98**, 3422.

Building, dredge used, **95**, 3922; **99**, 3640.

Building, general methods, **94**, 3004.

Building, hoisting machine used, **99**, 3558.

Building, local; Mississippi River, **05**, S., 45.

Building, machine, Mississippi River, **93**, 3855.

Building, matured plan, necessity for, **98**, 1748.

Building, mechanical device, **99**, 3644.

Building, methods, economical, **95**, 1878.

Building, methods, general, **97**, 3312.

Building, San Diego, Cal., **77**, 997.

Building, specification, **99**, 3571.

Capping, methods, **97**, 3796.

Causes. (See Sloughing, below.)

Caving and cut-offs, preventing, Mississippi River, **04**, S., 235.

Channels; important in developing, **07**, 2622; **12**, 3725.

Commissioners, act appointing, Mississippi River, **98**, 1635.

Concrete for, **00**, 4913.

Condition of, Louisiana, **75**, 599.

Condition of, Mississippi River, **75**, ii, 596.

Condition of, Missouri River, **75**, 588.

Levees—Continued.

- Connecting of, surveys for, **00**, 2500.
- Construction details, **02**, 1639; **04**, S., 150, 216.
- Construction, rate of, Mississippi River, **07**, 2751.
- Contractors aided with advance money, Mississippi River, **05**, S., 241.
- Cost, **01**, 2161.
- Cost, local bearing of, **04**, S., 27.
- Costs, Mississippi River, **05**, 1547; and see p. 1067 of this Index.
- Costs, Yazoo River, **04**, 2055.
- Crevasse, closing, **84**, 2866.
- Crevasse, closure, **84**, 2866.
- Crevasse, Mississippi River, **12**, 3864.
- Crevasse, repair, **98**, 1782.
- Cross fences, illegal, **08**, 2654, 2743.
- Cross section of, Mississippi River, **68**, 470, 472, 473; **69**, 344; **72**, 438; **74**, 391; **75**, 552, 555, 562, 564, 587, 593, 626; **78**, 1384.
- Cross section of, proper, **95**, 3812.
- Cross section of, proposed, Mississippi River, **71**, 381; **74**, 386; **75**, 628.
- Culverts, location, Mississippi River, **04**, S., 244.
- Culverts, drainage, Mississippi River, **04**, S., 244.
- Culverts, steel-concrete, Mississippi River, **04**, S., 196.
- Data, index to, Mississippi River, **95**, 3710.
- Destruction of, St. Francis bottom, **74**, 381.
- Dikes, spur, Mississippi River, **04**, S., 233.
- Districts, boards, Missouri River, H. D. 1287, 61st, 3d.
- Districts, divisions, Mississippi River, **05**, S., 19; and see p. 1067 of this Index.
- Drainage of, **00**, 4861.
- Drainage of, methods, **97**, 3818.
- Drains, **93**, 3854.
- Effect of, channels, deepening, Mississippi River, **95**, 3624.
- Effect of, Mississippi River, **79**, 1017, 1021; **95**, 3658.
- Effect of, river beds, **12**, 3715.
- Enlargement, **98**, 1782.
- Erosion of, causes, wave wash, **00**, 4861.
- Failure of, reasons, **97**, 3789.
- Flood heights, effect of, Mississippi River, **94**, 2967.
- Floods, action of, lessons from, **97**, 3543.
- Floods, controlling, **00**, 2845.
- Floods, control of, California rivers, H. D. 81, 62d, 1st.
- Floods, effect, **95**, 3649.
- Floods, effect, Mississippi River, **12**, 3721.
- Floods, lessons derived from, Mississippi River, **12**, 3724.
- Foundations of, **95**, 3812.
- Foundations of, exploring, **00**, 4862.
- Grades, **95**, 3808.
- Grades, best, **93**, 1918.
- Grades, Mississippi River, **93**, 3850.
- Hay and sand to form, **05**, 3030.
- Height, determining proper; St. Louis, H. D. 772, 59th, 1st.
- Height of, raising, methods, **97**, 3816.
- Holland, **75**, 563.
- Improvements, proposed, Mississippi River, **07**, 2715.

Levees—Continued.

- India, **75**, 552.
- Inspection, U. S.; need of, Mississippi River, **04**, S., 234.
- Intakes, details, **02**, 1642.
- Lands, condemnation recommended, **03**, 1387.
- Lands, excessive damages asked for those needed, Mississippi River, **04**, S., 149.
- Lands, reclamation of, Altamaha system, H. D. 443, 62d, 2d.
- Leaks in, stopping, methods, **97**, 3821.
- Level of, sinking of, causes, **02**, S., 123.
- Local work, Mississippi River, **05**, S., 24.
- Location of, Mississippi River, **75**, 557.
- Location, proper; a great need, Mississippi River, **04**, S., 234.
- Machine, **99**, 3558; **08**, 2739, 2743, 2817.
- Maintenance, **02**, 1639.
- Maps showing existing levees, Mississippi River, **05**, S., 196.
- Mississippi River (see p. 1067 of this Index), **68**, 468; **69**, 313, 322, 327, 335; **74**, 380; **75**, 536, 548, 564, 668; **81**, 2731, 2740; **82**, 2753, 2766; **83**, 2148; **84**, 2422; **85**, 1713, 2547, 2566, 2873; **87**, 2766; **11**, 3182.
- Mississippi River, work carried on prior to 1882, **05**, S., 201.
- Mississippi River, section, **84**, 2863, 2866.
- Missouri River. (See p. 1025 of this Index.)
- National control, necessity of, **98**, 1748.
- Needs, Mississippi River, **04**, S., 232.
- Nile, **75**, 556.
- Organization, system of, Mississippi River, **12**, 3718.
- Organized system, building up, Mississippi River, **04**, S., 25.
- Outlet, details, **02**, 1642.
- Overflow, causes, Mississippi River, **95**, 3644.
- Overflow, preventing, Mississippi River, **95**, 3625.
- Overflow, lawsuits, **94**, 2713.
- Oversights, Mississippi River, **10**, 3047.
- Permanent bench marks, **00**, 4861.
- Principles, general, **68**, 470; **75**, 549.
- Profiles, typical, Mississippi River, **04**, S., 244.
- Protecting, **74**, 383; **75**, 555; **90**, 3289, 3317; **91**, 3704; **92**, 3241, 3246; **95**, 3808; **97**, 3730.
- Protecting, crawfish, against, **84**, 2863.
- Protecting, Mississippi River, **75**, 555; **96**, 3721; **97**, 3753.
- Protecting, sand bags for, Mississippi River, **12**, 3724.
- Protection by, Mississippi River, **05**, 1548, 1549; **12**, 3725, 3916.
- Protection, methods, **04**, S., 26.
- Raising, floods, Mississippi River, **12**, 3724.
- Repairing, **90**, 3289, 3317; **91**, 3704; **92**, 3241, 3246.
- Repairing, during floods, views, Mississippi River, **12**, 3724.
- Repairing, methods, **97**, 3827; **98**, 3449.
- Repairing, methods, general, **97**, 3812.
- Repairing, methods, improved, **95**, 3900.
- Repairing, Mississippi River, **96**, 3721.
- Responsibility, division of, Mississippi River, **11**, 3185.
- Revetment, **93**, 3854.
- Revetments for protection of, **07**, 2622.

Levees—Continued.

- Revetments, importance of, **08**, 2654.
- Right of way, method of gaining, **02**, 1633.
- Riparian rights should be recognized, **01**, S., 299.
- River beds, effect on, **90**, 3093, 3105.
- River beds, levees do not raise them progressively, Mississippi River, **12**, 3715.
- Sand boils, **99**, 3571.
- Sand boils, views of, Mississippi River, **12**, 3724.
- Sections, Mississippi River, **93**, 3850.
- Seepage, **99**, 3563.
- Seepage, preventing, **98**, 3353.
- Settlement of, **97**, 3747.
- Sinking, cross section, Mississippi River, **97**, 3820.
- Sinking of, **99**, 3642.
- Slopes of, **95**, 3808.
- Slopes of, Mississippi River, **78**, 1384.
- Sloughing, **99**, 3642.
- Sloughing, treatment of, **97**, 3820.
- Sloughing, wave wash, leaks, etc., causes, **03**, S., 315.
- Specifications, California, H. D. 262, 59th, 1st.
- Spur levees, desirable, Mississippi River, **05**, S., 235.
- Spur levees, recommendations, Mississippi River, **05**, S., 247.
- Standard sections, Mississippi River, **03**, S. 46; **04**, S., 234.
- Strengthening of, methods, **95**, 3808, 3812.
- Successful, Mississippi River, **95**, 3625.
- Surveys, **97**, 2127.
- Surveys, Mississippi River, **96**, 2721.
- Systems, effect of floods on, Mississippi River, **12**, 3723.
- Systems, errors, Mississippi River, **75**, 550.
- Systems, extension of, and effect on commerce of Mississippi River, **04**, S., 23.
- Taxation for, **02**, S., 17.
- Training walls, plan, Mississippi River, **04**, S., 244.
- U. S. and non-U. S. work, Mississippi River, **12**, 3932; and see p. 1067 of this Index.
- Use of, roads, **00**, 4862.
- Value of, rivers, improvement of, **83**, 2143.
- Valves, outflow, **02**, 1642.
- Wave wash, protection from, **04**, 2056.

Levees, Old.

- Insufficient cross section, Mississippi River, **74**, 391.
- Treatment of, **97**, 3750.

Levees, Side.

- Improvements, locks, **11**, 2048.

Leveling. (See Base Lines; Cribs; Surveys.)

- Base rings, gun carriage, **00**, 977.
- Cribs, **00**, 4127.
- I-beams, dredged areas, **05**, 1041.

Leveling, Precise. (See Levels, below.)

- Birmingham Canal, Ala., **99**, 1765.
- Methods, **80**, 2426; **83**, 1335, 2175, 2269; **84**, 2007, 2441, 2454, 2547, 2581; **85**, 2650; **86**, 1268; **87**, 2945, 2949, 2981; **99**, 3405.
- Methods, Altamaha system surveys, H. D. 443, 62d, 2d.

Leveling, Precise—Continued.

- Methods, improved, **00**, 2552.
- Methods, Lockport to St. Louis, H. D. 263, 59th, 1st.
- Methods, observing, **03**, 2783.
- Mississippi River, **93**, 3620, 3624.
- Missouri River, **94**, 1751.
- Results, **80**, 2426; **83**, 1335, 2175, 2269; **84**, 2007, 2441, 2454, 2547, 2581; **85**, 2650; **86**, 1268; **87**, 2945, 2949, 2981; **99**, 3420.
- Vials, inefficient, **93**, 4136.

Leveling, Reciprocal.

- Platforms, **91**, 1896.

Level Line.

- Lockage, equation, **74**, 536, 556, 558; **78**, 738.

Level Party.

- Organization, **01**, 2533.

Levels. (See Bench Marks; Surveys.)

- Adjustment of, Louisiana, **95**, 1903.
- Changes, Gulf of Mexico, **96**, 3478.
- Data, index to, Mississippi River, **95**, 3704.
- Fluctuation, Great Lakes, **98**, 2847.
- Gulf of Mexico, **94**, 2794.
- Mississippi River, **78**, 1387; **79**, 1892, 1942; **96**, 3534; **00**, 4606.
- Missouri River, **94**, 3114.
- Ouachita and Black Rivers, **98**, 1607.
- Running, instructions for, **00**, 3405.
- Variation in, Lakes Huron and Erie, **02**, 2779.
- Washington Monument, **00**, 5236; **02**, 2752.

Levels, Great Lakes. (See p. 2041 of this Index.)

- Discharge of Detroit River, effect, H. D. 676, 61st, 2d.
- Investigations, **01**, 3770.
- Lowering, objections to, H. D. 263, 59th, 1st.
- Observations, **12**, 3546.
- Regulation, **07**, 849.
- Rights, vested, H. D. 263, 59th, 1st.
- Stage indicator, **04**, 4063.
- Variation in, Lakes Huron and Erie, **02**, 2779.
- Water-power privileges, leases for, St. Marys River, H. D. 261, 59th, 2d.

Levels, Precise. (See Leveling, above.)

- 90**, 1334; **91**, 3476; **92**, 1334, 2947, 3074.
- Adjustments of, Louisiana, **95**, 1903.
- Charlotte River to Detour, **97**, 4118.
- Cypress Bayou, **93**, 2078.
- Data relating to, index to, Mississippi River, **95**, 3703.
- Error allowable, **87**, 2981.
- Field-work methods, **93**, 3955, 4135.
- Inefficient vials, **93**, 4136.
- Instructions for making, **99**, 3469.
- Instruments, **96**, 1950.
- Instruments and methods, details, Mississippi River, **01**, S., 69.
- Lake survey, **76**, iii, 70; **77**, 1106, 1189; **78**, 1408.
- Level vials, **93**, 4136.
- Mississippi River, **93**, 3603; **98**, 3244; **99**, 3405; **00**, 3963, 4138, 4622.
- Missouri River, **93**, 4218; **94**, 3095.
- Notes, specimens of, Altamaha surveys, H. D. 443, 62d, 2d.
- Ouachita and Black Rivers, **98**, 1670.

Levels, Precise—Continued.

- Red River, **93**, 1944.
- Rods, lengths of, **93**, 3961; **96**, 1955.
- St. Marys River, **96**, 4058.
- South Pass, **94**, 2750.
- Systems, characteristics, **96**, 1950.
- Tennessee River, **96**, 1920, 1949, 1950, 1971.
- Various places, U. S.; index, **96**, 1959.
- Wye levels, value of, **87**, 2981.
- Yazoo River, **94**, 1493.

Levels, Summit.

- Water supply, canals, **80**, 871; **81**, 1152, 1890, 2402, 2410; **86**, 1252.

Levels, Transalluvial.

- Mississippi River, **95**, 3690.

Levels, Wye.

- Value, precise levels, **87**, 2981.

Lewis Holes.

- Stone, **93**, 3007.
- Stiles, stone, **94**, 2608.

Life Saving.

- Facilities for, harbors of refuge, Point Judith, H. D. 911, 60th, 1st.

Lifter.

- Bear-trap gates, **11**, 2121.

Lifts. (See Guns; Locks.)

- Ammunition. (See Forts, p. 1797 of this Index.)
- Ten-foot most advantageous, locks, **76**, ii, 131.

Lifts, Hydraulic.

- Locks, **90**, 3032, 3042, 3046.

Lighthouses. (See pl. 71.)

- Foundations, of, pier ends, **00**, 4078.
- Site marking, Chicago Harbor, **94**, 2133; **95**, 2699.
- Site marking, surveys, **94**, 2133.

Lighting. (See Batteries; Breakwaters; Electricity; Locks.)

- Electric plant, dredges, **04**, S., 124.
- Harbors of refuge, improvements in, Point Judith, H. D. 911, 60th, 1st.

Lightning.

- Effect of, Washington Monument, **92**, 3387; **00**, 5234.

Light Projectors. (See Projectors.)**Lightship.**

- Breakwaters, marking of, **99**, 2768.

Lights. (See Electricity.)

- Mains, forts. (See Forts, p. 1797 of this Index.)

Lights, Ornamental.

- Piers, Duluth-Superior, **05**, 1974.

Lights, Welsbach.

- Gas torches preferred, lock works, **00**, 3145.

Lim. (See Quicklime.)

- Cement, effect in, **96**, 2803.
- Slacking of, vessels fired by, **74**, ii, 286.

Limestone Screenings.

- Mortars, **96**, 2803.
- Tests, **94**, 2325.

Lines.

- Expansion of, defective soundings, **74**, 687.

Lining. (See Banks; Iron; Lead; Sluices; Steel.)

- Magazines. (See Forts, p. 1797 of this Index.)
- Buildings, concrete, **01**, 922.

Lining-over.

- Booms for, rapids, **96**, 3381.

Littoral. (See Currents; Shores.)**Loading Room.**

- Submarine mines, **98**, 759.

Loads.

- Measuring, hydraulic dredges, **05**, 2343.

Locations. (See Sites.)**Lockages.** (Reported in river and harbor reports annually in reports on operation and care of canals.)

- Boat larger than lock, **98**, 2184.
- Delays, causes of, Poe Locks, St. Marys River, **11**, 2425.
- Equation of, to level line, **74**, 536, 556, 558; **78**, 738.
- Factors determining number of, **04**, 1407.
- Governing conditions, Warrior and Tombigbee Rivers, **10**, 1562.
- Lake Superior to Mississippi River, **96**, 2415.
- Ohio River, **06**, 1585.
- Steamboat swept over dam, Monongahela River, **08**, 1767.
- Time required, **74**, 495, 505, 535, 538; **78**, 738; **96**, 1821.
- Water needed, estimating, Willamette River, H. D. 99, 58th, 3d.
- Water supply for, **73**, 1008; **76**, 519, 526, 529; **77**, 704, 707, 724, 756, 770; **78**, 293.

Lockers.

- Forts. (See Forts, p. 1797 of this Index.)

Locks. (See Bricks; Canals; Cement; Concrete; Gates; Lifts; Masonry; Missouri River, p. 1025 of this Index; Sills, Draft; Slackwater Navigation; Stone.) (See pls. 20-28, 30-32, 34-41, and 70.)

- 90**, 2590; **91**, 1745, 3333, 3350; **92**, Atlas, 940, 1997; **94**, 99.
- Abutments, **98**, 2482; **04**, 3763.
- Abutments, building, **00**, 3507.
- Abutments, concrete, **01**, 2115.
- Abutments, deterioration of, checking, **93**, 2493.
- Abutments, eroded and destroyed by floods, **03**, 1421.
- Abutments, grading, **00**, 3511.
- Abutments, protecting, **00**, 3511.
- Abutments, quicksand flow, preventing, **98**, 2125.
- Abutments, repair of, **98**, 2143, 2149.
- Accidents, Great Lakes, **09**, 2069.
- Approaches of, building, **97**, 2968.
- Approaches of, excavating, methods, **00**, 2926.
- Back filling, **00**, 2926.
- Bayou Manchac, **68**, 489.
- Bishop's, **69**, 65, 529.
- Borings for, **00**, 2179.
- Brick in, use of, **81**, 1312.
- Bricks for, **95**, 2932.
- Building of, **98**, 2120; **00**, 2169, 2182, 3726.
- Building of, Allegheny River, **99**, 2404.
- Building of, bank movement, checking, **99**, 3237.
- Building of, cableways, **99**, 2176; **00**, 2768.
- Building of, cofferdam, building, **94**, 1919, 1956, 1970, 1995; **95**, 2500; **96**, 2291.
- Building of, company for, **93**, 2097.
- Building of, concrete plant, **94**, 1293.
- Building of, devices, special, concrete work, **11**, 2029.

Locks-Continued.

Building of, estimating for, **00**, 2977.
 Building of, excavating methods, **98**, 1914.
 Building of, expense, items of, **97**, 2260; **00**, 3515.
 Building of, improvements, **87**, 1304.
 Building of, materials, handling crane for, **94**, 1873.
 Building of, methods, **98**, 1886.
 Building of, plant, **94**, 1956; **99**, 2174; **00**, 2775.
 Building of, pumping plant, **96**, 1936.
 Building of, traveling crane, **94**, 1873.
 Building of, Yamhill River, **99**, 3236.
 Canal width at, proper, **11**, 2049.
 Capacity, increasing, St. Marys River, H. D. 64, 62d, 1st.
 Cements for, **97**, 2975.
 Central Transportation Route, **77**, 733, 739.
 Chambers, scoured by floods, **03**, 1674.
 Cofferdams, excavating in, **94**, 1292.
 Cofferdams, sills for, placing, **00**, 3533.
 Columbia River Cascades, **78**, 1334, 1338.
 Conduits, flushing, **95**, 2366.
 Connecticut River, **73**, 1009; **78**, 294.
 Construction of, considerations governing, **01**, 2767.
 Construction plant, arrangement, **02**, 1881.
 Construction plant, St. Marys River, **11**, 2418.
 Crib abutments, building, **98**, 2125.
 Culverts and valves, **04**, 3758.
 Culverts, designing, **00**, 2976.
 Culverts, dimensions, determining, Lockport to St. Louis, H. D. 263, 59th, 1st.
 Culverts, floors, **94**, 2303.
 Culverts, plan of, **95**, 2906.
 Culverts, repairing, **98**, 1800, 2983.
 Culverts, valves, details of, **96**, 3271.
 Deepening, St. Marys River, H. D. 64, 62d, 1st.
 Defense of, provisions, Puget Sound, H. D. 953, 60th, 1st.
 Delays, causes, **12**, 2636.
 Deposits, removal of, a cause of delay, **09**, 1830.
 Design, and appurtenances, Puget Sound, H. D. 953, 60th, 1st.
 Design, connecting lakes of differing levels, Puget Sound, H. D. 953, 60th, 1st.
 Design, factors determining proper "guard," Cumberland River, **11**, 2034.
 Design, 14-foot, Mississippi River, H. D. 50, 61st, 1st.
 Design, sizes, Lockport to St. Louis, H. D. 263, 59th, 1st.
 Designing, **00**, 2972.
 Designs, **00**, 3617.
 Des Moines Rapids, **68**, 399, 420; **69**, 225; **70**, 297, 299; **71**, 267, 284; **72**, 315; **73**, 418, 420; **77**, 537.
 Details, Big Sandy River, **02**, 1948.
 Details, Great Kanawha River, **99**, 2484.
 Dimensions, factors, **04**, 3753.
 Dimensions increased, Panama, because of larger ships, H. D. 267, 62d, 2d.
 Dimensions, movable dams, **78**, 804.
 Dimensions, various canals, **68**, 273; **69**, 535; **72**, 452, 460; **73**, 221; **78**, 804.
 Donaldsonville, **75**, 887.

Locks-Continued.

Draft pipes, **94**, 2303.
 Draining, pumping, **98**, 1886.
 Drift, accumulations a hindrance, **08**, 1796.
 Drift chutes, **95**, 2366.
 Drift, removing from chambers, **08**, 1799.
 Eight-hundred foot, building of, **95**, 2898.
 Eight-hundred foot, floor, St. Marys Falls, **94**, 2303.
 Eight-hundred foot, plan, St. Marys Falls, **94**, 2303.
 Elk River, **76**, ii, 169.
 Emptying, formula, tests for, **95**, 2294.
 Emptying, time required, **97**, 3936.
 Enlarging, benefits from, **97**, 3263.
 Enlarging, cost, items of, **97**, 3260.
 Enlargement, proper cost, **03**, 1503.
 Enlargement, when necessary, **03**, 1503.
 Entrances to, designing, **97**, 2261.
 Entrances to, excavating, **96**, 2270.
 Entrances to, plans for, **97**, 2286.
 Entrance walls, designing, **00**, 2975.
 Erie, **75**, ii, 536.
 Excavating for, **95**, 3583; **96**, 3269; **97**, 3420; **98**, 3542.
 Excavating for, costly methods, **97**, 2260.
 Filling, **75**, 735, 742.
 Filling, formula, tests for, **95**, 2294.
 Filling, from forebay, St. Marys River, H. D. 715, 61st, 2d.
 Filling, time required, **97**, 3936.
 Filling, valves for, operating, easy, **98**, 2019.
 Floods, bad effects from, on embankment, Tennessee River, **11**, 2048.
 Floods, effect of, **95**, 3572; **97**, 2261; **99**, 3237; **00**, 2172, 2985.
 Floors of, building, **95**, 2899.
 Floors of, concrete beneath, **75**, ii, 623.
 Floors of, 800-foot lock, St. Marys Falls, **94**, 2303.
 Floors of, hemlock lumber, **98**, 2207.
 Floors of, plan, **95**, 2906.
 Floors of, repairing, **06**, 1434.
 Floors of, thickness of, **86**, 1258; **87**, 1830.
 Foundations, **74**, 830, 873; **75**, 469, 888, ii, 621, 623; **79**, 1365, 1370; **04**, 3753.
 Foundations, building, **94**, 1826; **97**, 2516; **98**, 2208, 3542; **99**, 2483.
 Foundations, coal under, **94**, 1993.
 Foundations, concrete in, **75**, 469, ii, 621, 623.
 Foundations, concrete in, placing, **88**, 2167.
 Foundations, draining, **94**, 2166.
 Foundations, dredging, **94**, 1826.
 Foundations, dredging, abandoned, **94**, 1826.
 Foundations, excavating, **94**, 1292, 1956; **00**, 2769.
 Foundations, excavating, cofferdam, Coosa River, **94**, 1292.
 Foundations, jet borings, **97**, 2068.
 Foundations, leakage, preventing, **94**, 2166.
 Foundations, Mississippi River, mouth of, **74**, 830, 873; **01**, 2302.
 Foundations, Osage River, **96**, 3857.
 Foundations, peculiar soil movement, **98**, 1472.
 Foundations, piling, **94**, 2166.
 Foundations, plans, **95**, 2416.
 Foundations, quicksands, controlling, **94**, 1826.

Locks—Continued.

- Foundations, sheet piling, peculiar overturning of, **98**, 1472.
- Foundations, testing pits, **95**, 2293.
- Foundations, timber for, **00**, 2771.
- Foundations, water-jet borings, **97**, 2068.
- Fox and Wisconsin Rivers, **68**, 355; **73**, 221, 224; **75**, 220.
- Gates. (See Gates.)
- Granite sills, laying, **00**, 2256.
- Guard gates, designing, **00**, 2982.
- Guard lock, plans, Colbert Shoals Canal, **98**, 1922.
- Guide cribs, **96**, 2269; **04**, 3761.
- Harbor at, Tennessee River, **99**, 2268.
- Head of, movable dam, necessity for, **78**, 804.
- Hourglass, shape, Muskingum River, **95**, 2369.
- Hydraulic lifts, **90**, 3032, 3042, 3046.
- Illinois River, **68**, 390, 440; **69**, 218; **75**, 488; **81**, 2177; **85**, 2054.
- Inclined planes and, comparison of, **74**, 498, 550, 552, 555; **75**, 770, 879; **76**, ii, 82, 100; **77**, 682.
- Injury of, cement, expansion of, **87**, 1814.
- Inlet pipes, **94**, 2303.
- Ironwork, placing, **94**, 1996.
- Kanawha River, **73**, 509; **75**, ii, 91, 95; **76**, ii, 155, 158, 164; **77**, 298, 299, 302, 687, 698, 746; **79**, 547.
- Land walls, design of, **00**, 2973.
- Large, building, **95**, 2898.
- Large, 800-foot, plan of, St. Marys Falls, **94**, 2403.
- Large, machinery for, large locks, **97**, 2975.
- Large, operating, machinery for, designing, **97**, 2978.
- Large, planning for, **97**, 3156.
- Large, pumping, engines for, tests, **97**, 2994.
- Large, pumping plant, **97**, 2992.
- Large, pumps for, **97**, 2987.
- Leakage at, canals, **74**, ii, 95; **76**, 528; **77**, 339, 704, 707, 756; **78**, 293; **79**, 1540.
- Leakage at, preventing, **95**, 2306; **98**, 1886.
- Leakage at, preventing, canvas for, **73**, 287.
- Leakage, reinforcing foundations to prevent, **09**, 1886.
- Leaks in, stopping, **04**, 2381.
- Levees, side, improvements desirable on account of floods, Tennessee River, **11**, 2048.
- Lifts of, 10-foot most advantageous, **76**, ii, 131;
- Lifts of, walls, designing, **00**, 2976.
- Lighting, gas torches and Welsbach lights, first preferred, **00**, 1345.
- Location, points determining, **69**, 252.
- Louisville and Portland, **66**, iv, 317; **68**, 529, 72, 453; **78**, 780.
- Machinery for, **97**, 2975.
- Masonry of, building, **95**, 3584.
- Masonry of, laying, **94**, 1996.
- Masonry, repairing disintegrated, **02**, 1893.
- Masonry of, specifications, **00**, 2977.
- Materials for, handling, **96**, 2291.
- Materials for, handling, cableway, **94**, 1956; **96**, 1937.
- Materials for, handling, cranes, **96**, 1937.
- Materials for, handling, derricks, **96**, 1937.
- Materials for, tests of, **95**, 2911; **96**, 2796.

Locks—Continued.

- Meekers Island, Mississippi River, **74**, 287.
- Minnesota River, **75**, 362, 423.
- Mississippi River, **74**, 786, 816, 825.
- Miter sills, bolting, **00**, 2926.
- Miter sills, leakage, preventing, lead lining, **98**, 1432.
- Miter sills, repair of leaks, **99**, 1704.
- Monongahela River, **72**, 414; **73**, 503, 504.
- Movable dams at head of, **78**, 804.
- Movable dams and, relative dimensions, **78**, 804.
- Muscle Shoals, **83**, 1484, 1486; **87**, 1742.
- Niagara, **68**, 278.
- Ohio River, **68**, 553; **74**, 408; **75**, ii, 614; **78**, 803.
- Operating, machinery, **91**, 2358; **96**, 3272.
- Operating, machinery, water supply to, **96**, 3274.
- Operating, plant for, proper size of, **98**, 1921.
- Operating, power for, **00**, 2982.
- Operating, power house, **95**, 2908.
- Operating, turbines for, **97**, 2977.
- Operating, water for, quantity, determining, **00**, 3167.
- Operation, details, St. Marys River, H. D. 64, 62d, 1st.
- Operation of, hydraulic power replacing hand power, Tennessee River, **05**, 1766.
- Operation, organization for, **12**, 2623.
- Operation, turbine auxiliary plant for, **11**, 2109.
- Ouachita River, **72**, 368.
- Pass sill, **94**, 1997.
- Paving, specifications, **00**, 2925.
- Plan, Muscle Shoals Canal, Tennessee River, **11**, 2056.
- Planning for, rivers, **00**, 2967.
- Plans, new lock, St. Marys River, H. D. 333, 59th, 2d.
- Plans, Tennessee River, **11**, 2046.
- Power house, plans for, Tennessee River, **98**, 1921.
- Presence or absence, consideration of advantages, Delaware & Chesapeake Canal, S. D. 215, 59th, 2d.
- Pumping out, Chinese pump, **99**, 3236.
- Pumping out, permanent sills for, cofferdams, **00**, 3533.
- Pumping out, plant for, **98**, 2981.
- Pumping out, turbine, **95**, 2905; **98**, 2981.
- Quoin posts, bending device, **95**, 3048.
- Quoins, hollow; relined with cast-iron plates, **09**, 1706.
- Repairing, diver better than caisson, **98**, 1800.
- Repairing, methods, **03**, 1494.
- Repairs, Muscle Shoals Canal, **01**, 2447.
- Reservoirs at, **76**, 407.
- Reservoirs at, canals, **76**, 407.
- Richmond ship lock, **71**, 654.
- Rivers, improving, **00**, 2349.
- River walls, building, **00**, 3504.
- River walls, designing, **00**, 2972.
- Safety latch locks, **93**, 1734.
- St. Marys Falls, **71**, 165; **77**, 922.
- Sediment in, **76**, 759; **77**, 611, 618; **78**, 743, 781, 787, 789; **79**, 1294.

Locks—Continued.

Settlement, adjusting, Plaquemine, **09**, 1461.
 Sills, **04**, 3775.
 Sills, designing, **00**, 2976.
 Sills, miter, **04**, 3761.
 Sills, miter, repairs, Louisville & Portland Canal, **05**, 1942.
 Sites for, land sheet, **00**, 2786.
 Sites, percolation, caisson in lieu of piling used, **12**, 1777.
 Sites, percolation, overcoming, **12**, 1777.
 Sluice lining, **00**, 2772.
 Steel chains, use of, experience against, **98**, 2127.
 Stone for, cutting, **93**, 3001, 3006; **96**, 1939; **97**, 2281.
 Stone for, St. Marys Falls Canal, **94**, 2304.
 Stone for, handling, **94**, 2305.
 Stone for, handling, steam power for, **74**, 164; **76**, 661.
 Stone for, records, **93**, 3008.
 Stonework, cost of, **87**, 2484.
 Surroundings, Cascade Locks, **06**, 1994.
 Surveys, **96**, 2214.
 Tennessee River, **68**, 569, 573; **72**, 499; **77**, 581, 586; **78**, 765.
 Testing, and after operations, Plaquemine Bayou, **09**, 1460.
 Traffic, Monongahela, **11**, 2114.
 Turbine culvert, valves for, **96**, 3273.
 Turbines, **11**, 2109.
 Usage of, Great Lakes, **06**, 1875.
 Use of, rules, **95**, 2661.
 Valuable estimate, **75**, ii, 616; **76**, ii, 18.
 Valves, **91**, 2370, 2742; **97**, 2976.
 Valves, best types, Cumberland River, **11**, 2035.
 Valves, breaking down of, due to vibration, **11**, 2110.
 Valves, discharging; device to prevent injurious torsion, **01**, 2659.
 Valves, openings, covered with sheet steel, **09**, 1705.
 Valves, operating, **97**, 2976.
 Valves, operating, difficulty of, causes, **00**, 3389.
 Valves, operating, machinery, **98**, 1921.
 Valves, shafts, improvements, **95**, 2359.
 Walls, building, **00**, 3505; **04**, 3757.
 Walls, collapse, Monongahela River, **00**, 3235.
 Walls, concrete for, placing, **96**, 2284.
 Walls, concrete for, simple methods, **97**, 2430.
 Walls, dimensions, determining; Lockport to St. Louis, H. D. 263, 59th, 1st.
 Walls, floods, effect of, **95**, 3572.
 Walls, formula, **75**, 807, 887, 904, 913; **77**, 711.
 Walls, leakages, stopping, **09**, 1706.
 Walls, raising, details, Cumberland River, **11**, 2035.
 Walls, raising, for adequate "guard," **11**, 2035.
 Walls, reinforcement of, concrete for, **98**, 2002.
 Water power, gaining, Puget Sound, H. D. 953, 60th, 1st.
 Water-power rights, preserving, **98**, 983.
 Water supply, providing, **00**, 3168.
 Water supply, reservoirs, **76**, 407.
 Wide lock, gate for, **78**, 804.
 Widening, proposed, Erie Canal, **97**, 3251.

Locks—Continued.

Wisconsin River, **76**, ii, 291.
 Youghiogheny River, **74**, 562.

Locks and Canals.

Borings, methods, Louisville & Portland Canal, **11**, 2217.

Locks and Dams. (See Canalization; Navigation; Slackwater.) (See pls., p. 2626 of this Index.)

Abutments, concrete, **04**, 2102.
 Additional, planning for, Brazos River, H. D. 95, 62d, 1st.
 Borings, test; methods, Connecticut River, H. D. 231, 58th, 3d.
 Building, plant, **04**, 2107.
 Concrete, brands, **04**, 3755.
 Concrete forms, economical types, Cumberland River, **11**, 2030.
 Concrete forms, notable details, **12**, 2243.
 Concrete, mixing, Cumberland River, **11**, 2030.
 Concrete plant, **04**, 3754.
 Concrete work, forms, **04**, 3755.
 Construction, details, **04**, 3750.
 Construction, details, Cumberland River, H. D. 758, 60th, 1st.
 Construction, details, Mississippi River, **01**, 2298, 2302.
 Construction of, Sen. D. 301, 61st, 2d.
 Costs, **04**, 3775.
 Costs, Allegheny River, **01**, 2705.
 Costs, Cumberland River, **11**, 2030.
 Designing, series of locks and dams, Tennessee River, H. D. 781, 60th, 1st.
 Design suitable for swift-current streams, **01**, 3513.
 Dimensions, Monongahela River, **07**, 1690.
 Dimensions, Ohio River, **07**, 1717.
 Dredging a substitute for, H. D. 71, 61st, 1st.
 Estimates, Allegheny River, H. D. 167, 58th, 3d.
 Estimates, Black Warrior River, **04**, 1840.
 Estimates, Ouachita River, **11**, 1854.
 Floods, damages from, reconstruction, Monongahela River, **11**, 2107.
 Injury, from highly acid water, Monongahela River, **11**, 2110.
 Location factor in canalization, H. D. 219, 58th, 3d.
 Locations, determining, series of locks and dams, H. D. 705, 59th, 1st.
 Number, reducing number in proposed series, Cumberland River, H. D. 758, 60th, 1st.
 Plans, Big Sandy River, **11**, 2186.
 Plans, Cumberland River, H. D. 758, 60th, 1st.
 Rebuilding, experience in, **12**, 2299.
 Reconstruction, concrete work in, **11**, 2108.
 River improvement and, **01**, 2568.
 Sills, fixing, and depths over, **01**, 2766.
 Sites, surveying for, **05**, 945.
 Surveys, details, **11**, 1851.
 Value, doubtful, sediment-bearing rivers; H. D. 50, 61st, 1st.
 Views of work, Ouachita River, **11**, 1846, 1848, 1850.

Locks, Auxiliary.
 St. Marys River, H. D. 64, 62d, 1st.

Locks, Concrete.

94, 2176; 95, 1675, 2304, 2415; 97, 2260, 2420;
98, 2482, 3543; 00, 2256, 3504, 4349; 01, 2113;
04, 3755.

Culverts, 98, 2482.

First concrete lock and dam works in America,
Illinois and Mississippi Canal, 94, 2164.

Floors, 75, ii, 623; 98, 2482.

Forms, 95, 2413, 2416.

Foundations, 75, 469, ii, 621, 623; 88, 2167;
98, 2482.

Gate work, 00, 4349.

Illinois and Mississippi Canal, 94, 2172.

Laying, 95, 2416; 96, 2283.

Making, 94, 1293.

Making, rules, 94, 2165.

Materials, handling, 96, 2284.

Methods, 96, 2283.

Methods, modifications, 96, 1917.

Models, 95, 2304.

Osage River, 97, 3933.

Plans, 96, 2284; 97, 3946; 00, 2258.

Plant, 95, 2416; 01, 2113.

Sections, 00, 2258.

Stone in, 94, 1996.

Walls, 74, 786, 820; 75, 904, ii, 623; 98, 3543.

Locks, Emergency.

Waterways, intracoastal, H. D. 391, 62d, 2d.

Locks, Guard.

Concrete masonry, placing, 94, 2173.

Culverts, 94, 2176.

Currents, effect on canal, 05, 1755.

Deposits, effect on dams and drifts, 05, 1755.

Heads, Illinois and Mississippi Canal, 94, 2176.

Height, slack-water navigation, 00, 2960.

Necessity for, Tennessee River, 11, 2048.

Removing, overcoming objections and dis-
advantages of, Tennessee River, 05, 1743,
1756.

Sluiceways, 94, 2176.

Locks, Lift.

Entrances, designing, 97, 2294.

Entrances, plans, 96, 2042.

Walls, stability of, with increased height, 05,
1755.

Locks, Masonry.

91, 3356.

Building, 93, 3002; 95, 3584; 96, 3270; 00,
2915.

Building, St. Marys Falls, 94, 2302.

Plans, 96, 1434.

Locks, Old.

Repairs needed, 04, 2381.

Locks, Pneumatic.

Operation of, 97, 3162.

Locks, Ship.

Walls for, Black Rock Harbor, 10, 2318.

Locks, Stone.

Building of, details of, 97, 2534.

Building of, plant for, 96, 1936.

Concrete in, 94, 1996.

Details, Big Sandy River, 97, 2534.

Foundations, excavating, 96, 1938.

Masonry of, classifications, 96, 1940.

Locks, Tidal.

Choice of, factors governing, 04, 1408.

Waterways, intracoastal, H. D. 391, 62d, 2d.

Locks, Wooden.

Rebuilding, 97, 2723.

Locomotives. (See Electricity.)**Logging.** (See Snagging.)

Obstructing navigation, Ocklawaha River,
99, 1604.

Regulations, 00, 2809.

Rules proposed, 99, 1607.

Steamboating and, regulating, difficulty, 00,
2809.

Log Jams.

Breaking of, 00, 4465.

Effect of, 98, 3120.

Rivers, effect on, 98, 3120.

Log Puller, Steam.

99, 1606.

Logs. (See Waterways.)

Dams, concrete; effect on, 04, 2650.

Effect of, scour, increase of, rivers, 74, 202.

Floating of, regulations, 01, 2330.

Navigation, obstructing, 75, 374; 79, 843, 1173,
1182, 1196.

Rivers, closure of, Pearl River, 79, 896.

Shipment cheaper by water, 11, 670.

Logs, Round.

Cribs, 67, 216; 72, 157.

Longitude. (See Astronomical Observations;

Latitude; Lunar Culminations.)

Determining, lunar culminations for, P. P. No.
10, C. E.

Determining, telegraph for, 70, 593; 71, 1014;
72, 1054, 1118; 73, 1224; 74, ii, 425, 434; 76,
iii, 92; 79, 1895.

Determining, Wisconsin and Illinois, interior
of, 74, ii, 425.

Difference, determining, 94, 3336.

Difference, Detroit, Mich., and Ogden, Utah,
74, ii, 434.

Difference, Sault Ste. Marie and Ann Arbor,
Mich., 94, 3382.

Observations, wiring, 94, 3322.

Work, stars, 94, 3338.

Low Water. (See Elevations; High Water; Water
Heights.)

Forestation and, Merrimac River, H. D. 9,
62d, 1st.

Mississippi River, 94, 2971.

Ohio River, 93, 2458.

Plane of, raising, Mississippi River, 09, 1609.

Plane of, lowering, Mississippi River at St.
Louis, 09, 1610.

Red River, 94, 1141.

Survey, Mississippi River, 96, 3535, 3575.

Various years, Mississippi River, 00, 2544.

Lumber. (See Beams; Hemlock; Timber.)**Lumber, Hemlock.**

Lock floors, 98, 2207.

Lumber Trade.

Interested in waterway improvement, H. D.
524, 61st, 2d.

Most important business, on upper Mississippi
River, 01, 2232.

Lumps. (See Mud.)**Lunar Culminations.** (See Longitude.)

Longitude, determining, P. P. No. 10, C. E.

M.

Machinery. (See Locks and Dams.)

Hydraulic dredges, Mississippi River, **04**, S., 128, 228.

Machine Shops.

97, 2305.

Outfit, **93**, 2425.

Magazines. (See Forts, p. 1797 of this Index.)**Magnet.**

Improvised, guns used for, **88**, 354.

Magnetic Attraction.

Great Lakes region, **03**, 1799.

Magnetic Declination.

Observation, Great Lakes, **04**, 4066; **05**, 2791, 2794.

Surveys, lakes, **98**, 3769.

Magnetic Dip.

Surveys, lakes, **98**, 3769.

Magnetic Intensity.

Great Lakes, **05**, 2794.

Magnetic Observations.

St. Marys River, **95**, 4169; **96**, 4026.

Surveys, **97**, 4076.

Magnetics. (See Compass.)**Magnetic Variation.**

Azimuth compass observations, testing accuracy, **04**, 4133.

Determining, **04**, 4133, 4134.

Determining, Great Lakes, **10**, 2725.

Iron in a pier, attraction of, **04**, 4133.

Latitude, change of, effect, **04**, 4133.

Methods, details of observing, Great Lakes, **10**, 2726.

Observation points, Great Lakes, **04**, 4133.

Observation, reducing, **04**, 4133.

Vessel and instruments, **04**, 4133.

Main. (See Water Main.)

Lights, forts. (See Forts, p. 1797 of this Index.)

"Maine," U. S. S.

Removal, Habana, Cuba, **12**, 3565.

"Mall, The," D. C.

Plan of Pierre Le Enfant, and studies for its realization, **01**, 3718.

Manual, Engineer.

01, 39, 911; **02**, 801.

Manufactures.

Center for, New York best, H. D. 1506, 60th, 2d.

Railroads near, a factor in locating factories, New York, H. D. 1506, 60th, 2d.

Water competition advantageous, Merrimac River, H. D. 2, 61st, 1st.

Manufacturing.

Improvements, U. S., effect of, Willamette River, **05**, 2497.

Established on banks of improved Ohio River, **03**, 1692.

Manufacturing—Continued.

Extension due to improvements of waterways, **09**, 771.

Maple.

Blocks of, for flooring, **04**, 3346.

Mapping.

Methods, **96**, 3368.

Suspended pantograph for, **93**, 2036.

Map Printing.

Photolithographic process, objectionable, because of great skill needed, **91**, 545.

Maps. (See Charts.)

Data, index to, Mississippi River, **95**, 3709.

Device for printing signs on, **85**, 2898.

Early maps, Mississippi River, **93**, 3703.

Making, survey, Lockport to St. Louis, H. D. 263, 59th, 1st.

Photolithographing, survey, Lockport to St. Louis, H. D. 263, 59th, 1st.

Reducing in scale for publication, photography the best, **05**, 2126.

Tourist routes, Yellowstone Park, **02**, 3044.

Transportation routes of the world, H. D. 492, 60th, 1st.

Maps, Old. (See Old Charts.)

Mississippi River. (See Vol. I, pp. 1069 and 1088.)

Mobile Harbor, **96**, 1432

Maps, Progress.

Example, **04**, 1338.

Maregrams.

Correcting, Saxton tide gauge, **01**, 1435.

Masonry. (See Concrete; Locks; Stone.)

Batteries, **93**, 609.

Building, locks, **94**, 1996; **95**, 3583.

Classifications, stone locks, **96**, 1940.

Repairing disintegrated masonry, locks and dams, **02**, 1893.

Specifications, lock gates, **00**, 2977.

Masts.

Height of, **69**, 400, 403; **74**, 614.

Height of, vessels, lakes, **74**, 614.

Materials. (See Jetties.) (See pl. 46.)

Bridges, **02**, 2670.

Bunkers for, fort construction. (See Forts, p. 1797 of this Index), **02**, 2494.

Costs, forts. (See Forts, p. 1797 of this Index.)

Unloading. (See pl. 46.)

Materials, Hard.

Cutter for, hydraulic dredging, **06**, 1964.

Dredging. (See pl. 55.)

Mattresses. (See Dams; Fascines; Foundations; Jetties; Piers; Revetments). (See pls. 16, 60, 61, 62.)

89, 1153, 1264, 1300, 2736, 2778; **92**, atlas, 164, 165, 3158, 3174; **96**, 3657.

Mattresses—Continued.

Anchoring, **03**, 2441.
 Ballasting, Missouri River, **01**, S., 410.
 Ballasting of, **00**, 4921.
 Banks, protection of, **94**, 1386.
 Banks, revetment of, **97**, 2205.
 Barges, mooring, **94**, 2899.
 Best materials, **88**, 1083.
 Brush, use of, river improvements, **72**, 144;
76, 574, 641, 653, 678, ii, 404, 619; **77**, 484; **78**,
 624, 640, 654; **79**, 737, 977, 1030, 1052, 1061,
 1074, 1080.
 Building, **93**, 1414, 3728; **94**, 2884, 2931; **95**,
 4003, 4047.
 Building, bank protection, **96**, 1879.
 Building, foundations, **94**, 1597.
 Building, jetties, **94**, 2514, 2518.
 Building, methods, **94**, 2514.
 Building, piers, **00**, 4186.
 Building, river sills, **93**, 3410.
 Building, shore protection, **94**, 1597.
 Cables, splices, **94**, 2934.
 Canes, use of, **79**, 876, 932.
 Carpet of, river beds, protecting, **78**, 616; **79**,
 876.
 Chute dams, **94**, 3142.
 Compression and settlement, **06**, 1296.
 Compression, mouth of Mississippi River, **05**,
 1434.
 Connecting revetment work, Mississippi River,
05, S., 174.
 Construction, Mississippi River, **04**, S., 167;
05, S., 173.
 Cost details, **02**, S., 158.
 Costs, **02**, S., 164.
 Costs, Mississippi River, **05**, S., 176; **07**, 2741;
12, 3870; and see p. — of this Index.
 Deep water, jetties, **91**, 3187.
 Designs, jetties, **00**, 4450.
 Destruction of, by currents, **99**, 1859.
 Dikes, **01**, S., 390.
 Dikes, repairing, **92**, 1519.
 Discarding, economy, jetties, **98**, 2954.
 Discarding, scour, preventing, **98**, 2949.
 Dropping, methods, **94**, 2518.
 Failure of, revetment work, **02**, S., 141.
 Flexibility of, valuable, **79**, 1052.
 Forms, improved, **12**, 2148.
 Foundations, cribs, **82**, 2321.
 Foundations, dams, **89**, 1093.
 Foundations, jetties, **94**, 1378; **95**, 1509; **00**,
 4245, 4438.
 Foundations, training walls, **95**, 1491.
 Hurdles for, **94**, 1602.
 Improvements, **93**, 3714.
 Jetties, **94**, 2518.
 Jetties, foundations of, **94**, 1378; **95**, 1509; **00**,
 4245.
 Jetties, repairing, **93**, 1578.
 Jetty foundations, not necessary in, **01**, 1663.
 Lost mattresses, cause of, Mississippi River,
05, S., 214.
 Making, machine for, **79**, 876, 1112.
 Mattress boat, **80**, 1419; **81**, 1507, 1508.
 Necessity of, doubtful, foundations, jetties, **00**,
 4438.
 Needful, foundations, jetties, Pacific coast, **94**,
 2518.

Mattresses—Continued.

Omission of, foundations, jetties, **96**, 3216.
 Pile dikes, **95**, 2231.
 Placing; crevasses, closing, **95**, 1738.
 Placing, dams, **98**, 3030.
 Placing, dams, repair, **95**, 3781.
 Placing, dikes, **00**, 4350.
 Placing, foundations, rock jetties, **00**, 4469.
 Placing, jetties, **00**, 4287, 4469.
 Placing, scour, preventing, dams, building,
98, 3030.
 Plain mats better than woven mats, **12**, 2148.
 Plan of, jetties, **00**, 4450.
 Rivers, contraction of, Mississippi River, **94**,
 1594.
 Rock foundations preferable to, jetties, **95**,
 1774; **00**, 4245.
 Scour, preventing, **98**, 2949, 3030.
 Scour, piles, **98**, 1698.
 Settlement, Mississippi River, **05**, 1434.
 Shores, protecting, **89**, 770; **93**, 1699; **94**, 1597.
 Sinking, **90**, 3230; **94**, 2514, 2546; 2900; **95**, 3363;
00, 4469.
 Sinking, bags of sand, **94**, 2600.
 Sinking, ballasting and, **03**, 2442.
 Sinking, concrete for, making, **00**, 4921.
 Sinking, difficulties, **00**, 4912.
 Sinking, difficulties, Mississippi River, **03**,
 S., 308.
 Sinking, methods, **01**, 1880.
 Sinking, scour, **93**, 1441.
 Sinking, sills, **01**, 1880.
 Sinking, stone for, concrete substituted, **00**,
 4879.
 Specifications, **93**, 1622.
 Teredo, action, jetties, **82**, 1188; **86**, 1312.
 Teredo, effect of, jetties, **82**, 1188; **86**, 1312.
 Thin mattresses, advantages of, foundation,
94, 2518.
 Weaving of, **99**, 3690; **03**, 2441.
 Weaving of, on ice, **95**, 3960.
 Weaving of, strands better than cable, **99**,
 3690.
 Weighting, bronze weights for, Mississippi
 River, H. D.: 50, 61st, 1st.
 Wire-netting machine, **81**, 1625, 1628, 1632.
 Wire strands, **94**, 2900.
 Woven on ice, Missouri River, **01**, S., 39C; **11**,
 2008.

Mattresses, Board.

Revetments, **01**, S., 341, 347.

Mattresses, Brush.

Objectionable, Gulf dikes, **02**, 1401.

Mattresses, Cane.

78, 616; **79**, 827, 876, 931, 932.
 Buoyancy, **80**, 1211.
 Cost, **80**, 1146, 1210; **82**, 1362.
 Teredo proof, **79**, 932, 937.

Mattresses, Connecting.

Building, **93**, 3729; **95**, 3774.

Mattresses, Crib.

Brush and stone dam, **94**, 2892.

Mattresses, Fascine.

94, 2867.
 Bank protection, **94**, 2904.
 Building, **94**, 2878, 2905.

Mattresses, Fascine—Continued.

- Improved form, **95**, 3818.
- Revetments, **99**, 3513.
- Standard type, **99**, 3513.

Mattresses, Flexible.

- 96**, 3419.

Mattresses, Foot.

- 89**, 2779.
- Brush and stone dams, **94**, 2892.
- Building, **98**, 3359.
- Revetments, protecting, **98**, 3359.

Mattresses, Framed.

- Advantages of, **97**, 3799.
- Bank protection, **97**, 3799.
- Tests of, **00**, 4916.

Mattresses, Head.

- 94**, 2900.

Mattresses, Log.

- Building of, **96**, 1192.
- Placing, **96**, 1192.

Mattresses, Lumber.

- Bank protection, Mississippi River, **01**, 2212.

Mattresses, Reinforced.

- Extension of, revetments, **96**, 3827.

Mattresses, Sill.

- Dike's, **94**, 2599.

Mattresses, Submarine. (See Torpedoes.)

- 90**, 3213.

Mattresses, Willow-Woven.

- Standard form, bank revetment, Missouri River, H. D. 62d, 1st.

Mattresses, Winged.

- 80**, 1380; **87**, 789.

Mats.

- Dredges, anchoring, **01**, 2263.

Maumee Basin.

- Exceptionally favored for satisfying human needs, H. D. 769, 62d, 2d.

Measurements. (See Discharge.)

- Bridges, **93**, 3944.
- Flow, measuring, Niagara Falls, **08**, 2539.
- Prism and scow, relation between, rock, **75**, 326; **77**, 239; **78**, 1136.
- Scow displacements, rocks, **68**, 424.
- Standards, surveys, **68**, 937; **72**, 1046; **77**, 1110.
- Standards, lake surveys, **75**, ii, 854, 904; **76**, iii, 6, 79.

Measurements, Foot.

- Metric equivalents, conversion to, table, **93**, 1995.

Measurements, Metric.

- Foot and metric equivalent, tables, **93**, 1995.

Measurements, Prism.

- Scow and, relations, **71**, 181, 191, 200, 719; **75**, 275; **77**, 239, 246; **78**, 520, 1136; **79**, 507.

Measuring, Place.

- Dredging, **94**, 2502.

Memorials.

- Competition in designing, program, etc. "Grant," "McClellan," **01**, 3756.
- Statues for, District Columbia, **12**, 3510.

Meridian.

- Are of, length of, **70**, 544; **73**, 1174.
- Are of, degrees of, length, **70**, 544; **73**, 1174.

Meridian Stone.

- Surveys, **94**, 3085.

Metals.

- Coast defense, **69**, 4.
- Defensive purposes, experiment, **69**, 4.

Meteorological Records.

- Columbia River, **93**, 3514; **94**, 2653; **96**, 3279; **97**, 3422.
- Northern and Northwestern Lakes, **67**, 586, 602, 684, 721; **68**, 967, 993; **72**, 1068; **73**, 1197; **74**, ii, 472; **76**, iii, 103.
- Pacific coast, **93**, 3242.
- Portland channel, Alaska, **97**, 3498.
- Willet's Point, **80**, 312; **81**, 449; **82**, 477; **84**, 448; **85**, 454.
- Yaquina Bay, **96**, 3309.

Meteorology. (See Rainfall; Run-off; Winds.) (See pl. 72.)**Meters.** (See Currents.)

- Water supply, District Columbia, **01**, 3659.
- Water supply, cities, **02**, 2698; **11**, 2945.

Meters, Blast.

- 04**, 3739.

Meters, Current.

- 80**, 1219; **81**, 1709; **90**, 2104; **00**, 5324.
- Aqueduct flow, gauging, **97**, 4014.
- Catamarans for, **00**, 5325.
- Coefficients of, determining, **69**, 566; **78**, 1306.
- Computing methods, river gauging, H. D. 231, 58th, 3d.
- Currents, velocities of, determining, **78**, 259, 262, 305, 380, 392.
- Gauging and rating, **02**, 2791.
- Outfit, **02**, 2869.
- Rating, **81**, 1709; **85**, 2695; **87**, 1227, 2822, 2836, 2841, 2848, 2856; **90**, 2104; **94**, 1137; **97**, 4094; **98**, 1611; **00**, 4759, 5327, 5334, 5366; **02**, 2796, 2828; **11**, 1947.
- Rating, details, **02**, 2818, 2868.
- Rating, discharge measurements, **05**, 940.
- Rating, frequent, desirable, **01**, 3774.
- Rating, Haskell meter, **97**, 4094; **99**, 1907; **00**, 4759.
- Rating, methods, Connecticut River, H. D. 231, 58th, 3d.
- Rating, Mississippi River surveys, **05**, S., 126.
- Rating, Price meter, **91**, 3490; **93**, 3700; **00**, 4759.
- Reduction tables, **93**, 2458.
- Stackpole propeller, **91**, 1584.
- Use, Mississippi River, **80**, 1518, 1528; **81**, 1709; **83**, 2226.
- Wheel, gauging and rating, **02**, 2791.
- Woltman's, description of, **78**, 1305.

Mica.

- Excess of, granite, effect on, **72**, 529.

Mileage.

- Railroads, Ohio, 1839, **96**, 3043.

Millia.

- Army and, functions, seacoast defense, **81**, 402.

Mill Edgings.

Shore protecting, use in, **80**, 1580.

Mine, Comstock.

Description of, **72**, 1129.

Drainage of, **72**, 1153.

Geology of, **72**, 1129, 1140.

Ore of, raising, cost, **72**, 1158.

Silver from, amount of, **72**, 1139, 1156, 1161.

Ventilation of, **72**, 1131.

Mineral Products.

Ohio, **96**, 3000.

Wealth of, Big Sandy River, **00**, 3413.

Mines. (See Copper; Submarine.)

Drift in, cost of, Ophir mines, **72**, 1154.

Exploding, electric batteries, arrangement of, **77**, 237.

Fissure veins, cause of, Comstock mine, **72**, 1143.

Shafts in, cost of, Ophir mines, **72**, 1154.

Sutro tunnels, **72**, 1126.

Tunnels, cost of, Chollar Potosi, **72**, 1165.

Mines, Salted.

Diamonds, Ruby Gulch, **73**, 1208.

Mines, Submarine. (See Forts, p. 1797.)

Cable gallery, **97**, 705.

Casemate, **97**, 705; **98**, 759.

Concrete walls, **96**, 471.

Draining, **96**, 471.

Foundations, **96**, 471.

Damages, repairs, **98**, 691, 758.

Deterioration of, **98**, 657.

Dynamite, experiment with, **76**, 31; **79**, 35.

Explosions, pressure gauges, **95**, 530.

Explosions, snag boat, wreck of, **99**, 2009.

Firing of, methods, **98**, 616.

General system, **98**, 12.

Improvised material, **98**, 618, 756.

Investigations, **87**, 9.

Judgment firing stations, **98**, 744.

Loading room, **98**, 759.

Material, emergency, New London, **98**, 618.

Necessity of, **95**, 4.

Plan, **98**, 744.

Planted, damages, **98**, 599.

Planting, **98**, 598, 599, 656, 756, 769.

Planting, tests, **88**, 364.

Planting, vessel for, **86**, 51.

Repairs, **98**, 599, 691.

Tests of, **98**, 616, 761.

Tests of, resistance in ohms, winter tests, **88**, 367.

Vessels, passage, regulations for, **98**, 636.

Mining. (See Sluices.)

Débris of, barrier system on waterways to protect against, **07**, 2265.

Débris of, in State waterways, relation of U. S. to, H. D. 262, 59th, 1st.

Operations of, rivers, injury of, **76**, ii, 620; **77**, 993; **78**, 1297; **79**, 1857.

Mining Casemate. (See Batteries; Torpedoes.)

Concrete walls, **96**, 471.

Draining, **96**, 472.

Foundations, building, **96**, 472.

Improving waterways affected by mine washings, **05**, 2590.

Mining, Coal.

Philippines, **04**, 3870.

Mining Débris. (See Mining.)

Causes of, and effect, California, H. D. 262, 59th, 1st.

Control of, laws for, **00**, 5068.

Control of, waterway improvements effective in, **07**, 2262.

Impounding dams, plans, **00**, 5040.

Impounding of, **00**, 5031.

Influx of, into rivers, investigation, **07**, 2264.

Laws, **00**, 5032.

Retention, **95**, 4054.

Reworking of, **94**, 3173.

Settling basin for, **00**, 5059.

Mining, Gold. (See Mines, and Mining, here-with.)

Hydraulic work, views, California, **05**, 2602.

"Washing," deleterious effect of, on streams, **05**, 2585.

Mining, Hydraulic.

Cavities of, availability for reservoir sites, California, **94**, 3172.

Detritus, **82**, 2556, 2620; **91**, 2996.

Effect of, rivers, **81**, 2485, 2494; **82**, 2543, 2548; **87**, 1933.

Judicial decisions, California, **94**, 3180.

Methods, **82**, 2546, 2551; **91**, 2996.

Regulation of, California, **06**, 2069.

Restraining dams, specifications, **04**, 3698.

Rivers, effect on, **91**, 2996.

Rules, California, **94**, 3176.

Water used, volume, **82**, 2611; **91**, 2996.

Mining, Illegal.

Prevention, California, **01**, 3626.

Mining, Sluice.

78, 1296.

Mining, Submarine. (See mines, above.)

Equipment, **01**, 961.

Mirage.

Signaling, effect on, lakes, **67**, 575.

Mississippi River. (See p. 1067 of this Index.)

Channels, adequate; methods and cost, **05**, 1590.

Commerce, not less than 8 feet helpful to, **05**, 1591.

Description, H. D. 50, 61st, 1st.

Maintenance, uninterrupted; absolutely needful to commerce growth, **05**, S., 10.

Map of districts, **97**, 3836.

Miter Sills. (See Sills.)

Fitting, Plaquemine Locks, **05**, 1451.

Locks, **04**, 3761.

Mixer.

Building, fort construction. (See Forts, p. 1797 of this Index.)

Mixer, Concrete.

Improved type, **04**, 3802.

Materials, handling, **02**, 2494.

Methods, **04**, 3785.

Plant, **01**, 702.

Mixer, Gravity.

Concrete mixing, **00**, 821.

Moat.

Sewer across, laying, **96**, 500.

Moisture.

Cement, effect on, **94**, 2348.

Prevention, lining for, tunnels, **96**, 472.

Molding.

- Concrete blocks, **04**, 3781.
- Blocks, on barges, **01**, S., 358.
- Cutwaters, piers, **01**, 2832; **04**, 3802.
- Piers, concrete, **04**, 3802.
- Walls, sea, **05**, 3027.

Molds, Concrete.

- Filling, breakwaters, **10**, 2058.

Molds, Subaqueous.

- Piers, concrete, **04**, 3802.

Molds, Timber.

- Templates, concrete piers, **04**, 3802.

Monolith. (See Concrete.)

Monopoly, Private.

- Where fostered by waterway improvement, latter should cease, **09**, 1683.

Monument, Geodetic.

- Surveys, **94**, 3005.

Monuments. (See Washington, D. C., p. 2040

- of this Index.) (See pls. 68, 69.)
- Building of, factors governing, **01**, 3823.
- Foundations, concrete mixed by large force in one day, advantages, **01**, 3831.
- Levels, Washington Monument, **02**, 2725.
- Trees as, Washington, D. C., **04**, 4046.

Mooring. (See Barges.)

Mooring Buoys.

- Harbors of refuge, **73**, 293; **74**, 210.
- Screws, attached to, **73**, 294.

Mooring Posts. (See Steel.)

- Cement for, tests, **96**, 1885.
- Ice harbors, **94**, 1771.

Mooring Rings.

- Breakwater, **73**, 294; **74**, 210.

Mooring Rope.

- Torpedoes, **89**, 491.

Mooring Sites.

- Piles driven for, Mississippi River, **05**, 1637.

Mortar. (See Cement; Concrete.)

- Brickwork, **04**, 3831.
- Materials of, heating, effect, **96**, 2803.
- Sand for, different varieties, values, **94**, 2319.
- Screenings, limestone, **96**, 2803.

Mortars, Cement. (See Forts, p. 1797 of this Index.)

- Strength, tensile, of various mortars, **02**, 2456.

Mortars, Military. (See Forts, p. 1797 of this Index.)

Motors. (See Electricity.)

- Sims torpedo, **89**, 481.

Mounds. (See Rubble.)

Mountainous Country.

- Prairie and, run-off, **96**, 3013.

Mountains.

- Bridges for, Mount Rainier, **09**, 2514.
- Lower levels and, rainfall, differences, **74**, ii, 375.
- Roads, traffic factors, **03**, 2466.
- Viaducts, **03**, 2470.
- Walls, retaining, **03**, 2454.

Mud Lumps.

- Formation of, **70**, 330, 372; **75**, 626; **77**, 431.
- Formation of, rivers, mouths of, **77**, 431.
- Removing, blasting, **70**, 330, 334.

Mud, Soft.

- Hydraulic dredging in, **10**, 1258.

Municipalities.

- Reservoirs for, **98**, 2852.

Municipal Work. (See pl. 68.)

N.

National Harbors of Refuge. (See Harbors.)

National Parks.

- Roads, wagon, Yellowstone Park, H. D. 502, 60th, 1st.

National Waterways Commission.

- Report, Sen. D. 301, 61st, 2d.

Naval Equipment.

- Submergence of, effect, "Maine," **11**, 3048.

Naval Stores.

- Traffic in, center of, Savannah, H. D. 181, 59th, 1st.

Navigable Streams. (See Streams; Waterways.)

- Limit of navigation, final, a question, Chicago River, H. D. 700, 59th, 1st.

- Mining débris, protecting from, **07**, 2264. (See Mining.)

- Water-power development, one company better than many, H. D. 781, 60th, 1st.

- Water power on, cost, per horsepower, H. D. 781, 60th, 1st.

Navigable Waters.

- Protecting, laws proposed, **97**, 4137.

Navigation. (See Canals; Slackwater.)

- Breakwater, aided by outer, **03**, 2084.

- Bridges, height required, **69**, 395, 401; **74**, 603, 627, 641, 648, 654; **75**, ii, 681; **76**, ii, 302; **78**, 907, 928, 934, 1054.

- Canal and slackwater system, abandonment of former justified, Muscle Shoals Canal, H. D. 781, 60th, 1st.

- Dams, when an aid, **03**, 1501.

- Dangers to, Nantucket Sound, H. D. 536, 62d, 2d.

- Impediments to, internal streams, H. D. 540, 62d, 2d.

- Improvement with storage reservoirs, Ouachita system, H. D. 588, 62d, 2d.

- Limit of, a question, Chicago River, H. D. 700, 59th, 1st.

- Navigation interests and water-power rights, conflict, canals, **96**, 2535.

Navigation—Continued.

Navigation interests and water-power rights, irrigation and conflict, rivers, **93**, 3292.

Obstructions, bridges, **68**, 717, 822; **69**, 306; **71**, 407, 411, 414, 429, 713; **76**, ii, 306; **77**, 646; **78**, 1038, 1054.

Obstructions, logs, **75**, 374; **79**, 843, 1173, 1177, 1182, 1196.

Power interests and navigation interests opposed, reservoir construction, Minnesota River, H. D. 700, 62d, 2d.

Regulations, Green and Barren Rivers, **01**, 2809.

Reservoir system a benefit, waterways, **06**, 475.

Rivers, experience of foreign countries, H. D. 1374, 61st, 3d.

Rules, canals, **95**, 2661; **98**, 2226.

Rules, narrow channels, **00**, 4028.

Season of, Great Lakes, determination of, **11**, 2281; **12**, 2462, 2469.

Season of, Ohio River, **11**, 2087.

Summer, in, reduction of rail rates due to, **12**, 809.

Waterway development combined with, Connecticut River, H. D. 818, 61st, 2d.

Navy.

Key West, Fla., recommended for needs of Navy in war, H. D. 706, 62d, 2d.

Navy, Army and.

Value of Delaware & Chesapeake Canal, S. D. 215, 59th, 2d.

Needles. (See Vicat.)**Negatives.** (See Celluloid.)

Drawings, **93**, 2074.

Printing from, drawings, **93**, 2073.

Negatives, Celluloid.

Drawings, reproduction of, **93**, 2073.

Netting, Wire.

Dikes, **95**, 3964, 4015.

Machine for making, **81**, 1625, 1628, 1632.

New York Harbor. (See p. 233 of this Index.)

Forty-foot channel, difficulties of making, **08**, 1075.

Operating U. S. dredges, expense of, **08**, 1076.

Niagara Falls Reservation. (See p. 2041 of this Index.)

Preservation of, **08**, 893; **10**, 1050, 2722; **11**, 3022.

Niagara River.

Other streams and, comparison, **98**, 2846.

Nicaragua Canal. (See p. 2357 of this Index.)**Night Work.**

Rock removing, **94**, 1932.

Nitroglycerin.

Action of, **66**, iv, 335; **68**, 91, 738.

Black powder and, comparison, **68**, 423, 738.

Charges, large; adjacent objects unaffected by explosion of, **76**, 241.

Composition, **77**, 355.

Cost, **77**, 355.

Dynamite and, comparison, **79**, 1507.

Experiments with, **76**, 238.

Explosions, discussion, **66**, iv, 335; **75**, 523.

Explosions, rock, various; effect, **68**, 91; **73**, 776; **77**, 355.

Explosions, rock waves, destruction from, **77**, 233.

Explosive energy, **79**, 36.

Manufacture of, details, **77**, 355.

Mica powder and, blasting, **91**, 2796.

Natural rafts, removing, **74**, 702, 708.

Use of, Blossom Rock, **71**, 927.

Use of, Detroit River, **76**, ii, 545; **77**, 936.

Use of, Eagle Harbor, **69**, 76; **76**, ii, 326.

Use of, Hallets Point, **73**, 935; **75**, ii, 204.

Use of, Hell Gate, **68**, 727, 737; **71**, 725; **72**, 804; **74**, ii, 160, 163; **75**, ii, 209.

Use of, James River, **73**, 776; **74**, ii, 39, 42; **75**, ii, 82.

Use of, Noonday Rock, **75**, ii, 720.

Nitroglycerin, Frozen.

Explosion of, **76**, 31.

Nomenclature. (See Surveys.)**North Atlantic.** (See Harbors.)**Northers.**

Damages from, channels, H. D. 328, 61st, 2d.

Notes. (See Surveys; Leveling; Levels.)**O.****Oaks.**

Shore protection, **79**, 931.

Obelisks.

Core of concrete, **01**, 3833.

Comparison of, American obelisks, **01**, 3833.

Curves of height and base, **01**, 3833.

Obstructions. (See Navigation; Rivers; Snags; Yankee catchers.) (See p. 21 of this Index.)

Bridges, rivers, **97**, 2796.

Chicago River, **93**, 2795.

Harbors, obstructing and dredging rivers at, **75**, 287.

Incomplete jetties, **99**, 1158.

Locating under water, **03**, 2763.

Obstructions—Continued.

Removal, special legislation needed for removing obstructions under water, **01**, 2613.

Removing, rivers, **98**, 1945.

Rivers, Civil War, **75**, 874; **76**, 330.

Sweep for, **04**, 4064.

Tunnels, obstruction in rivers, **97**, 2796.

Water hyacinths, rivers, **97**, 1754; **00**, 1985.

Obstructions, Submarine.

Locating, methods, **03**, 2763.

Offices. (See pls. 70, 71.)**Oil.**

Concrete, percolation, treatment, **03**, 2406.

Creosoted timber, **81**, 815, 818.

Oil—Continued.

Oil fields, Big Sandy River, **00**, 3416.
Roads, **02**, 2564; **03**, 2463; **11**, 2974.
Transportation of, pipes, **76**, ii, 151; **79**, 1375.

Oil, Linseed.

Cracks, in concrete, filling with, **99**, 1003. (See Forts, p. 1797 of this Index.)

Operations. (See p. 22 of this Index.)**Ordinance.**

Handling. (See Forts, p. 1797 of this Index.)

Ore Traffic.

Great Lakes, **10**, 2097.

Ores. (See Copper; Iron; Silver.)

Freight, handling, **97**, 3189.
Reducing, copper, **75**, ii, 135.

Ornaments.

Buildings, steel, **04**, 3849.

Oscillations. (See Seiches.)

Lakes, **66**, iv, 93; **67**, 100, 599; **68**, 86, 983;
69, 600; **72**, 116, 1033, 1040; **73**, 1193; **76**, ii, 341.

Outlets. (See Lakes; Rivers.)

Current velocity at, lakes, **68**, 961; **70**, 556.
Data concerning, index to, Mississippi River, **95**, 3710.
Deepening, Great Lakes, **85**, 681.
Lakes, **82**, 2470.

Outlets—Continued.

Levees, **02**, 1642.
Restricting, rivers, **95**, 3640.

Overflow. (See Floods; Rivers.)

Causes, levees, Mississippi River, **95**, 3644.
Comparison of, Mississippi River, **97**, 3710.
Lawsuits arising from, **94**, 2713; **95**, 3644.
Preventing, levees, Mississippi River, **95**, 3625.

Overflowage.

Claims, canalization, **11**, 2031.
Reservoirs, extension of, a remedy, Mississippi River, H. D. 42, 61st, 2d.
Reservoirs, headwaters of Mississippi River, not responsible, H. D. 42, 61st, 2d.
Tide gauge records valuable, **04**, 1647.

Overhead Structures.

Canals, providing for overhead structures, Puget Sound, H. D. 953, 60th, 1st.

Oyster Beds.

Deposits from dredgings over, destructive effect, Biloxi Harbor, H. D. 1088, 60th, 2d.
Dredging, **00**, 1721.
Injury of, lawsuits favorable to U. S., **00**, 1721.
Irregularity of depths over, **73**, 818.

Oyster Industry.

Fostering of, Maryland, **93**, 1312.

Oyster Shells.

Hearting of, jetties, **97**, 1328.

P.**Package Freight.** (See Freight.)**Paint.** (See Lock Gates.)

Best paint, lock gates, **00**, 4331.

Painting.

Concrete, **03**, 2386.
Forts. (See p. 1797 of this Index.)
Hydraulic dredges, **04**, S., 129.
Lock gates, **00**, 4331.
Paints and washes, concrete work, **02**, 2494.
Piers, to retard decay, **98**, 2658.
Signal towers, canals, **09**, 1861.
Steelwork, **99**, 2290.

Panama Canal. (See p. 2357 of this Index.)

Effect of, on canalization of Ohio River, H. D. 492, 60th, 1st.

Panels.

Pile sinking, **75**, ii, 621.

Pantograph, Suspended.

Coradi's, **93**, 2036.
Mapping with, **93**, 2036.

Paper. (See Blue Prints.)**Paper, Tarred.**

Waterproofing concrete work, **02**, 2469. (See Forts, p. 1797 of this Index.)

Paraffin.

Eflorescence, cure for, brickwork, **04**, 3831.
Waterproofing, brickwork, **04**, 3832.

Parallel Jetties. (See Jetties.)**Parapets.** (See Batteries; Piers.)

Concrete work, forts. (See Forts, p. 1797 of this Index.)
Pumped up, forts, **04**, 3030. (See Forts, p. 1797 of this Index.)
Sand movement on, checking, gun batteries, **97**, 679.
Superstructures, piers, **84**, 2144; **85**, 2279, 2307.

Parks. (See pl. 69.)

00, 5236.
Bridges, Yellowstone Park, **02**, 3034.
Celebrated parks, dimensions, **67**, 535.
Copings, concrete, **04**, 3918.
Entrances, ornamental, **03**, 2469.
Grounds, parking of, Duluth-Superior, **08**, 1901.
Harbors, reclamation should be for, Chicago, H. D. 700, 59th, 1st.
Improvements, Washington, D. C., **10**, 2669.
Improvements and maintenance, District of Columbia, **12**, 3488.
Layouts, Washington, D. C. (See p. 2040 of this Index.)
Parking, plans for, Yellowstone Park, **03**, 2894.
Proposed parks, Washington, **67**, 523, 542, 547.
Public Grounds and Buildings, Washington, D. C. (See p. 2040 of this Index.)

Parks—Continued.

- Reclaimed land for, **97**, 1319.
- Roads, **03**, 2444; **04**, 4207.
- Roads, Mount Rainier, **09**, 2514.
- Roads, Yellowstone Park, **03**, 3034.
- System, cities, District of Columbia, **06**, 2238.
- Use of, regulating, **97**, 4062.
- Water-supply system, Yellowstone, **02**, 3043.

Parks, City.

- Details, U. S., **01**, 3711.

Parks, Natural.

- Great natural parks, Colorado, **75**, ii, 937.

Parks, Public.

- Fort sites; utilization, **85**, 423.
- Reclaimed land for, **00**, 1702.

Parks, Small.

- Landscape possibilities, District of Columbia, **12**, 3492.

Parks, U. S.

- Roads in, **08**, 2554.

Parties.

- Ice surveys, organization for, **95**, 4236.
- Surveys, **94**, 1749.

Passes. (See Dams.)

- Building, movable dams, **97**, 2546.
- Closure, discussion, St. Andrews Bay, Fla., H. D. 12, 61st, 1st.
- Substructures, movable dams, **97**, 2546.
- Tidal currents at, velocity of, **74**, 790.

Passes, Navigable.

- Bear-trap gates, dams, **96**, 1838.
- Dams, **93**, 2269.
- Designing, dams, **93**, 2269.
- Movable dams, **96**, 2311.

Passing Places. (See Canals.)

- Canal, **93**, 2716.

Pass System.

- River regulation, California, H. D. 262, 59th, 1st.

Patrol.

- Necessary, harbors, **05**, 1976.

Pavements. (See Batteries; Concrete.)

- Banks, **93**, 3729.
- Waterproofing, concrete batteries, **05**, 3006.
- (See Forts, p. 1797 of this Index.)
- Wing dams, **94**, 1664.

Paving. (See Banks; Locks; Stone; Wing Dams.)

- (See pls. 57, 58, 59, 60.)
- Bank protection, **93**, 3729; **94**, 2902.
- Banks, **03**, 2443.
- Brush and stone dams, **94**, 2893.
- Concrete in situ, details, **02**, S., 159.
- Cost details, banks, **02**, S., 160.
- Cost of, banks, Mississippi River, **12**, 3870.
- (See p. 1067 of this Index.)
- Specifications, locks, **00**, 2925.
- Wing dams, Rock Island Rapids, **94**, 1664.

Paving, Concrete. (See Paving, above; and Concrete Banks, 11, 2003.)**Peat.**

- Analysis, **76**, 396.
- Origin of, Atlantic coast, **76**, 393.

Pendulum. (See Hydrometers.)**Percolation. (See Damp-proofing.) (See Forts, p. 1797 of this Index.)**

- Asphaltum for, concrete work, **03**, 2412.
- Experiments, concrete work, **03**, 2374.
- Locks, **12**, 1777.
- Tunnel, water supply, District of Columbia, **01**, 3666.
- Water tunnels, **96**, 3937; **00**, 5208.

Percussion.

- Rock removal, **94**, 812.

Phosphates.

- Development of industry, improved channels and, St. Johns River, H. D. 281, 62d, 2d.
- Enormous deposits of, contiguous to Charlotte Harbor, Fla., H. D. 699, 62d, 2d.

Photogrammetry.

- 95**, 4170, 4225; **96**, 4061.

Photographic Reproduction.

- Drawings, **93**, 2074.

Photography. (See Maps.)

- Explosions, Flood Rock, **86**, 691, 716.
- Map reproduction, **05**, 2126.
- Outfit, Company of Corps of Engineers, **03**, 692.
- Valuable, torpedo trials, **82**, 448.

Photolithographing.

- Chart reproduction, "Great Lakes Surveys," **08**, 2516.

Phototopography.

- 96**, 4061.

Physical Characteristics. (See p. 22 of this Index.)**Physics. (See Rivers.)****Pierheads. (See Cribs.)**

- Duluth, **01**, 2859.
- Elevations, concrete, **04**, 3802.
- Molds, concrete work, **04**, 3802.

Pierheads, Concrete.

- Cross sections, **04**, 3802.

Piers. (See Breakwaters; Bridges; Canals; Concrete; Cribs; Dams; Dikes; Docks; Harbors, Ice; Jetties; Locks; Masonry; Piles; Revetments; Wharves.) (See pls. 6, 7, 8, 9, 10, 11; 12, 13, 37.)

- 88**, 2201, 2552; **89**, 2082.
- Bar formation, **93**, 3098; **95**, 3139.
- Bar formation, retarding, triangular cribs for, **95**, 3118.
- Bars, unusual shape, **93**, 3082.
- Blocks, concrete; alternate monolithic, **01**, 2832.
- Blocks, concrete, Great Lakes, **06**, 1842.
- Blocks, concrete, making, **07**, 1995.
- Blocks, footing, concrete, **01**, 2832.
- Bolting, patch, submarine work, **01**, 2851.
- Bolts, patch, special form, **01**, 2850.
- Boulé dams, **00**, 3482.
- Breaches in, repairing with boxes, **95**, 2793, 2800.
- Building, harbors of refuge, **97**, 2071.
- Building, movable dams, **97**, 2548.
- Building, regulations, Philadelphia Harbor, **93**, 1156.
- Canals, Duluth, **98**, 2226.

Piers—Continued.

- Careening, Marcus Hook, Pa., **83**, 616.
 Collision of steamer, effect of, **08**, 1902.
 Concrete, apron, **00**, 4110.
 Concrete, apron, cracked by severe storms, **99**, 3097, 3100.
 Concrete, apron, repairing, **00**, 4110.
 Concrete, covering, disintegration from frost, **99**, 2774.
 Concrete, footing blocks, molding, **98**, 2226.
 Concrete for, mixing, **04**, 3784.
 Concrete molds, Duluth-Superior, **05**, 1986.
 Concrete superstructure, **98**, 2226; **00**, 4062.
 Concrete superstructure, building, **00**, 4102.
 Concrete superstructure, Duluth, **99**, 2644.
 Concrete work, Duluth, **01**, 2832.
 Connection plates, **01**, 2855.
 Corners, strengthening, **98**, 2429.
 Costs, **01**, 2853.
 Crib connections, **01**, 2850.
 Cribs, building, **99**, 2633.
 Cribs, cross sections, Chicago Harbor, **94**, 2134.
 Cribs, details, Kenosha, **01**, 2948.
 Cribs, dredging, affected by, **01**, 2833.
 Cribs, moving, **01**, 2948.
 Cribs, repair of, **98**, 2752.
 Cribs, storms, effect of, **95**, 2778.
 Cribs, substitutes for, gravel and rock cheaper, **98**, 1761.
 Cross sections, Harbor Beach, H. D. 900, 59th, 1st.
 Currents between, velocity, **98**, 2740.
 Cutwater block, molds, **01**, 2832.
 Damages of, causes, **95**, 2797.
 Decayed parts, removing, **98**, 2752.
 Decay of, retarding, painting for, **98**, 2658.
 Deep water, extending to, necessity for, **76**, ii, 506.
 Eccentric footing blocks, Duluth, **98**, 2226.
 Extension, economy of, harbors, **95**, 3109.
 Extension, lighting, difficulties, **76**, ii, 427.
 Extension, methods, **98**, 2676.
 Extension, Philadelphia Harbor, **93**, 1156; **00**, 1567.
 Extensions, rights of riparian owners, Chicago, H. D. 710, 62d, 2d.
 Faulty design, cause of bar forming, **98**, 2246; **99**, 2709.
 Foundations, dredgings for, Philadelphia Harbor, **95**, 1054.
 Foundations, section, **98**, 2676.
 Gauge well, **01**, 2851.
 Harbor entrances, effect, **97**, 2775.
 Ice formations, Great Lakes, **10**, 2092.
 Ice, pressure of, **82**, 785; **87**, 2076.
 Ice, protection against, **73**, 294, 296; **75**, 57, 320.
 Injury of, attached vessels, **69**, 85, 141; **77**, 965; **78**, 452.
 Injury of, colliding vessels, **78**, 1183.
 Injury of, gales, **77**, 967.
 Injury of, ice action, **75**, 310.
 Injury of, river currents, **76**, ii, 532.
 Legislation required, **77**, 940.
 Length, proper, Great Lakes harbors, H. D. 690, 62d, 2d.
 Lighthouses, foundations, **00**, 4078.

Piers—Continued.

- Lights, ornamental, Duluth, **05**, 1974.
 Maintenance, rafting, **00**, 3346.
 Masonry superstructure, **66**, iv, 157, 163; **76**, ii, 390; **78**, 1166; **79**, 1524.
 Masonry superstructure, disadvantages of, **66**, iv, 157, 163; **67**, 137, 222, 226, 228.
 Materials, Great Lakes, best materials, H. D. 62, 59th, 1st.
 Mattresses for, **00**, 4186.
 Modification of, waves in inner harbor, to prevent, **73**, 204.
 Occupation of, disreputable characters, control over, **95**, 2696.
 Occupation of, private persons, **80**, 2195; **85**, 2255, 2257.
 Parallel system, breakwaters, modification, **01**, 3265.
 Parapets, form of, **84**, 2144; **85**, 2279, 2307.
 Pier ends, bars at, checking, **95**, 3118; **96**, 2933.
 Pier ends, improved form, **94**, 2131.
 Pier ends, protecting, triangular cribs for, **95**, 3118.
 Pier ends, sand drift around, **74**, 223, 230.
 Pier ends, scour, **84**, 1966.
 Pier ends, strengthening, **93**, 2803.
 Pierheads, designs, **00**, 4078.
 Pierheads, lighthouse foundations on, **00**, 4078.
 Pipe wells, **01**, 2857.
 Plans for, new harborage, Jamaica Bay, N. Y. H. D. 1506, 60th, 2d.
 Promenade, **01**, 2832.
 Proper width between, lake harbors, **66**, 26, 27.
 Protecting, mattresses for, **70**, 187.
 Protection piles, **01**, 2851.
 Reconstruction, etc., costs of, **05**, 2353.
 Relocation of, bar formation, to check, **96**, 2933.
 Repairs, **99**, 2913, 2936.
 Repairs, methods, **98**, 2752; **99**, 2901; **00**, 3913.
 Sand-tightening, **92**, 2332.
 Sand-tightening, brush for, **80**, 1906.
 Sand-tightening, brush mats, **78**, 1211.
 Sand-tightening, sheet piling for, **80**, 1906, 1914, 1916; **81**, 2078; **82**, 2138; **99**, 2907.
 Scour above and below, bear-trap dams, **05**, 1844.
 Sections, Duluth, **01**, 2858.
 Settlement, **94**, 2216.
 Settlement, Duluth, **01**, 2858; **08**, 1902.
 Sheathing, **00**, 4062.
 Shoaling between, **96**, 3134; **98**, 2331.
 Shoaling between, checking, **97**, 2779.
 Shore connection, Great Lakes, **04**, 3172.
 Shore drift at, accumulation of, **82**, 582.
 Sloping superstructure, **71**, 215.
 Snubbing posts, introduction of, **66**, iv, 70; **69**, 141; **71**, 193, 194; **77**, 965.
 Stones, large, economy of, Great Lakes, **06**, 1821.
 Substructure, concrete, Great Lakes, **04**, 3802.
 Substructure, subaqueous concrete, placing, **09**, 1905.
 Superstructure, concrete, **01**, 2832; **03**, 1888; **04**, 3333.
 Superstructure, concrete, reconstructing, **06**, 1842.

Piers—Continued.

- Superstructure, concrete, views, **01**, 2832.
- Superstructure, permanent, proposed, Harbor Beach, harbor of refuge, H. D. 900, 59th, 1st.
- Superstructure, removing, Great Lakes, **06**, 1841.
- Superstructure, removing, methods, Great Lakes, **07**, 1995.
- Superstructure, unique cross sections, Great Lakes, **06**, 1841.
- Superstructures, parapet, form of, **84**, 2144; **85**, 2279, 2307.
- Superstructures, stone in, deterioration of, Milwaukee, **99**, 2772.
- Timber cribs, **98**, 2660.
- Timbers, securing, **97**, 3069.
- Triangular cribs, advantages of, **95**, 3118.
- United States piers, docks for private persons, **66**, 15, 22, ii, 37, iii, 5; **67**, 29, 141; **69**, 85; **76**, ii, 559, 561, 571; **79**, 1721.
- Vicinity of, accretions, **97**, 2779.
- Vicinity of, bars, growth of, **95**, 3139.
- Vicinity of, bars, rapid growth, **96**, 3100.
- Vicinity of, shore lines, advancement of, **95**, 2772.
- Weakening of, channel deepening a cause of, **98**, 2654.

Piers, Bear-Trap.

- Settlement, checking, **08**, 1798.

Piers, Bridge.

- Deterioration of, underwater parts, helped by freshets, **12**, 1310.
- Examining, method of, **01**, 3643.
- Reconstruction, **08**, 2346.
- Repairs, concrete work, **01**, 3639.

Piers, Catchment.

- Sand for, **74**, 52.

Piers, Concrete.

- Aprons, **00**, 4110.
- Aqueducts, **98**, 2482.
- Blocks, arrangement of, **04**, 3802.
- Bucket, special, **04**, 3302.
- Building, details, Duluth Harbor, **99**, 2644.
- Building, Great Lakes, **04**, 3192.
- Building, important details, **04**, 2775.
- Building, plant and methods, **04**, 3779.
- Construction, details, Duluth-Superior, **05**, 1974.
- Cross sections, **04**, 3802.
- Curves, blocks on, **04**, 3802.
- Curves in, Duluth-Superior, **05**, 1986.
- Cutwater molds, **04**, 3802.
- Derricks, building plant, **04**, 3802.
- Details, Great Lakes, **05**, 1974.
- Holes, tie-rod, **05**, 1987.
- Locking device, castings, etc., **04**, 3802.
- Materials, **04**, 3783.
- Metal details, **04**, 3802.
- Molds, **04**, 3802.
- Molds, assembling frames, etc., **04**, 3802.
- Molds, pierhead, **04**, 3802.
- Molds, subaqueous, **04**, 3802.
- Molds, timber, templates, **04**, 3802.
- Plant, **04**, 3802.
- Plant, Duluth-Superior, **05**, 1986.
- Plant, special details, Duluth-Superior, **06**, 1699.

Piers, Concrete—Continued.

- Pressures, unit, **01**, 2359.
- Rods, locking, **04**, 3802.
- Sections, **98**, 2226.
- Settlement, **01**, 2860.
- Superstructure, **04**, 2776.
- Timber foundations, sections of, **98**, 2226.
- Travelers, concrete, **04**, 3802.
- Trenches, trestles, and cross sections, **04**, 3802.
- Weights, **01**, 2859.
- Weights, ballast, **04**, 3802.

Piers, Crib.

- Breaches in, preventing, triangular cribs for, **96**, 2966.
- Building, **97**, 2071.
- Building, methods, improved, **96**, 2967; **97**, 2809.
- Caps under, **96**, 1836.
- Collisions, repairing damages from, **08**, 1902.
- Cost, items of, **96**, 2967.
- Damaged, rebuilding, methods, **96**, 2678.
- Decay of, **96**, 2935.
- Design, **95**, 3112; **00**, 4062.
- Design, improved, **96**, 2952.
- Fastenings of, improved, **93**, 3091.
- Foundations of, **96**, 2713.
- Framing, improved methods, **93**, 3091.
- Iron to strengthen corners, **97**, 2809.
- Pile piers and, compared, **68**, 156; **69**, 102, 133, 135.
- Piling, repairing, methods, **96**, 2691.
- Repairing, **93**, 2216, 2391, 2399; **95**, 2796.
- Sand tightening, **96**, 2674; **97**, 2924.
- Stone and concrete superstructure, **97**, 3075.
- Stone, replacing of, provisions for, **96**, 2945.
- Superstructure of, building, improved methods, **96**, 2966.

Piers, Crib and Masonry.

- Building, methods, **97**, 3075.

Piers, Crib and Stone.

- Sections of, **95**, 3106.

Piers, Detached.

- Dangers from, **95**, 2799.

Piers, Divergent.

- Objections to, **66**, 21, 22, iv, 11, 17, 18, 142, 145, 148; **67**, 141, 218; **72**, 230, 240; **77**, 171; **79**, 1698, 1700.

Piers, Entrance.

- Rebuilding, cost, Great Lakes, H. D. 939, 60th, 1st.

Piers, Ice.

- Costs, Ohio River, **04**, 2422.
- Value demonstrated, Ohio River, **01**, 2676.

Piers, Iron.

- Description of, **71**, 668; **76**, 267; **78**, 431.
- Foundations of, screw piles, **71**, 665; **74**, ii, 133; **75**, ii, 174; **76**, ii, 267; **77**, 256.
- Lewes, Del., **82**, 782; **86**, 838.
- Magnetic variations, **04**, 4133.
- Proposed for Delaware Bay, **82**, 781; **85**, 842.

Piers, Landing.

- Forts. (See p. 1797 of this Index.)

Piers, Masonry.

- Marcus Hook, Pa., **70**, 424; **71**, 657.
- Newcastle, Del., **71**, 689.
- Portland, Me., **74**, ii, 305.

Piers, Mooring.

Plan, Keweenaw Canal, H. D. 325, 60th, 1st.

Piers, Old.

Condition of, Lake Pepin, **01**, 2250.

Cost of repairing, **05**, 1633.

Reconstructing, **98**, 2527.

Piers, Old Crib.

Rebuilding, **98**, 2660.

Piers, Parallel.

Dangerous at harbor entrances, **80**, 2021; **82**, 2296.

Disadvantages of, **80**, 2021; **82**, 2296.

Piers, Pile.

66, iv, 69, 88; **67**, 70, 219; **68**, 154, 155, 215;

69, 102, 104; **73**, 998; **75**, 237; **00**, 3708.

Advantages of, **66**, iv, 17, 20, 69, 71.

Blunder, considered a, **69**, 136.

Brush in, **66**, iv, 105; **73**, 201.

Building, **00**, 4068.

Crib piers and, comparison, **68**, 156; **69**, 102, 133, 135.

Iron-tie roads, necessity for, **68**, 156.

Modifications proposed, **68**, 156; **75**, 236.

Objections to, **68**, 156; **69**, 133; **75**, 236, 237, 255, 258.

Proposed, Duluth, H. D. 82, 59th, 2d.

Sand drift through, **75**, 255, 258.

Sand tightening, timber beams for, **75**, 243; **78**, 1213; **79**, 1659.

Sand tightening, brush for, **73**, 201; **75**, 193, **78**, 1211.

Sand tightening, planks for, **75**, 243; **79**, 1512, 1514.

Sand tightening, shavings for, **79**, 1622.

Piers, Reconstruction of.

Costs, Great Lakes, **03**, 2090.

Concrete work, plant, **04**, 3779.

Piers, Slab.

66, iv, 141; **73**, 250; **75**, 193; **76**, ii, 505; **79**, 1659.

Sand tightening, **75**, 193; **76**, ii, 505.

Piers, Timber.

Changing to concrete form, **04**, 2743.

Designs, **98**, 2665.

Factors to be considered, **01**, 2903.

Sheathing, **00**, 4062.

Piers, Timber Crib.

Oswego, N. Y., **04**, 3818.

Stone superstructure, **04**, 3818.

Piers, U. S.

Use of, regulations, **96**, 921.

Pile Drivers. (See pl. 13.)

90, 3013, 3021; **91**, 3191.

Bank grading, used for, **99**, 2156.

Dikes, for training, **01**, 1662.

Mississippi River, **82**, 1719; **83**, 1251.

Operation of, **00**, 2789.

Two rows of piles, **73**, 993.

Pile Driving. (See Brooming; Hammers; Water Jet.)

68, 515; **72**, 1008; **75**, 469; **82**, 1716; **83**, 1185, 1249; **88**, 2561; **94**, 1699, 2153; **95**, 2413, 4003, 4047; **96**, 1835; **98**, 748, 1992, 2952.

Brooming, **82**, 2164.

Butts down, **81**, 1555.

Pile Driving—Continued.

Derrick, from, **01**, 922.

Dikes, **98**, 3506.

Drop hammers, **83**, 1185.

Followers, **79**, 1591.

Foundations, dams, **00**, 5002.

Hammers, **93**, 4241.

Jet, by, **05**, 2591.

Jetties, **94**, 2543.

Jetties, curves of, **94**, 2544.

Methods, **03**, 1573.

Powder used, **75**, ii, 82.

Records, Mississippi River, **84**, 1505, 1519.

Resistance to, **98**, 748.

Resistance to, curves of, **98**, 749.

Sandy soils, **68**, 515; **83**, 1249.

Steam power, **73**, 216; **83**, 1185, 1270, 1272.

Troops, engineer, **02**, 816.

Water jet, **75**, 869; **77**, 449, 450; **80**, 1912; **81**, 1508, 1554, 1621; **82**, 1607, 1677, 1711, 1719, 1723; **83**, 1185, 1250, 1270, 1289, 1292; **84**, 2770, 2832; **85**, 2384; **86**, 1981; **87**, 3100.

Pile Heads.

Protecting, tar and sand for, **92**, 1541.

Piles. (See Bulkheads; Cribbs; Dikes; Jetties; Shoring.)

Brush and, bank protection, **96**, 1400.

Bulkheads of, building, **94**, 1670.

Buttresses of, hurdles, **95**, 2078.

Caps, fastening, **95**, 3314.

Concrete substituted for, **95**, 509.

Crib angles, **67**, 149; **68**, 169, 174, 181, 209; **69**, 107, 122, 126; **76**, ii, 533; **78**, 1201, 1204, 1207.

Crib careening, failure to prevent, **69**, 126.

Crib foundations, **88**, 2347.

Crib sinking, **72**, 166; **78**, 1185, 1188; **79**, 1557, 1558, 1590.

Cutting, floating saw plant for, **96**, 2517.

Cutting under water, special machine for, Duluth-Superior, **09**, 1906.

Deterioration of, jetties, **00**, 4475.

Distances between, measuring apparatus, **98**, 3505.

Extracting, **74**, ii, 239; **79**, 447, 651.

Fascines and, spur dams, **93**, 1562.

Foundations, cribs, **72**, 166; **78**, 1185, 1188;

79, 1557, 1558, 1590; **82**, 2321; **84**, 1968, 1985; **00**, 3878.

Horizontal timbers and, wing dams, **71**, 359.

Ice, lifted by, **81**, 618.

Ice protection, Mississippi River, **05**, 1637.

Omission of, scour prevention, **98**, 2955.

Penetration, diagram, **98**, 748.

Penetration, Fort Brown, Tex., **78**, 620.

Preserving, carbolization, **74**, 787; **79**, 393.

Protecting against teredo, **06**, 758.

Protection of, **01**, 2851.

Protection of, Gallinowsky process, **97**, 700.

Scour at, preventing, **98**, 2955.

Scour at, preventing, mattresses for, **98**, 1698.

Securing, rocky bottoms, **82**, 2137.

Sheathing and, revetments, **96**, 2966.

Shodding of, **97**, 3367.

Shore protection, **77**, 475.

Shoring with, **96**, 2414.

Sinking, panels, **75**, ii, 621.

Sinking, nozzles and hooks, **89**, 2794.

Piles—Continued.

- Sinking, sinking boats, **98**, 3181.
 Sinking, two nozzles used, **94**, 3133.
 Sinking, water jet, **91**, 2683.
 Sustaining power, P. P. No. 5, C. E.; **72**, 761;
77, 256; **78**, 432; **86**, 1982; **87**, 970; **98**, 750.
 Tereido attacks, jetties, **00**, 4475.
 Tereido attacks, preventing, **80**, 1212.
 Tereido, destruction by, **92**, 2658.
 Tereido, unexpected absence of, Columbia
 River, **08**, 2271.
 Training walls, **93**, 1562.
 Two rows, driver for, **73**, 998.
 Ungreased pile dikes, decay of, **97**, 1115.
 Unreliable for foundations of batteries, **96**, 503.
 Various kinds, tereido effect, **68**, 508, 512; **71**,
 531, 536, 548; **79**, 937.
 Watling, **94**, 2614.

Piles, Anchor.

- Disk anchor substituted for, **01**, 2195.

Piles, Bearing.

- Pierhead cribs, **11**, 2276.

Piles, Concrete.

- Dikes, **11**, 1992.
 Dikes, Missouri River, **09**, 1661.
 Economy, **04**, 3869.
 Foundations, treacherous ground, **04**, 3866.

Piles, Cypress.

- Durability of, **83**, 1132.

Piles, Hollow Cast-Iron.

- 80**, 612; **85**, 843.

Piles, Palmetto and Mangrove.

- Tereido proof, **68**, 512; **71**, 548.

Piles, Screw.

- 71**, 666; **75**, ii, 174.
 Delaware River, **73**, 876.
 Dimensions, **79**, 448.
 Flanges, proper form for, **72**, 762.
 Foundations, iron piers, **71**, 665; **74**, ii, 133;
75, ii, 174; **76**, 267; **77**, 256.
 Gloucester Point, **72**, 789.
 Lewes, Del., **71**, 665, 667; **72**, 759; **73**, 860; **74**,
 ii, 131; **76**, 267; **77**, 256; **78**, 431; **79**, 448.
 Penetration of, **72**, 761.
 Removing, water jet for, **79**, 447.
 Salt water, effect of, **79**, 447.
 Sinking, **72**, 769; **73**, 861; **75**, ii, 174; **79**, 448.
 Sinking, facilitation of, water jet for, **73**, 860.
 Sinking, water jet for, **72**, 759, 770; **73**, 860,
 861; **78**, 432; **79**, 447.
 Sustaining power, **72**, 763, 765; **77**, 256; **78**,
 432.

Piles, Sheet.

- Driving, **94**, 1700.
 Sinking, method, Holland, **75**, ii, 621.

Piles, Square-ended.

- 80**, 2261.

Piles, Wattled.

- Shore protection, **76**, 497.

Piling. (See Breakwater; Dikes; Fenders; Jetties;

- Locks; Piers.) (See pls. 13, 32.)
 Caisson preferred at lock sites, **12**, 1777.
 Foundations, locks, **94**, 2166.
 Injury of, drift, jetties, **94**, 2556.

Piling—Continued.

- Plan of, soft bottoms, **87**, 970.
 Protecting from tereido, Pacific coast, **06**, 2014.
 Ravages of tereido despite Gallinowski process,
01, 823.
 Resistance of, **98**, 745.
 Sea walls, **05**, 3025.
 Slabs and, breakwaters of, expensive to main-
 tain, **94**, 2024.

Piling, Close.

- Piers of, **69**, 101; **75**, 237.

Piling, Concrete.

- Foundations, brick buildings, **04**, 3866.

Piling, Creosoted.

- Advantages of, **93**, 921.

Piling, Fender.

- 97**, 2666.
 Building, **97**, 2661.

Piling, Sheet. (See pls. 31, 37.)

- Driving, **96**, 1835.
 Peculiar overturning, foundations, locks, **98**,
 1472.
 Piers, sand tightening of, **80**, 1906, 1914, 1916;
81, 2078; **82**, 2138.
 Reservoir dams, **96**, 1835.
 Sand movement, checking, **94**, 2462.
 Sand tightening, piers, **80**, 1906, 1914, 1916; **81**,
 2078; **82**, 2138; **99**, 2907.
 Sea walls, **05**, 3025, 3028.
 Wing dams of, **94**, 1335.

Plotage.

- Harbors, in, methods during fog, **01**, 1013.
 Rates for, uncontrolled, and harm from,
 Charleston Harbor, H. D. 288, 62d, 2d.

Pine, White.

- Weight of, **68**, 230.

Pinnacles, Rock.

- Blasting under water, **01**, 3483.

Pins, Wooden.

- Cribs, **67**, 138, 216.

Pipe Lines. (See pls. 51, 52, 53, 55.)

- Dredges, hydraulic, **02**, S., 43.
 Dredges, hydraulic; measuring efficiency,
 methods, **03**, S., 143.
 Dredging, pontoons, **04**, S., 127.

Pipes. (See Borings; Culverts; Discharge; Draft;

- Dredges; Inlets; Steam.)
 Borings, used in, **94**, 1493.
 Dredges, **93**, 1498.
 Laying across canals, **94**, 1939.
 Recovering, borings, **01**, 1834.
 Triangulation stations, **03**, 2685.

Pipes, Discharge.

- Barges, supporting, dredges, **01**, 1883.
 Hydraulic dredges, **95**, 3630.
 Lengthening with sacking, dredging, **01**, 1884.
 Loss of head from friction, dredges, **03**, S., 149.
 Swivel joints, hydraulic dredges, **98**, 1707.
 Wide pontoons, effects of, hydraulic dredging,
98, 1707.

Pipes, Gas.

- Triangulation stations, **04**, 4064.

Pipes, Inlet.

- Locks, **94**, 2303.

Pipes, Steam.

Borings, 99, 1709.

Pipes, Suction.

Choked with gravel, etc., dredging, 11, 2080.
Dredges, economical arrangement, 94, 1407.
Strengthening of, 93, 1498.

Pipe Wells.

Piers, 01, 2857.

Piping.

Plans, U. S. dredges, 03, S., 158.
Dredges, hydraulic, 03, S., 115.

Pitot Tubes.

Flow, measuring, U. S. dredges, 03, S., 158.

Pits. (See Mortars.)

Mortar pits, 94, 451.

Pits, Testing.

Foundations, locks, 95, 2203.

Plains.

Mountains and, rainfall differences, 74, ii, 375.

Planer. (See Stones.)**Planes. (See Flood Planes; Low Water; River.)**

Change of, Mississippi River, 93, 3564.
Planes of rest, stone breakwaters, 93, 3261.
Study of planes and slopes, Mississippi River,
H. D. 50, 61st, 1st.

Planes, Datum.

Fixing reliable datum planes, Altamaha system, H. D. 443, 62d, 2d.

Planes, Inclined.

Canals, 74, 498, 550, 552, 555; 75, 770, 879; 76, ii, 82, 100; 77, 682.
Locks and, comparison of, 74, 498, 550, 552, 555; 75, 770, 879; 76, ii, 82, 100; 77, 682.

Planimeter.

Discharge observations, measuring, 93, 1991.

Planimeters, Polar.

Rolling planimeters preferred, 93, 1991.

Planimeters, Rolling.

Advantages of, 93, 1991.
Polar planimeters preferable to, 93, 1991.
Tests of, 93, 1991.

Planks.

Sand tightening with, pile piers, 75, 243; 79, 1512, 1514.

Plans. (See p. 22 of this Index.)**Plant. (See Canals; Concrete; Dams; Dredging; Electricity; Jetties; Locks; Piers; Steam.)****Plant, Central Power.**

Advantages, dams, building, 93, 2485.

Plant, Construction.

Layout, forts, 02, 2494. (See Forts, p. 1797 of this Index.)

Plant, Dredge. (See pl. 57.)**Plant, Floating. (See Boats; Dredges; Tugs.)**

Rivers, long; required for, 05, 1772.
U. S. (See p. 2137 of this Index.)

Plant, Rattlesnake.

Description of, 68, 649.

Plant, U. S. (See Plant, Floating, above.)

Dredging, 11, 1905.
Shipyards for, 11, 2057.

Plant, U. S.—Continued.

Storage facilities, wharf, Cleveland, H. D. 270, 59th, 2d.

Repairs, waterways, costs, 01, S., 278.

Plants, Ornamental.

03, 2669.

Plants, Tropical and Other.

List of, Washington, D. C., 00, 5312.

Plaster of Paris.

Cement, effect in, 95, 2917; 96, 2803.

Plates.

Gauge bulletins, 97, 1940.

Plates, Protection.

Cribs, repair through ice, 01, 2830.

Platforms. (See Drilling; Guns; Mortars; Storage.)

Building, target practice, 96, 474.

Forts. (See Forts, p. 1297 of this Index.)

Reciprocal leveling, 91, 1896.

Platting. (See Plotting; Surveys.)

Surveys, 68, 430, 431; 94, 1753.

Plotting. (See Platting.)

Discharge, Tennessee River, H. D. 360, 62d, 2d.

Surveys, hydrographic, 02, 2512.

Playgrounds, Public.

Details, various places, 03, 2666.

Washington, D. C., 01, 3702; 11, 2973.

Plumbing.

Buildings, 04, 3855, 3860.

Dredges, hydraulic, 04, S., 112.

Poles, Loaded.

Currents, measuring, 96, 1204.

Policies.

River and harbor improvements, Sen. D. 301, 61st, 2d.

Pontoons. (See pls. 52, 66.)

Engineer troops, 02, 816.

Ice harbors, forming, 86, 834; 87, 804.

Remodeling, dredging, 01, S., 219.

Train, 01, 959.

Train equipment, 01, 959.

Train, improvement, 02, 801.

Wide, advantages of, hydraulic dredging, 98, 1707.

Wrecks, lighting, 99, 1277.

Pools. (See Canals.)

Canalized rivers, 98, 2147.

Canal pools, water supply of, 69, 535.

Pools, Dead.

Rivers, effect on, 98, 3168.

Population.

Growth of, New York, H. D. 1506, 60th, 2d.

Ports. (See Seaports.)

Rail and water rates, Texas, H. D. 1290, 61st, 3d.

Ports, Foreign.

Commerce of, facilities for, H. D. 1506, 60th, 2d.

Posts, Snubbing.

Introduction of, piers, 66, iv, 70; 69, 141; 71, 193, 194; 77, 965.

Posts, Vertical.

Cribs, strengthening, 79, 1588, 1590.

Powder.

Depth of hole and, relation, blasting, **68**, 425.
Various powders, rock blasting, **69**, 424.

Powder, Mica.

Nitroglycerin and, blasting, **91**, 2796.
Use of, Detroit River, **77**, 936.

Powder, Orange.

New River, used at, **78**, 496.

Powder, Smokeless.

Peace storage magazine, **05**, 3007. (See Forts,
p. 1797 of this Index.)

Powder, White.

Composition, **69**, 429.

Power. (See Air; Electricity; Mules; Steam;
Turbines; Water Power.)

Companies, supervision of, Great Lakes, **11**, 3028.
Dams for, right to use surplus water, Hudson
River, Sen. D. 887, 62d, 2d.

Development of, combination of channel im-
provement with, Connecticut River, H. D.
818, 61st, 2d.

Explosives, **90**, 417.

Hydraulic power replaced by hand power,
Tennessee River, **05**, 1766.

Navigation interests opposed to interests of,
Minnesota River, H. D. 700, 62d, 2d.

Pile driving, used for, **75**, ii, 82.

State, rights of, and of U. S., water power,
Hudson River, Sen. D. 887, 62d, 2d.

Power, Hand.

Hydraulic power replaced by, locks, Tennessee
River, **05**, 1766.

Power Houses.

Design of, water-power system, Ouachita
River, H. D. 588, 62d, 2d.

Electricity, **04**, 3710.

Locks, operation of, **95**, 2908.

Plans, locks, **98**, 1921.

Power, Hydraulic.

Hand power displacing, locks, Tennessee
River, **05**, 1766.

Power Plants.

Compressed air, **00**, 2769.

Operating, provisions, gun batteries, **98**, 11;
99, 12.

Transmission of power, compressed air best,
98, 1810.

Power Stations. (See pl. 71.)**Prairie.**

Mountainous country and, run-off, **96**, 3013.

Precipitation.

Arid regions, reservoirs, effect of, **98**, 2865.

Data relating to, index to, Mississippi River,
95, 3712.

Forests and stream flow, Merrimac River,
H. D. 9, 62d, 1st.

Muskingum River, **96**, 3014.

Red River, **00**, 2843.

Reservoirs, effect of, arid regions, **98**, 2865.

Pressure, Barometric.

Scour and, **01**, 575.

Pressures.

Concrete, piers, **01**, 2869.

Price, Selling.

Water power, navigable streams, H. D. 781,
60th, 1st.

Prices, Unit.

Canalizing waterway, Lockport to St. Louis,
H. D. 263, 59th, 1st.

Printing Office. (See Government.)**Printing Paper.** (See Blue Prints.)**Prism.** (See Canals.)**Prisms.**

Abnormal increase in volume of, Yazoo Canal,
05, 1553.

Private Channels. (See Channels.)**Private Interests.**

U. S. improvements should not be under-
taken for, H. D. 1067, 61st, 3d.

Private Parties.

Dredging by statute governing, Washington,
01, 3599.

Private Work. (See p. 22 of this Index.)**Profiles.** (See Rivers; Canals; Channels; Jetties)
Channels in vicinity of jetties, St. Johns River,
Fla., H. D. 611, 61st, 2d.

Making, survey, Lockport to St. Louis, H. D.
263, 59th, 1st.

Mississippi River, **01**, S., 232.

St. Johns River, Fla., H. D. 611, 61st, 2d.

Projectors.

Notes on, by Lieut. E. H. Schulz, Corps of
Engineers, U. S. Army, **03**, 2425.

Two 36" projectors probably better than one
60", **03**, 2425.

Projects. (See p. 22 of this Index.) (See titles
of various kinds of waterway improvements.)

Adoption of, river and harbor improvements,
steps to be taken before adopting, H. D. 301,
61st, 2d.

Slackwatering, Mississippi River, H. D. 50,
61st, 1st.

Promenade.

Piers, **01**, 2832.

Property. (See p. 2040 of this Index, for White
House list.)

Owners, consent of, waterway improvements,
obtaining, **06**, 2034.

Saved by breakwaters, Great Lakes, **06**, 969.

Property, Riparian.

Protection of, river and harbor works (Bixby),
Sen. D. 301, 61st, 2d.

Protection Works. (See Banks; Bends.)**Public.**

Wharves, access of public to, Hawaiian Islands,
H. D. 593, 61st, 2d.

Public Grounds and Buildings. (See p. 2040 of
this Index.)

Designing, Washington, D. C., **05**, 2772.

Public Opinion.

Favorable to improved waterways, H. D. 781,
60th, 1st.

Puddle.

Puddle walls, cofferdams, **68**, 426.

Remarks on, **84**, 2331.

Pulsations. (See Floods; Seiches.)Floods, **79**, 786.Running streams, **69**, 594; **71**, 989; **72**, 1033, 1040.**Pump, Chinese.**Lock, pumping out, **99**, 3236.**Pumpage.** (See Canals.)Water supply, canals, **76**, 406.**Pumping.** (See Cofferdams; Locks.)Canals, water supply for, **81**, 1152.Chinese pump, locks, **99**, 3236.Cofferdams, **93**, 2485; **98**, 3541, 3571.Cofferdams, within, **68**, 422; **71**, 164; **77**, 299.

Cost of, drinking water, H. D. 342, 61st, 2d.

Engines, tests, large locks, **97**, 2994.Foundations, batteries, **96**, 510.Gauges, mortar pits, **94**, 451.Gun batteries, **93**, 613; **98**, 645.Locks, **98**, 1886, 2981.Locks, building, **96**, 1936.Locks, permanent cofferdam sills for, **00**, 3533.Large locks, **97**, 2992.Turbines, **98**, 2981.**Pumps.** (See Canals; Dredges.)Discharge of, Rock Island Rapids, **69**, 242.large locks, **97**, 2987.Requirements, city water supply, **76**, ii, 697.Rock Island Rapids, **68**, 422.Sprinkling wagon, Yellowstone Park, **02**, 3044.

Station, emergency, H. D. 342, 61st, 2d.

Various pumps, duty of, **75**, ii, 204.Water jet, operating, **79**, 1514.Wear of, dredges, **00**, 4567.**Pumps, Canal.**Delaware & Chesapeake Canal, **76**, 406.**Pumps, Centrifugal.** (See Dredges.)**00**, 4567.Cofferdams, pumping in, **68**, 422; **71**, 164; **77**, 299.Dredges, **70**, 316; **72**, 666, 669; **73**, 750; **74**, ii, 11, 71; **75**, ii, 38, 40, 69; **76**, 445; **79**, 560, 1542; **89**, 1097; **90**, 736; **91**, 1472.Dredging, **85**, 2331.Dredging, cost, **72**, 669; **74**, ii, 12; **75**, ii, 40; **76**, 445.Dredging plants, **01**, S., 52.Dredges, **02**, S., 44.Efficiency of, on hydraulic dredges, **04**, S., 98.Holly's and, comparison, **71**, 164.Sand and water raised by, percentage of, **72**, 666, 668; **73**, 750; **74**, ii, 11, 71; **75**, ii, 38, 40, 69; **76**, 445.**Pumps, Dredge.**Capacity, measuring, methods, **03**, S., 143.Discharge velocity, measuring, **03**, S., 142.Efficiencies of, **03**, S., 165.Hydraulic dredges, **04**, S., 123.Pitot tubes to measure velocity, **03**, S., 139.Plans, **03**, S., 158.Testing data, **03**, S., 155; **04**, S., 130.Work of, total, computing, **03**, S., 163.**Pumps, Force.**Boring with, **75**, 235.Borings, **01**, 1719.**Pumps, Jet.**Dredges, hydraulic; efficiency, **03**, S., 148.**Pumping, Rapid.**Cofferdams, **68**, 426.**Pumps, Suction.**Dredges, **89**, 1097; **90**, 736; **91**, 1472.**Q.****Quarrying.** (See Rock.) (See pl. 46.)Cost of, Mississippi River, **05**, 216.Economical methods, **00**, 2916.Rock, **96**, 1876.**Quicklime.**Cement, effect on, **95**, 2917, 2924.**Quicksand.**Bank, effect on, **00**, 2845.Building on, **94**, 1826.Controlling, **01**, 913.Controlling, foundations, locks, **94**, 1826.**Quicksand—Continued.**Dikes, settlement of, **95**, 1666.Flow, preventing, lock abutments, **98**, 2125.

Forts. (See p. 1797 of this Index.)

Pocket, foundations, effect on, sheet-pile dams, **98**, 1487.**Quoin Posts.**Plates for, bending, device for, **95**, 3048.**Quoins, Hollow.**Lining, locks, **09**, 1706.

R.**Rack-a-Rock.** (See Explosives.)

Constitution of, **85**, 724; **86**, 682.

Use of, Hell Gate, **85**, 716, 721, 724; **86**, 680, 682, 683.

Racks.

Sponges and rammers, forts. (See Forts, p. 1797 of this Index.)

Rafting. (See Canals.)

Piers for, maintaining, rules, **00**, 3346.

Regulations, canals, **93**, 2682.

Rafts. (See Drilling.)

Building, Engineer troops, **02**, 816.

Passage of, bridges, spans, dimensions required, **77**, 820; **78**, 931.

Rafts and Logs.

Floating of, regulations, **01**, 2330.

Rafts, Natural.

Red River, **72**, 569; **73**, 613, 640; **76**, 598; **79**, 955.

Removing, nitroglycerin employed, **74**, 702, 708.

Rice plantation, removal of rafts opposed by pumpers to, Colorado River, H. D. 1211, 60th, 2d.

Raft-Towing.

Restrictions, Great Lakes, **94**, 2378.

Rules, canals, **95**, 2536.

Rail and Water Rates. (See Rates.)**Railings.**

Forts. (See p. 1797 of this Index.)

Railroads. (See Rates.)

Accidents on, investigation of, **77**, 831.

Aided by U. S., H. D. 781, 60th, 1st.

Bridges, rail and wagon traffic, **70**, 244, 261.

Bridges used by, conditions governing, **02**, 2654.

Canals and, capacity, comparison of N. Y. C. R. R. & Erie Canal, **71**, 647.

Canals and, comparison, **00**, 3622.

Canals and, New York State, **96**, 3063.

Charges, canal tolls and; comparison, **82**, 2497; **86**, 1944.

Control over, Government lands, **93**, 4288.

Cost of, average per mile, U. S., **75**, ii, 629.

Cost of, operating, canals, **05**, 1770.

Connections, new harborage, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.

Construction of, floods a bar, **08**, 860.

Due to U. S. waterway improvements, alluvial valley of the Mississippi, **04**, S., 24.

Engineer troops, work of, **02**, 816.

Extensions due to breakwaters, Hawaiian Islands, H. D. 417, 62d, 2d.

Railroads—Continued.

Free waterways, influence of, **96**, 3090.

Freight movement by, control of, Chicago Harbor, H. D. 710, 62d, 2d.

Freight rates, canal and, **96**, 3062.

Industries, factor in locating, H. D. 1506, 60th, 2d.

Influence of, waterway traffic, Missouri River, H. D. 1120, 60th, 2d.

Maintaining, difficulties, **03**, 1610.

Mileage of, Ohio, 1839—, **96**, 3043.

Operation and maintenance, cost, **04**, 2385.

Other methods of transportation and, freight rates, comparison, **71**, 630, 644.

Prosperity of, waterways, effect of, **96**, 3090.

Rates by, and by water, **12**, 2367.

Rates by, higher than on Great Lakes, **01**, 3281.

Sand fences on, **99**, 3218.

Tracks, forts. (See Forts, p. 1797 of this Index.)

U. S. freight, refusal of Central Pacific R. R. to conform to regulations in carrying, **73**, 1117.

Water routes should be cooperative with railroads, H. D. 769, 62d, 2d.

Waterways and, changing relations, H. D. 781, 60th, 1st.

Waterways and, competition, H. D. 710, 62d, 2d.

Waterways and, functions of, **10**, 2976.

Waterways and, relation, Sen. D. 301, 61st, 2d.

Waterways and, transportation by, relations, H. D. 301, 61st, 2d.

Rail Routes.

Canal and, comparison, **00**, 3622.

Rail Transportation.

Water and, comparison, **71**, 630, 644; **72**, 518; **74**, ii, 106, 116, 123; **77**, 399, 640, 645, 654.

Water and, rates, **82**, 2497; **87**, 2129, 2130.

Railway, Portage.

Columbia River, **94**, 2668.

Rail vs. Water.

Cotton shipments, routes, study, H. D. 12, 61st, 1st.

Railways. (See Rates.)

Aided by U. S., H. D. 781, 60th, 1st.

Bridges used by, conditions governing, **02**, 2654.

Maintenance of canals, **00**, 2941.

Waterways and, cost of building or making, H. D. 391, 62d, 2d.

Railways, Boat.

Defects, **01**, 3524.

Rainfall. (See Meteorology; Watersheds.)

Allegheny watersheds, **79**, 1391.
 California, **76**, ii, 624.
 Canals, **76**, 533.
 Colbert Shoals, canal, **98**, 1923.
 Columbia River, **79**, 1844; **80**, 2302.
 Charts of, **75**, 676.
 Cumberland Sound, **76**, 457, 458.
 Dakota, **74**, 296; **79**, 1225, 1243.
 Dismal Swamp Canal, **96**, 1090.
 Drainage and, ratio, **79**, 1391; **81**, 1778.
 Evaporation and, ratio, **70**, 287.
 Florida, coast of, **76**, 457.
 Forests, effect of, **75**, ii, 172; **79**, 1211; **84**, 662.
 Fox River, **00**, 3724.
 French Broad River, **00**, 3027.
 Great Lakes, **03**, 2855.
 Great rainfall, Neah Bay, **98**, 3084.
 Greenville, Mississippi River, **99**, 3565.
 Hudson River, **94**, 726; **95**, 900; **96**, 826.
 James River, headwaters of, **77**, 759.
 Lake discharge and, ratio, **68**, 962.
 Lake region, **67**, 684; **68**, 961, 971, 980; **69**, 601.
 Minnesota, **79**, 1224, 1243.
 Mississippi Basin, **84**, 1615, 1622.
 Mississippi River, lower, **75**, 571.
 Mississippi River, upper, **70**, 287; **74**, 296; **75**, ii, 438, 440; **79**, 1197, 1199, 1213, 1226; **80**, 1591, 1599, 1612; **81**, 1778, 1801; **83**, 1453; **84**, 1622.
 Mississippi River, watershed, **96**, 1862.
 Mountains and lower levels, differences, **74**, ii, 375.
 Ohio River, **95**, 2351; **97**, 2338; **98**, 2053.
 Ohio River, valley of, **74**, 507, 520, 523, 532; **76**, ii, 100.
 Pacific coast, **95**, 3459.
 Punta Rosa, Fla., **82**, 1207, 1228.
 Reservoir discharge and, relation, Mississippi River, **94**, 1709.
 Reservoirs, Mississippi River, **94**, 1705; **96**, 1843.
 River and, comparison, Ohio River, **96**, 2074; **00**, 3105.
 Run-off and, Mississippi River watershed, **96**, 1862.
 Run-off and, relation, **96**, 3013.
 Run-off and, relation, above Pokegama Falls, **05**, 1678.
 Run-off and, relation, Mississippi River, **97**, 2169.
 Run-off and, relation, Mississippi River, reservoirs, **96**, 1843.
 St. Johns River, **93**, 1627.
 St. Louis, **84**, 1615.
 San Diego, **74**, ii, 374, 375; **80**, 2247.
 Sault Ste. Marie, curves, **82**, 2344.
 South Atlantic States, **76**, 532; **77**, 390; **79**, 780.
 Washington, D. C., **93**, 4280.
 Watershed and, ratio, **70**, 287; **73**, 499; **74**, 507, 532, 538; **75**, ii, 438; **76**, 532, ii, 100; **77**, 756; **79**, 1197, 1199, 1219, 1221, 1227, 1236, 1241.
 Water supply, canals, **76**, 533.
 Wind, effect of, **67**, 598.
 Wisconsin, **79**, 1225, 1245.

Rain Storms.

Washington, D. C., **93**, 4307.

Rain Water.

Forts. (See p. 1797 of this Index.)

Rake.

Bar channels, scraping of, **98**, 2977.

Raking.

Shoals, best for gravel, **06**, 1985.

Rammers.

Cement-testing, **96**, 2678.

Racks for, batteries. (See Forts, p. 1797 of this Index.)

Ramming. (See Dams.)

Gates, lock, effect on, **11**, 2424.

Ramming, Stock.

Dams, **91**, 2714; **92**, 2405 (Atlas 110).

Ramous. (See Brush.)

Dams, effect, **76**, 375; **79**, 1201.

Range Finders.

Datum beacons, construction of, **01**, 892.

Position of, batteries, **99**, 13.

Towers, **97**, 661.

Ranges. (See Borings.) (See pls. 70, 71.)

Discharge measurements, **01**, 2203.

Locating, dredging, **04**, S., 244.

Rapids.

Large number, Colorado River, **01**, 3407.

Lining over, boom for, **96**, 3381.

Passage of, methods, **94**, 2668.

Rivers, origin in, indications of, **68**, 308; **78**, 916.

Rates.

Canalization, effect of, H. D. 785, 59th, 1st.

Coal rates lower by water, Ohio River, **03**, 1692.

Comparative rates, Kanawha River, **11**, 2169.

Control over, Texas, H. D. 1290, 61st, 3d.

Cotton, cost of transporting, by rail or water, **01**, 1899.

Deep water, effect of, H. D. 287, 62d, 2d.

Effect of intracoastal waterways on, Texas and Louisiana, H. D. 640, 59th, 2d.

Forty-foot channel, effect problematical. H. D. 340, 59th, 2d.

Great Lakes, **12**, 2638.

Harbor improvements, instances of favorable effect, **08**, 633.

Improvements, waterway, lowered by, H. D. 510, 61st, 2d.

Influence of navigable waterways, limitation of, **01**, 1993.

Kept down by maintained channels, **11**, 670.

Logs and lumber cheaper by water, **11**, 670.

Lower on Great Lakes than by rail, **01**, 3281.

Mississippi River, **01**, S., 39; **10**, 624.

Navigable waterways, reduced by, **12**, 809.

Ohio River, points, H. D. 492, 60th, 1st.

Reduction due to waterway improvements, H. D. 231, 58th, 3d; H. D. 705, 59th, 1st.

Regulation by Texas beneficial, H. D. 1290, 61st, 3d.

River improvement, favorable effect from, on rates, **08**, 525.

Saved by intracoastal waterways, H. D. 391, 62d, 2d.

Rates—Continued.

- Saved by water improvement, **03**, 1354; **10**, 378, 955; **12**, 2487.
- Slackwater systems affect greatly, **09**, 617.
- Slackwater systems beneficial to, **11**, 743.
- Ton-mileage data, Great Lakes, **09**, 1943.
- Water rates, controlled by, Cape Fear River, H. D. 287, 62d, 2d.
- Waterway improvements, effect of, **09**, 587.

Rates, Barge.

- Rail and, intracoastal canals, H. D. 391, 62d, 2d.

Rates, Freight. (See Freight; Improvements; Rail and Water.)

- Before and after waterway improvement, **10**, 562.

Rates, Rail.

- Kept down by U. S. improvements, **11**, 796.

Rates, Rail and Water.

- Comparison, **04**, 2225; H. D. 219, 58th, 3d; H. D. 440, 59th, 2d; **12**, 2367; H. D. 645, 59th, 1st.
- Difference due probably to U. S. improvements, **09**, 556; **12**, 809.
- Mississippi River, **11**, 669; H. D. 50, 61st, 1st.
- Summer navigation, effect, **12**, 809.
- Texas ports, H. D. 1290, 61st, 3d.
- Water rates cheaper, **10**, 690.
- Water rates, effect on rail rates, **01**, 2085.

Rates, Transportation.

- Land and water, Europe and U. S., Sen. D. 301, 61st, 2d.

Rates, Water.

- Rail rates, control of, Cape Fear River, H. D. 287, 62d, 2d.

Readings. (See Gauges.)**Recesses.** (See Gates; Locks.)

- Deposits in, reducing, locks, **09**, 1779.
- Sheathing of, rapid decay, lock gates, **95**, 2360.

Recessions.

- Falls, Minnesota River, **78**, 915.

Reclamation. (See Land.)

- Areas, reclaimed, Washington, D. C., methods, **08**, 1214; **09**, 1218.
- Bottom lands, California, H. D. 262, 59th, 1st.
- Harbor lands, Jamaica Bay, N. Y., H. D. 1605, 60th, 2d.
- Methods proposed, Altamaha system, H. D. 443, 62d, 2d.
- Projects for, examined by special board of officers of C. E., H. D. 1262, 61st, 3d.
- Sandy areas reclaimed with Holland grass, **08**, 803.
- Should be for harbors, not for parks, Chicago. H. D. 700, 59th, 1st.
- Title to, Anacostia River, H. D. 194, 59th, 1st.

Reconnoissance.

- Black Hills, **74**, ii, 628.

Records. (See Meteorology; Pile Driving; Stone.)

- Concrete, mixing, **98**, 2454.
- Dredging, **00**, 3577.
- Pile-driving, **84**, 1505, 1519.
- Rock-blasting, **00**, 1731.

Records, Tide Gauge.

- Important in claim for overflowage, **04**, 1647.

Bedredging.

- Dredgings, **98**, 2670.

Reefs, Barrier.

- Atlantic coast, **76**, 379.

Reels. (See Soundings; Wire.)

- Currents, measuring, **00**, 5327.
- Ripley-Haskell, **95**, 4240.
- Soundings, **95**, 4170.
- Special reel for measuring water surfaces, **03**, 2818.

Reel, Wire.

- Soundings, **00**, 5331.

Reference Marks. (See Bench Marks.)

- Sites, **94**, 2133.

Reference Points. (See Bench Marks.)

- Cypress Bayou, **93**, 2081.
- Milestones for, triangulation, **96**, 1402.
- Red River, **93**, 1957.

Refraction.

- Coefficient of, triangulation, **73**, 1189; **96**, 4037.
- Surveys, **91**, 1899.
- Triangulation, effect on, **67**, 575.

Refrigerating Plant.

- Dredges, **00**, 4600.

Refrigeration.

- Plants, dredging, **01**, S., 52; **04**, S., 126.

Refugees.

- Floods, Mississippi River, **12**, 3724.

Refuse.

- Disposal, cities, **95**, 3609; **97**, 3499.
- Disposal, dumping, methods, **96**, 3395.
- Disposal, sea dumping, **93**, 3541.
- Regulations governing dumping of, New York Harbor, **01**, 3610.

Regulating Works. (See Works.)

- Annual work, character of, Mississippi River, **12**, 2132.
 - Bank grading, Missouri River, **03**, 2440.
 - Costs, Mississippi River, **07**, 1551.
 - Costs, rock and brush, **12**, 2158.
 - Dams, proper place for, **02**, 1874.
 - Devices, various; details, Missouri River, H. D. 46, 62d, 1st.
 - Dikes, permeable pile; superiority of, Missouri River, H. D. 46, 62d, 1st.
 - Dredging and, proper progress, Savannah, **11**, 1592.
 - Estuaries, **01**, 1662.
 - Factors of success, **02**, 1772.
 - Failures, causes of, rivers, **02**, 1747.
 - Great Lakes, H. D. 779, 61st, 2d.
 - Materials and form of works, **02**, 1779.
 - Means and systems, **02**, 1777.
 - Methods, review of, U. S. and foreign, **02**, 1770.
 - Mississippi River, H. D. 50, 61st, 1st.
 - Pass system, rivers, H. D. 262, 59th, 1st.
 - Projects, detailed, Tennessee River study, **02**, 1781.
 - Type of works, Missouri River, H. D. 1120, 60th, 2d.
 - Weirs for, rivers, H. D. 262, 59th, 1st.
- Regulations.** (See Bridges; Harbors; Rafts and Logs; Timber; Rates; Rivers; Waterways.)
- Canal operation, **04**, 2769.

Regulations, Harbor. (See Harbors.)

Need for, San Juan, P. R., H. D. 914, 59th, 1st.

Rentals.

Water power, Muskingum River, **01**, 2719.

Water power, Tennessee River, H. D. 360, 62d, 2d.

Repairs. (See Dredging.)

Dams, Ohio River, **01**, 2627.

Embankments, Ohio River, **01**, 2634.

Dredges, U. S., **06**, 975.

Reports.

Map, progress; examples, **04**, 1338.

Reservations. (See pls. 22, 25.)

State cession for; road control retained, **02**, 653.

Washington, **94**, 3295.

Reservoirs. (See Arid Lands; Irrigation; Locks; Rivers; Sediment.) (See pls. 18, 19, 69.)

Alluvial rivers, regimen of, effect on, **98**, 2893.

Artificial lakes, **98**, 2849.

Bever, Germany, **98**, 2854.

Building of, Colorado, **98**, 2918.

Building of, corporations for, **98**, 2866.

Canals, water supply of, **96**, 3026.

Canals and, evaporation, **71**, 639; **72**, 515, 521; **74**, 505, 523, ii, 95; **75**, ii, 547, 566; **76**, 756; **78**, 293.

Cities, **98**, 2852.

Complaints against, Mississippi River, **06**, 1449.

Cost, **04**, 2236.

Dam, Lake Winnibigoshish, **01**, 2314.

Dams, Mississippi River, **06**, 1438.

Definition, **98**, 2846.

Deposits in, **93**, 4297; **98**, 2823.

Details, Mississippi River, **06**, 1443.

Development, arid regions, **98**, 2875.

Discharge, measuring, Mississippi River, **06**, 1473.

Discharge, Mississippi River, **94**, 1705.

Discharge, rainfall and, relation, **94**, 1709.

Discharge, regulation of, **85**, 1747.

Effect of, Mississippi River, **06**, 1467.

Floods, arrest of, **69**, 313, 324; **75**, 540, 616, 669.

Floods, control of, **98**, 2859; **04**, 2270.

Floods, control of, California, H. D. 81, 62d, 1st.

Floods, cure for, Mississippi River, H. C. D. 42, 61st, 2d.

Floods, effect of, **98**, 2864, 2878, 2887, 2893, 2894.

Floods, preventing, expensive, **98**, 2860.

Flowage, damages from, **00**, 2787.

Flowage, rights, **00**, 2790.

Forts. (See Forts, p. 1797 of this Index.)

Function of, **98**, 2845, 2878.

Gates, bear-trap; Lake Winnibigoshish, **01**, 2314.

Gates, Tainter; Lake Winnibigoshish, **01**, 2314.

Headwaters, Mississippi River, **01**, 2313.

Improvement, river; relation to, Mississippi River, H. D. 50, 61st, 1st.

Industrial purposes, **98**, 2852.

Irrigation, California, H. D. 262, 59th, 1st.

Irrigation for, **98**, 2852, 2864, 2878.

Leakage, **96**, 3965.

Locks at, **76**, 407.

Maintaining, cost, **98**, 2845.

Reservoirs—Continued.

Maintenance, factors affecting, **03**, 1530.

Mammoth Hot Springs, **02**, 3044.

Masonry dams, **98**, 2824.

Mississippi River, **94**, 1704; **98**, 2851.

Msta River, **98**, 2822, 2850.

Navigation and power interests opposed,

Minnesota River, H. C. D. 700, 62d, 2d.

Objections to, from adjacent land owners, **03**, 1530.

Ohio River, **98**, 2862.

Operation, Mississippi River, **06**, 1448.

Overflows, reservoirs not responsible for,

Mississippi River, H. C. D. 42, 61st, 2d.

Policy for future, headwaters of Mississippi River, **01**, 444.

Potomac River, **84**, 2321; **85**, 2469, 2478, 2496.

Precipitation, effect on arid regions, **98**, 2865.

Public lands, effect on, **98**, 2870.

Rainfall, Mississippi River, **94**, 1705; **96**, 1843.

Rights of U. S., and citizens or corporations, Mississippi River, **06**, 1455.

River improvement and, Tennessee River, H. D. 360, 62d, 2d.

River regulation, **07**, 2284.

Rivers, effect on, **97**, 2142; **98**, 2849.

Rivers, height of, augmenting, **00**, 3336.

Rivers, improvement of, **66**, iv, 263, 315; **69**, 323; **70**, 282; **73**, 499; **75**, 540, 564, 616, ii, 436; **76**, ii, 288; **79**, 1193, Ex. Doc. 39, 46th, 2d; **80**, 1590, 1601, 1659, 1952; **81**, 1761, 1765,

1770, 1809, 2742, 2747; **83**, 1455, 1463, 1472, 1475; **85**, 1747; **86**, 1502; **87**, 1667, 1675, 1686.

Rivers, sediment-bearing, effect on, Mississippi River, H. D. 50, 61st, 1st.

Rules and regulations, Mississippi River, **06**, 1447.

Russian, **98**, 2822, 2850.

Sediment deposits, **98**, 2823.

Sites (see Natural), **98**, 2822.

Sites, arid regions, **98**, 2819, 2821, 2842, 2869, 2872, 2877, 2878.

Sites, cavities, hydraulic mines, **94**, 3172.

Sites, depressions, **98**, 2822.

Sites, jurisdiction over, **98**, 2872, 2878.

Sites, lakes as, **98**, 2821, 2846.

Sites, open valleys, **98**, 2821.

Sites, streams, diversion, **96**, 3963.

Sites, surveys, methods, **98**, 2879.

Sites, title to, **98**, 2872, 2878.

Sites, Wyoming and Colorado, **98**, 2815.

Study of, arid regions, **98**, 2815.

Systems, development, arid regions, **98**, 2875.

Ternay, France, **98**, 2854.

Valleys, **98**, 2821.

Volga River, **98**, 2822, 2850.

Water storage, Mississippi River, **00**, 2798.

Water, stored; utilization of, Missouri River, **01**, 2400.

Water supply, District of Columbia, **96**, 3908.

Water supply, drinking, H. D. 342, 61st, 2d; **12**, 3466.

Water supply, locks, **76**, 407.

Reservoirs, Artificial.

98, 2849, 2852.

Rivers, **98**, 2849.

Reservoirs, Permanent.Character of, **98**, 2872.**Reservoirs, Storage.** (See Dams; Reservoirs, above; Rivers; Waterways.)

Cost and dimensions, of large storage reservoirs, H. D. 588, 62d, 2d.

Dams for, Ouachita system, H. D. 588, 62d, 2d.

Effect of, river depths, Ouachita system, H. D. 588, 62d, 2d.

Floods reduced by, Ouachita system, H. D. 588, 62d, 2d.

Navigation, improvement of, Ouachita system, H. D. 588, 62d, 2d.

Size, determining, Ouachita system, H. D. 588, 62d, 2d.

Spillways, Ouachita system, H. D. 588, 62d, 2d.

Reservoirs, Tidal.East Chester Creek, **72**, 813.Flushing, **91**, 1156.San Antonio Creek, Cal., **74**, ii, 381.Washington, **09**, 1213.**Reservoir Systems.**Beneficial features, Mississippi River, **06**, 1440.Floods, effective over, waterways, **06**, 475.Floods from, doubtful, Mississippi River, **06**, 1459.Interests, conflicting; affecting operation, Mississippi River, **06**, 1440.Navigation, benefit to, **06**, 475.Operation, Mississippi River, **06**, 1471.**Revetments.** (See Banks; Breakwaters; Brush; Canals; Jetties; Levees; Piles; Sheathing; Timber.) (See pls. 8, 11, 57, 58, 60, 61, 62.)Advantages of, jetties, **95**, 3315.Ballast, concrete, **03**, S., 309; **04**, S., 278.

Banks, Mississippi River, H. D. 638, 62d, 2d.

Banks, Missouri River, **01**, S., 398; H. D. 1120, 60th, 2d.Bar lines and, Mississippi River, **05**, S., 196.Bend, desirable at, Mississippi River, **07**, 2624.Brush filling, **77**, 475.Brush, made of, **77**, 914.Brush, mattresses, **80**, 1275, 1335, 1339, 1389,

1408, 1412, 1417, 1420, 1422, 1427, 1436, 1440,

1442, 1444, 1459, 1496, 1506; **81**, 1374, 1524,

1552, 1562, 1598; Pl. XV, 1610, 1614, 1618,

1639; **82**, 1500, 1598, 1601, 1613, 1683, 1688,1690, 1694, 1700, 1732; **83**, 1193-1243, 1308,

1312, 1317, 1326, 1440, 2294; Pl. IV, Appen-

dix L; **84**, 2411, 2767, 2776, 2798, 2835; Pls.VIII and IX, Appendix L; **85**, 1566, 2776,2795, 2950, 3026; **86**, 1194, 1489; **87**, 1558,

1565, 2734, 2761, 2765, 3109.

Building, banks, **94**, 2899; **95**, 3836; **96**, 3824; **00**, 4350.Concrete work, **02**, 1106; **12**, 2196.Concrete and willow work, views, **12**, 2196.Costs, details of, Mississippi River, **01**, S., 276,

280, 285.

Costs, Missouri River, **03**, 2443.Damages, responsibility of vessels for, canals, **08**, 1926.Details, **02**, 1576.Effect, Mississippi River, **05**, S., 240.**Revetments—Continued.**Failure of, dikes, **06**, 1882.Form, standard, most durable, Missouri River, **11**, 2003.Foundations of, excessive settlement of, **72**, 839; **79**, 1051.Grading with road scraper and floating derrick, **01**, 2225.Groins preferred to jetties, **95**, 2217.Hydraulic grading, **94**, 3145.Important in protection of city fronts and harbors, **08**, 2656.Improvements, **93**, 3731.Island shores, **02**, 218.Jetty undermining, preventing, **95**, 3315.Levees, **93**, 3854.Levees, for protection of, **07**, 2622.Levees important, revetted, **07**, 2622; **08**, 2654.Mats, connecting, Mississippi River, **05**, S., 174.Mattresses, board, **01**, S., 341, 347.Mattresses, board, and concrete, **01**, S., 315, 316.Mattresses for, building, **97**, 2205; **98**, 1863.Mattresses, where they fail, **02**, S., 141.

Mattresses, willow, superiority of, H. D. 46, 62d, 1st.

Mississippi River (see p. 1067, this Index) **96**, 3701.Mortar pits, **98**, 727.New Orleans, **93**, 3821.

Piers. (See pls. 57, 58, 60, 61, 62.)

Pile, plank, etc., shore protection, **75**, 57.Pile sheathing, **96**, 2966.Placing, breakwaters, **00**, 4117.Plan for, Portage Canal, Wis., **76**, ii, 417.Protecting, foot mattresses for, **98**, 3359.Reinforce mattress, extension, **96**, 3827.Repairing, **00**, 3806, 3929.Repairing, Missouri River, **96**, 3839.Repairs, **95**, 3817.Sand exclusion, channels, **80**, 1906, 1914, 1916; **81**, 2078; **82**, 2138.Sand-filled revetment, **68**, 154.Sand-tightening of, beams for, **75**, 243; **78**, 1213; **79**, 1659.Shore line and, Mississippi River, **05**, S., 196.Shore protection, **71**, 202; **72**, 233; **76**, 708.Specifications, **95**, 4046.Stones of 1-man size preferable, **01**, 1431.Strengthening, details, **02**, 1644.

Types, Altamaha system, H. D. 443, 62d, 2d.

Types, effective, Mississippi River, **04**, S., 244.

Types, Missouri River, H. D. 1120, 60th, 2d.

Views of, **00**, 4963.**Revetments, Concrete.**Details of work, Duluth-Superior, **08**, 1899; **09**, 1905.**Revetments, Pile.****75**, 209; **76**, ii, 341, 416; **77**, 461.Brush filling, **80**, 1839.Building, **93**, 2880.Plank and, shore protection, **75**, 57.Rebuilding, **93**, 2886.Repairing, **93**, 2891, 2899.

Revetments—Continued.

Building, **97**, 2703.
Muskegon Harbor, **99**, 2928.
Toledo, **78**, 1249.

Revetments, Standard.

Cost, Missouri River, **03**, 2440; **04**, 2318.

Revetment, Stone.

Stone replaced by concrete blocks, **02**, 1107.

Revetments, Timber.

Life short, Calcasieu River, **94**, 1373.

Rhine River.

Improvement, H. D. 1120, 60th, 2d.

Rice.

Cultivation of, pumping plant, Colorado River, H. D. 1211, 60th, 2d.
Rafts, removal of, opposed by rice planters, H. D. 1211, 60th, 2d.
Salt water from improved channels destroys rice plantations, H. D. 836, 61st, 2d.

Right of Way. (See Canals; Sites.) (See pl. 45.)

Deeds, **02**, 1638.
Describing and locating, canals, **98**, 2483.
Gaining, levees, **02**, 1638.
Procuring, method of, **02**, 1638.

Rights, Private.

Barrier to waterway improvement, Connecticut River, H. D. 818, 61st, 2d.

Rights, Water-Power. (See Rivers; Water Power; Waterways.)

Rental, Tennessee River, H. D. 360, 62d, 2d.

Rings. (See Mooring.)**Riparian Owners.**

Should construct sand-tight docks. (See Docks.)
Wharfage, interference with adequate, San Juan, P. R., H. D. 914, 59th, 1st.

Riparian Property.

Relation to waterway improvement (Bixby), Sen. D. 301, 61st, 2d.

Riparian Rights.

00, 4414.
Levees and, **01**, S., 299.
U. S. and State; Brief and Memo., Sen. D. 351, 61st, 2d.
Water power, in connection with, navigable streams, H. D. 781, 60th, 1st.

Riprap. (See Jetties; Revetments.)

Bank protection, Missouri River, **10**, 1826.
Breakwaters of, **93**, 932.
Breakwaters of, superiority of, **87**, 578.
Bridge piers, **75**, ii, 687.
Bulkheads, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.
Cribs, protecting, **69**, 108, 137, 142; **70**, 151; **76**, ii, 445.
Dams, sections, Allegheny River, **98**, 2206.
Dikes of, settlement, **88**, 539.
Foundations of, shell for, **88**, 1082.
Groins, **93**, 1654.
Handling, jetties, **97**, 1799.
Illinois and Mississippi Canal, **08**, 2020.
Jetties, deep-water, **91**, 3187.
Jetties, expense, items of, **92**, 1221.
Placing, plant for, **95**, 2227.

Riprap—Sheet-Pile.

Rock, vicinity of Duluth, **01**, 2883.
Sandstone, failure of, **01**, 2886.
Sea walls, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.
Sea walls, protection of, **05**, 3027.
Slopes of, breakwaters, **92**, 933, 934.
Steel sheathing not drivable through, **11**, 2363.
Structures, waves, effect of, **90**, 2320.

River and Harbor Improvements.

Appropriations, Federal and non-Federal, division, Sen. D. 301, 61st, 2d.
Appropriations, steps to be taken before making, Sen. D. 301, 61st, 2d.
Bank protection and, relation, Sen. D. 301, 61st, 2d.
Board of Engineers, increase of powers of, desirable, **11**, 35.
Commerce, favorable effect, **08**, 717.
Droughts, relation, Sen. D. 301, 61st, 2d.
Drainage, relation of, Sen. D. 301, 61st, 2d.
Dock ownership, relation of, Sen. D. 301, 61st, 2d.
Flood prevention, relation, Sen. D. 301, 61st, 2d.
Irrigation and, relation, Sen. D. 301, 61st, 2d.
Projects, adoption of, steps to be taken before, Sen. D. 301, 61st, 2d.
Protection and banks, Sen. D. 301, 61st, 2d.
Rates, freight, favorable effect on, **08**, 633, 525.
Riparian property and, Sen. D. 301, 61st, 2d.
Wharf ownership and, relation, Sen. D. 301, 61st, 2d.

Rivers. (See Banks; Bars; Channels; Contraction; Dams; Dikes; Discharge; Erosion; Floods; Freshets; Harbors; Niagara; Revetment; Streams; Walls; Water Power; Waterways.)

Affluent, effect of, **78**, 911.
Alignment and limit lines, controlling, Mississippi River, H. D. 50, 61st, 1st.
Alignment, Mississippi River, H. D. 50, 61st, 1st.
Bank heads, Missouri River, H. D. 1120, 60th, 2d.
Barge traffic on, **96**, 3060.
Barriers, spillway, Yuba River, **06**, 2078.
Barriers, use of, **05**, 2602.
Bars, Artificial; Brownlow weed for, **78**, 640, 654, **79**, 1014, 1054, 1058, 1061, 1077, 1080, 1088, — reservoirs for, **98**, 2849.
Basins, floods, Mississippi River, **95**, 3661.
Bluffs, course between, Missouri River, H. D. 1120, 60th, 2d.
Bodily movement, **79**, 1011.
Bridges, **80**, 1849; **81**, 2009; **82**, 1979; **83**, 1591; **84**, 1769; **85**, 1917; **86**, 2111; **87**, 2613.
Bridges, collisions with, losses from (see Ohio River, River and Harbor Index), **97**, 2333.
Canalizing, plans for, **00**, 3164.
Changes, surveys compared, Connecticut River, H. D. 231, 58th, 3d.
Check dams, advantages, **93**, 2355.
Closing of, logs, **79**, 896.
Conditions, North America rivers, S. D. 215, 59th, 2d.

Rivers—Continued.

- Conditions, past and present; Altamaha system, H. D. 443, 62d, 2d.
- Controlling, currents, **00**, 4436.
- Dams, effect of, **97**, 2250.
- Dams, planning for, **00**, 2967.
- Dams, settlement, **97**, 2208.
- Dams, side; Mississippi River, H. D. 50, 61st, 1st.
- Dams, sill; cross weirs or, Mississippi River, H. D. 50, 61st, 1st.
- Dams, surveys for, methods, **00**, 3203.
- Dams, system of, planning, **00**, 3203.
- Dams, when they benefit commerce, **03**, 1507.
- Dead pools, Mississippi River, **98**, 3168.
- Deep channels in, plans for, **00**, 4016.
- Deepening, by canalizing, dredging; study, Ohio River, H. D. 492, 60th, 1st.
- Deepening with dredging and dikes, Savannah, **09**, 1320.
- Deltas, characteristics, **74**, 805.
- Depths, effect of storage reservoirs on, Ouachita system, H. D. 588, 62d, 2d.
- Destructive; Missouri most destructive, H. D. 1120, 60th, 2d.
- Dikes, effect of, **97**, 1990.
- Dikes, improvement with, **80**, 1427; **85**, 1576; **87**, 2096, 2761.
- Dikes, improvement with, abandoned, Wisconsin River, **87**, 2096.
- Dikes, objections to, Delaware River, **96**, 887.
- Diversion, Bear River, **98**, 2869.
- Diversión, California, H. D. 262, 59th, 1st.
- Drainage canals, California, H. D. 262, 59th, 1st.
- Drainage, Mississippi River, **98**, 2887.
- Dredging, effect of, Mississippi River, **01**, S., 49.
- Dredging, hydraulic, methods, Mississippi River, H. D. 492, 60th, 1st.
- Dredging, plant, cost of, etc., Ohio River, H. D. 492, 60th, 1st.
- Drift jam, removing, **97**, 1885.
- Driftwood, utilization, **95**, 2064.
- Enlargements of, preventing, **95**, 3640.
- Entrances, deepening, methods, **97**, 1818.
- Erosion, California rivers, H. D. 262, 59th, 1st.
- Evaporation from, determining, **00**, 3165.
- Experimental dredging, Mississippi River, **96**, 3630.
- Fall of, determining, St. Marys River, **02**, 2207.
- Filling up, sediment, Old River, **95**, 3860.
- Fill of, gauges and, relation of, **96**, 3484.
- Filtration, **69**, 252.
- Flat mouths of, Puget Sound, **96**, 3346.
- Floats and cords in, resistance, **74**, 534; **75**, ii, 369; **76**, 216; **78**, 380.
- Forestry, improvement by, Tennessee River, H. D. 360, 62d, 2d.
- Forests, effect of, **75**, ii, 172; **79**, 1373.
- Forests, effect of, on freshets, doubtful, Connecticut River, H. D. 1294, 61st, 3d.
- Freightage, best type of boats, Mississippi River, **10**, 2976.
- Gauges, Mississippi River, **93**, 2058.
- Gorges, dikes causing, **04**, 1092.
- Grain shipments, **01**, S., 33.
- Gravel bars, forming of, **78**, 842.

Rivers—Continued.

- Gravel bars, Wisconsin River, **76**, ii, 256, 402.
- Greatest, length of, U. S., **69**, 548; **79**, 1791.
- Harbors and, defense of, planning, **95**, 4.
- Harbors and, injury, sawdust deposit, **68**, 858; **70**, 500; **71**, 249, 622, 840; **72**, 203, 924, 930; **73**, 379, 382, 389; **74**, 104, ii, 291; **75**, 111, 112, ii, 68, 382; **76**, 289; **77**, 34, 154; **78**, 190, 452; **79**, 43, 245, 502; **81**, 1679.
- Heavy erosion, causes, **95**, 2273.
- Heavy shoaling, causes, **95**, 2273.
- Heights of, augmenting, reservoirs, water, **00**, 3336.
- High dams, doubtful efficacy of, **97**, 2100.
- Hurdles in, building, **97**, 2012.
- Hydraulic mining, **81**, 2485, 2494; **82**, 2543, 2548; **87**, 1983.
- Hydraulics of, study, Red River, **00**, 2489.
- Ice dikes, Delaware River, **93**, 1146.
- Ice closing, bridge piers, effect of, **71**, 718.
- Ice formation, Allegheny River, **80**, 1771.
- Ice formation, Buffalo Harbor, **87**, 2353.
- Ice formation, Delaware River, **81**, 822; **82**, 732, 959; **83**, 744.
- Ice formation, Mississippi River, **84**, 1620.
- Ice harbors, building, **95**, 2233; **97**, 2206.
- Ice, essentials of, **82**, 1769.
- Ice, plans, **95**, 2219, 2513.
- Ice piers in, design of, **93**, 2446.
- Ice season, Connecticut River, H. D. 1294, 61st, 3d.
- Injury of, mining, operations of, **76**, ii, 620; **77**, 993; **78**, 1297; **79**, 1857.
- Inverts under, H. D. 262, 59th, 1st.
- Jetties, effect on, **73**, 232; **74**, 785; **75**, 218; **76**, 459; **79**, 1173.
- Jetties, locating, **03**, 2232, 2242.
- Jetties, locating, Mississippi River, **07**, 1402.
- Junctions, artificial; Osage and Missouri Rivers, **97**, 3909.
- Junctions, artificial; rivers, **98**, 3528.
- Junctions, making, **97**, 3909; **98**, 3528.
- Jurisdiction over, **73**, 828; **74**, 203; **75**, 512, 826; **76**, 436; **77**, 828, 928, 940; **79**, 1021, 1024.
- Lakes, influence of, Po River, **98**, 2849.
- Landings, types of, Altamaha system, H. D. 443, 62d, 2d.
- Large rivers, dredging, results, Mississippi River, **97**, 3618.
- Lateral canals, advantages of, **97**, 2251.
- Levees, boards, Missouri River, H. D. 1287, 61st, 3d.
- Locks in, planning for, **00**, 2967.
- Locks in, water supply for, providing, **00**, 3168.
- Log jams, effect of, **96**, 3120.
- Longitudinal dams, advantages of, **93**, 2355.
- Mill waste, deposits, **98**, 840.
- Minimum discharge, maximum and, relation, **98**, 2847, 2849.
- Navigability of, as affected by mining debris, **07**, 2262.
- Navigable sluices, **75**, ii, 610.
- Navigation, experience of foreign countries, H. D. 1374, 61st, 3d. Sen. D. 301, 61st.
- Navigation, irrigation interests and, conflict, **93**, 3292.

Rivers—Continued.

Navigation, regulation, Green and Barren Rs. Ky., **01**, 2809.
 Niagara River, other rivers and, comparison, **98**, 2846.
 Origin of, recent, rapids and indications of, **68**, 308; **78**, 916.
 Peculiar character, Florida, **77**, 385.
 Physics of, study, Red River, **00**, 2489.
 Plane, change of, Mississippi River, **93**, 3564.
 Portable jetties, effect of, **97**, 2016.
 Power, complaints against impounding for, **11**, 1612.
 Precipitation, data, index to, Mississippi River, **95**, 3712.
 Precipitation, Red River, **00**, 2843.
 Private control, Government and, conflict of, Fox and Wisconsin Rivers, **98**, 2342.
 Private works on, value of, determining, **00**, 4381.
 Profiles, Columbia River, **95**, 3542.
 Profiles, Mississippi River, **96**, 1758; **01**, S., 232; H. D. 50, 61st, 1st.
 Profiles, Sacramento River, **96**, 3197.
 Rafting booms, maintenance of, rules, **00**, 3346.
 Rainfall and, comparison, Ohio River, **96**, 2074; **00**, 3105.
 Rates, freight; Mississippi River, **01**, S., 39.
 Rectification, Missouri River, **01**, 2367.
 Rectifying, plans, **95**, 3640.
 Reservoirs, Alb, Germany, **98**, 2860.
 Reservoirs, control of, rules and regulations, **96**, 1830.
 Reservoirs, data, index to, Mississippi River, **95**, 3712.
 Reservoirs, effect of, **97**, 2142; **98**, 2849.
 Reservoirs, effect of, Mississippi River, **95**, 2179; **96**, 1842.
 Reservoirs, effect of, Rhine, **98**, 2849.
 Reservoirs, effect of, Yellowstone River, **98**, 2849.
 Reservoirs, improvement by, Tennessee River, H. D. 360, 62d, 2d.
 Reservoirs, operation of, Mississippi River, **06**, 1471; H. D. 50, 61st, 1st.
 Reservoirs, water storage, Mississippi River, **98**, 1814; **01**, 2400.
 Revetted banks, effect of floods, **98**, 1658.
 Run-off, Mississippi River, **97**, 2169.
 Salt water, ascension, **75**, ii, 34.
 Sand in, heaviest in upper part of river, **72**, 149.
 Sand movement, **93**, 1800; **98**, 1680.
 Sand movement, Mississippi River, H. D. 577, 59th, 1st.
 Sand waves in, **75**, ii, 502, 504, 507; **76**, ii, 402; **79**, 1757, 1892, 1967.
 Sand waves in, movement, **83**, 2195, 2197, 2210, 2216, 2224, 2230; **85**, 569; **87**, 1351.
 Sawdust deposits (see Harbors, above).
 Scouring boils, Mississippi River, **98**, 3168.
 Sections, Red River, **94**, 1440.
 Self-narrowing of, helps to, **97**, 1967.
 Self-purification of, **98**, 3654.
 Self-purification of, Limmat River, **94**, 3240.

Rivers—Continued.

Separation of, Mississippi and Red Rivers, **95**, 3639.
 Sewage discharge, enormous, Chicago River, **93**, 2796.
 Sewage discharge, regulations, violation of, Calumet River, **93**, 2816.
 Shallower than adjacent lakes, generally, **78**, 912.
 Shoals in, channels, obtaining, **93**, 2304.
 Shoals, work at, Tennessee River, H. D. 360, 62d, 2d.
 Sill dams, effect of, **98**, 3447.
 Sill, mattresses for, building, **93**, 3410.
 Silt in, arrest of, hurdles for, **97**, 2012.
 Slack-watering, Mississippi River, H. D. 50, 61st, 1st.
 Slopes, study of, Altamaha system, H. D. 443, 62d, 2d.
 Southward movement of, Florida, **78**, 585.
 Spur systems, **02**, S., 139.
 Stages, bulletin, **03**, S., 68.
 Stages, data, index to, Mississippi River, **95**, 3707.
 Surface slopes, Mississippi River, **00**, 4607.
 Temporary improvement, dams, **98**, 1650.
 Terminals, **12**, 2202.
 Terminals, value of, Tennessee River, H. D. 360, 62d, 2d.
 Tides, effect of, **68**, 919; **78**, 583.
 Traffic on, estimating, H. D. 219, 58th, 3d.
 Traffic on, factors of successfulness, **10**, 2976.
 Traffic on, phases of, diagram, **01**, S., 40.
 Traffic on, type of boats most suitable, Ohio River, H. D. 492, 60th, 1st.
 Training dikes in, effect of, **00**, 3904.
 Training walls, effect of, **97**, 2250.
 Transportation, Tennessee River, H. D. 360, 62d, 2d.
 Tributaries and, floods from, combinations of, **98**, 2853, 2887.
 Tunnels in, Detroit River, **74**, 598, 608, 631.
 Volume, Mississippi River, **94**, 1734.
 Water power, **12**, 3550. (See Niagara Falls, p. 2041 of this Index.)
 Water power, development of, Tennessee River, H. D. 360, 62d, 2d.
 Water power, value, determining, **00**, 4381.
 Water power; waves from impounded water for, **11**, 1581.
 Watersheds, run-off, Mississippi River, **97**, 2169.
 Water storage, **98**, 2912.
 Water storage, Cache a la Poudre, **98**, 2840, 2841.
 Water supply, sources, artesian wells, James River, S. Dak., **93**, 2322.
 Water, use of, rights of U. S. and citizens, decisions, Willamette River, H. D. 99, 58th, 3d.
 Widths, adequate; essential, New York Harbor, H. D. 719, 62d, 2d.
 Widths of, bars, increased at, **78**, 842.
 Wing dams, effect of, **74**, 302; **75**, 453; **76**, 655; **77**, 529; **97**, 2250.
 Yangtse R., navigation, Sen. D. 301, 61st, 2d, 201.
 Yellow banks in, protection of, **95**, 2184.

Rivers, Alluvial.

Regimen; reservoirs, effect of, **98**, 2893.

Rivers, Banks of.

Abrasion of, **75**, ii, 498.

Caving of, **75**, ii, 519.

Caving of, falling stages, **72**, 436; **78**, 615.

Caving of, Mississippi River, **75**, 558, 608; **78**, 841; **79**, 976, 979.

Cultivation, changes due to, **78**, 846.

Dams and, **68**, 448.

Dams, effect of, **73**, 232.

Erosion, preventing, **96**, 1777.

Height of, difference in, **79**, 1009.

Peculiar caving of, Red River of the North, **78**, 730.

Protecting, piles and brush for, **96**, 1400.

Protection, Mississippi River, H. D. 50, 61st, 1st.

Rectifying, **72**, 839; **76**, ii, 279, 285; **78**, 255.

Rectifying, effect of, **76**, ii, 408.

Rectifying, Garonne River, **72**, 839; **76**, ii, 279.

Saving, by regulating private dredging, **12**, 2340.

Slopes, improvement, consistency with, **76**, 374, ii, 284.

Rivers, Bars of.

Blasting of, **70**, 334.

Causes, freshets, **76**, ii, 541.

Causes, storms, **68**, iii; **77**, 967.

Floods, effect of, **75**, ii, 477, 507; **79**, 1010.

Forming of, **72**, 108, 132, 139, 142; **74**, 804, 863, 865; **75**, 959, ii, 457, 474, 476, 477, 484, 502, 504; **76**, 449.

Forming of, Connecticut River, **78**, 267.

Forming of, Mississippi River, **74**, 804, 863, 865; **75**, 959, 967, 979; **76**, ii, 179; **78**, 842; **79**, 1010, 1892, 1967.

Forming of, opposing tides, confluence of, **74**, ii, 35.

High water, effect of, **72**, 132.

Length, Mississippi River, **78**, 841.

Motion of, wavelike, **75**, ii, 502, 504, 507; **76**, 449; **79**, 1751, 1757, 1759, 1892, 1967.

Origin, Mississippi River, **83**, 2373.

Progressive motion, **75**, ii, 477, 484; **76**, ii, 179, 256, 402.

Removing, water jet for, **68**, 671; **69**, 310; **79**, 383, 384.

Sparring boats over, **68**, 628.

Rivers, Basins of.

Draining, California, H. D. 262, 59th, 1st.

Rivers, Beds of.

Ancient beds, Great Lakes, H. D. 769, 62d, 2d

Ancient, Mississippi River, **75**, ii, 497.

Changes, **68**, 307, 760; **75**, 542, 549.

Changes, Connecticut River, **68**, 760.

Changes, ice, due to, **80**, 1771; **82**, 695.

Characteristics, Christiana River, **96**, 986.

Controlling elements and, relation between, **00**, 2489.

Crevasses, effect of, **91**, 3465.

Elevation of, no progressive elevation, Mississippi River, **12**, 3715.

Erosions, **96**, 3484.

Excessive depth, Potomac River, **83**, 781.

Rivers, Beds of—Continued.

Explosives on, placing, **93**, 1119.

Exposure of, **98**, 1952.

Filling of, causes, **68**, 307.

Floods, effect of, **98**, 2902.

Holes in, Tennessee River, **97**, 2249.

Levees, effect of, **90**, 3093, 3105.

Levees, effect, Mississippi River, **12**, 3715.

Mississippi River, **75**, 549.

Profile, Mississippi River, H. D. 50, 61st, 1st.

Protecting, mat carpet for, **79**, 876.

Rising of, Big Sandy, **95**, 2499.

Rising of, floods, causes of, **00**, 4553.

Rising of, high water, **75**, ii, 477.

Rising of, Mississippi River, **00**, 4553.

Rising of, movable dams, effect of, **96**, 2312.

Sand movement of, **69**, 601; **75**, ii, 502, 504; **79**, 1751, 1757, 1759, 1760, 1892, 1967.

Waves, **81**, 1579, 1653; **83**, 2195, 2197, 2210, 2216, 2224, 2230 **85**, 569 **87**, 1351.

Rivers, Bends.

Convex sides, deep water, effect of, Red River of the North, **79**, 1192.

Current velocity, effect, **75**, 575; **76**, ii, 265.

Depths, effect on, **79**, 1008.

Protecting, methods proposed, Savannah River, H. D. 962, 60th, 1st.

Regimen, effect on, **75**, 575, ii, 488; **76**, 296, ii, 265.

Revetment advisable, Mississippi River, **07**, 2624.

Rivers, Bottoms.

Changes, mouth region, Mississippi River, **05**, S., 42.

Mississippi River, H. D. 50, 61st, 1st.

Profile, St. Johns River, H. D. 611, 61st, 2d.

Protection, mat carpet, **78**, 616; **79**, 876.

Rising of, ground sills suggested, **98**, 1411.

Stability, Hudson River, H. D. 719, 62d, 2d.

Tester, **88**, 931.

Rivers, Canalized.

01, 2504, 2764.

Black and Ouachita Rivers, **00**, 2560.

Cost, etc., abroad and in U. S., **02**, 1753.

Improvement of rivers, **01**, 2568.

Lock and dam, additional, cost, Cumberland River, H. D. 1481, 60th, 2d.

Locks and dams, reducing number proposed, Cumberland River, H. D. 758, 60th, 1st.

Methods of making, Cumberland River, H. D. 758, 60th, 1st.

Mississippi River, H. D. 50, 61st, 1st.

Overflowage, claims for, Cumberland River, **11**, 2031.

Plans, **00**, 3164.

Plans, waterway, Lockport to St. Louis, H. D. 263, 59th, 1st.

Plant, floating, required, **05**, 1772.

Problems, **11**, 1831.

Progress, increasing, **11**, 1831.

Rights of U. S., Connecticut River, canalized by company, H. D. 1311, 60th, 2d.

Value of, Connecticut River, H. D. 231, 58th, 3d.

Rivers, Central.

Commercial history, H. D. 510, 61st, 2d.

Rivers, Channels.

Comparison, New Orleans, 1874-1894, **95**, 3669.
 Contraction, **00**, 4272.
 Deepening of, **96**, 975; **00**, 4434.
 Development, California, H. D. 262, 59th, 1st.
 Dredged, **68**, 60, 669; **69**, 460.
 Filling of, sewage, **95**, 2707.
 Maintenance of, **98**, 2697.
 Maintenance of, suitable type of hydraulic dredge, Savannah, H. D. 962, 60th, 1st.
 Movement, **03**, 2278, 2305.
 Permanent channels, securing, Missouri River, H. D. 1287, 61st, 3d.
 Rectification of, **72**, 839; **76**, ii, 279, 285, 408; **78**, 255.
 Thirty-foot, maintaining, Delaware River, **98**, 1111.
 Width, mathematical computation of, **00**, 3034.
 Wing dams for securing, cheaper than canalization, Mississippi River, H. D. 341, 59th, 2d.

Rivers, Chutes.

Closing dams, **93**, 3523; **96**, 1870.
 Closing dams, settlement, **96**, 1887.
 Use of, **81**, 1935, 1943, 1980.

Rivers, Commerce.

Decline of, helped by neglect of terminals, Missouri River, H. D. 1120, 60th, 2d.
 Future, probable, study, Ohio River, H. D. 492, 60th, 1st.
 Growth, Cumberland River, H. D. 758, 60th, 1st.
 Hudson River (Merchant), Sen. D. 301, 61st, 2d.
 Improvement, waterway, benefited by, Missouri River, H. D. 1287, 61st, 3d.
 Railroads, influence of, Missouri River, H. D. 1120, 60th, 2d.
 Various rivers, H. D. 492, 60th, 1st.

Rivers, Contraction.

Dams, Mississippi River, **94**, 1593.
 Dikes, Mississippi River, **94**, 1593.
 Hurdles, Mississippi River, **94**, 1593.
 Mattresses, Mississippi River, **94**, 1594.
 Mississippi River, H. D. 50, 61st, 1st
 Works, Mississippi River, **96**, 3419.

Rivers, Cross Sections.

Boeuf River, **96**, 1610.
 Brazos River, **95**, 1844; **08**, 1534.
 Detroit River, **74**, 589.
 Elements, Mississippi River, **96**, 3577; **97**, 3672; **98**, 3242; **99**, 3400.
 Existing and contemplated, St. Johns River, H. D. 611, 61st, 2d.
 Minnesota River, **75**, 404.
 Mississippi River, **73**, 601; **78**, 844, 847; **79**, 1232; **96**, 1758; H. D. 50, 61st, 1st.
 Missouri River, **93**, 4248.
 Mouths, **08**, 1534; **09**, 1444.
 Ohio River, **71**, 397, 401, 410, 413, 416, 421, 443.
 Red River, **93**, 2068.
 St. Clair River, **68**, 954; **74**, 589.
 St. Johns River, **93**, 1644.
 Tennessee River, **00**, 2963.

Rivers, Currents.

Controlling, **00**, 4436.
 Deflectors, **88**, 671.

Rivers, Currents—Continued.

Effect of, large rivers, H. D. 1287, 61st, 3d.
 Piers, injury to, **76**, ii, 532.
 Storms, before and after, **97**, 2777.
 Straightening, plans, Old River, **95**, 3860.
 Velocities of, computation of, mathematical, **00**, 3034.
 Velocities of, sediment, effect of, **75**, ii, 477.
 Velocities of, Tennessee River, **93**, 2366.

Rivers, Cut-offs.

Danger from, **71**, 381; **75**, 540.
 Dutch Gap, **76**, 292.
 Effect of, injurious, **72**, 435; **73**, 645; **75**, 540, **79**, 899.
 Forming of, **70**, 376; **75**, ii, 499, 507.
 Inadvisability of, **96**, 1578.
 Shortening by, estimates, Leipsic River, H. D. 574, 61st, 2d.

Rivers, Deposits in.

Backwater, effect of, **97**, 1967.
 Rate of, **98**, 2623.

Rivers, Depths.

Crevasses, effect on, **91**, 3473.
 Forests, destruction, effect of, **75**, ii, 172; **79**, 1211.
 Maintenance, Savannah, **09**, 1323.
 Reduction of, sediment, deposition of, **75**, 548, ii, 171.
 Restriction by, tunnels, **97**, 2796.
 Surface indications, **98**, 3168.
 Velocity and, relations, **76**, 451.

Rivers, Discharge of.

76, ii, 268.
 Formula for, **68**, 966; **76**, ii, 274, 277; **77**, 745, **78**, 531, 562.
 Formula for, Humphrey's and Abbot's, **76**, ii, 246, 275.
 Measuring, St. Marys River, **97**, 4092.
 Minimum and maximum, relation of, **98**, 2847, 2849.
 Mississippi River, **97**, 3652; H. D. 50, 61st, 1st.
 Missouri River, **94**, 1743.
 Observations, Mississippi River, **12**, 3844.
 Section, effect of, **69**, 589.
 Sluices, through, **75**, ii, 610; **77**, 745.
 Stage and, effect of, **00**, 5383.
 Study, Great Lakes watershed, H. D. 779, 61st, 2d.
 Wind, effect of, **00**, 5383.
 Winter, **02**, 2822.
 Wyoming, **98**, 2911.

Rivers, Diversion of.

Maintenance of channels and cost, Appomattox River, H. D. 952, 60th, 1st.

Rivers, Entrances of.

Sand movement, **03**, 2284.

Rivers, European.

Improvement of, large benefit from, H. D. 1120, 60th, 2d.

Rivers, Floods of.

88, 1026; **90**, 1373, 1487, 1489; **91**, 1105, 3413.
 Causes, river bed, raising of, **00**, 4553.
 Combinations of, **98**, 2853, 2887.
 Control of, Puyallup River, H. D. 1107, 60th, 2d.
 Control of, relief, opening, Mississippi River, **95**, 3894.

Rivers, Floods of—Continued.

- Control of, reservoirs for, Loire River, **98**, 2859.
- Crevasse, effect of, **00**, 4554.
- Discharge, California, H. D. 262, 59th, 1st.
- Diversion, canal for, California, H. D. 262, 59th, 1st.
- Effect of, **95**, 2183; **98**, 1653.
- Effect, Mississippi River, **12**, 3714.
- Excessive, relief from, plans, Mississippi River, **95**, 3649.
- Heights of, basins, effect of, **95**, 3661.
- Lessening by diversion, Minnesota, H. D. 493, 60th, 1st.
- Locks and dams, effect of, **00**, 2985.
- Flood waters, controlling, **95**, 3639.

Rivers, Flow of.

- Concentration of, jetties for, **97**, 2016.
- Concentration of, temporary, **97**, 2016.
- Diagramming, Tennessee River, H. D. 781, 60th, 1st.
- Irregularities, **98**, 2845.
- Resistance to, measure of, increased slope used, **95**, 3663.
- Uniformity of, **98**, 2845, 2846.

Rivers, Great Lakes.

- Regimen, study of, **04**, 3803.

Rivers, Improvement of.

- Adam's flume, doubtful value of, **93**, 2202.
- Barriers for, **04**, 3700.
- Bridges, where there are many, Hackensack River, H. D. 643, 61st, 2d.
- Brownlow weed for, **77**, 500; **78**, 640, 654; **79**, 1014, 1054, 1058, 1062, 1070, 1077, 1088.
- Brush mats, **72**, 144; **76**, 574, 641, 653, 678-ii, 404, 619; **77**, 484; **78**, 624, 640, 654; **79**, 737, 977, 1030, 1052, 1061, 1074, 1080.
- California Débris Commission, improving and protecting rivers, **04**, 3700.
- Canals, lateral, **97**, 2251.
- Canals, lateral, improving rivers with, Mississippi River, H. D. 50, 61st, 1st.
- Commercial factors, Coosa River, **05**, 1388.
- Contraction, limitation of, **96**, 1699.
- Cost per mile, Missouri River, H. D. 1120, 60th, 2d.
- Cut-offs, great advantages from, Mississippian River, H. D. 678, 62d, 2d.
- Dams, check and longitudinal, advantages of the former, **93**, 2355.
- Deposits, rate of, Savannah, **09**, 1324.
- Detached operations, defects of, Missouri River, H. D. 1120, 60th, 2d.
- Deterioration of improvement, Ohio River, **00**, 3096.
- Dikes, structures to displace, **98**, 3473.
- Engineering methods, **98**, 2845.
- Greatest slopes consistent with, **76**, 374, ii, 284.
- Ground sills, **98**, 1411.
- High-water discharge, **98**, 1748.
- Jetties for, Holland, **80**, 1271.
- Levees, value of, **83**, 2148.
- Locks and dams, **00**, 2349.
- Locks and dams, improvement by, **01**, 2568.
- Low-water discharge, **98**, 1748.
- Material, cost. (See Mississippi River, p. 1067 of this Index.)

Rivers, Improvement of—Continued.

- Methods, **93**, 2476; **00**, 2349; **01**, 2763; H. D. 301, 61st, 2d.
- Methods Sen. D. 301, 61st, 2d.
- Methods, Connecticut River, H. D. 1294, 61st, 3d.
- Methods, crooked and narrow streams, **01**, 1660.
- Methods, engineering, **98**, 2845.
- Methods, incompatible, **98**, 1748.
- Methods, streams filled with mining debris, Sacramento River, H. D. 1123, 60th, 2d.
- Movable dams for, **75**, 688, ii, 613, 630; **76**, 624, ii, 25.
- Permanent dams for, **74**, 285, 286, 287, 288, 289; **75**, ii, 612; **76**, 624; **77**, 746.
- Plant, cost of repairs in detail, **01**, S., 278.
- Private work, aid from U. S., H. D. 781, 60th, 1st.
- Reservoirs, **66**, v, 263, 315; **69**, 323; **70**, 282; **73**, 499; **75**, 540, 584, 616, ii, 436; **76**, ii, 288; **79**, 1193; Ex. D. 39, 46th, 2d; **80**, 1590, 1601, 1659, 1952; **81**, 1761, 1765, 1770, 1809, 2742, 2747; **83**, 1455, 1463, 1472, 1475; **85**, 1747; **86**, 1502; **87**, 1667, 1675, 1687.
- Reservoir system recommended for Minnesota River, H. D. 700, 62d, 2d.
- Rights of the U. S., Fox and Wisconsin Rivers, **98**, 2353.
- Slopes, consistency of, **76**, 374, ii, 284.
- Trailing dams, favorable results, **98**, 1788.
- Transportation, effect on, **87**, 1921, 2116.
- Transverse jetties for, **76**, ii, 406.
- Water power an interference, Merrimac River, H. D. 2, 61st, 1st.
- Works, condition after years, Missouri River, H. D. 1120, 60th, 2d.
- Works, location of, considerations governing, **01**, 2765.

Rivers, Inland.

- Navigability of Ohio River, for 10 years, **12**, 2223.

Rivers, Long.

- Dredging plant needed for, **05**, 1803.
- List of, H. D. 91, 62d, 1st.

Rivers, Mouths of.

- Bars, advance of, Mississippi River, **68**, 483; **70**, 322; **74**, 835, 855; **75**, ii, 477, 484; **77**, 429, 430.
- Changes in, Pacific coast, **93**, 3354.
- Channels, maintaining, **03**, 2298.
- Channels, movement, **03**, 2230.
- Closure of, discussion, St. Andrews Bay, H. D. 12, 61st, 1st.
- Dredges and jetties, combination required, Columbia River, H. C. D. 2, 59th, 2d.
- Forming of, **68**, 111; **72**, 242, 244; **73**, 335; **75**, 311, 967; **77**, 967.
- Forming of, Mississippi River, **66**, iv, 236; **67**, 376; **70**, 330; **74**, 835, 855; **75**, 959; **77**, 431.
- Forming of, St. Johns River, **78**, 582, 585.
- Growth of, **00**, 2290.
- Movement, control of, dikes for, **96**, 1907.
- Deepening, methods, **97**, 1840.
- Dikes, effect of, **75**, 949.

Rivers, Mouths of—Continued.

- Improvement, jetties, **75**, 980.
- Improving, jetties, Brazos River, **75**, 938.
- Jetties, **03**, 2300.
- Jetties at, benefit of, **93**, 3489.
- Jetties at, Rhone River, **75**, 965.
- Mississippi River, mouth, **74**, 833, 878; **75**, 951, 953, 980.
- Mud lumps, forming of, Mississippi River, **77**, 431.
- Shoaling, **80**, 1138; **81**, 1263; **82**, 1329; **83**, 1041; **84**, 1243; **85**, 1386; **86**, 1235; **87**, 1355.
- Shoals, causes, **97**, 3310.

Rivers, Narrow.

- Obstructed by bridge piers, Chicago River, **11**, 2352.

Rivers, Nontidal.

- Improving, **00**, 3022, 3028.

Rivers, Obstructions of.

- Bridges, **97**, 2796.
- Civil War, **75**, 874; **76**, 330.
- Dredging and, injury to harbors, **75**, 287.
- Hyacinths, **97**, 1754.
- Logging, **99**, 1604.
- Numerous, Chicago River, **93**, 2795.
- Removing, methods, **98**, 1945.
- Tides, effect, **74**, ii, 50, 156.
- Tunnels underneath rivers, **97**, 2796.

Rivers, Outlets of.

- Data, index to, Mississippi River, **95**, 3710.
- Restricting, **95**, 3640.

Rivers, Overflow of.

- Causes, levees, Mississippi River, **95**, 3644.
- Comparison of, Mississippi River, **97**, 3710.
- Lawsuits, **95**, 3644.
- Preventing, successful, Mississippi River, **95**, 3625.

Rivers, Planes of.

- Correction, proposed; Mississippi River, **09**, 1603.
- Details, Mississippi River, **09**, 1608.
- Raising, Mississippi River, **09**, 1609.
- Slopes and low-water plane, study of, Mississippi River, H. D. 50, 61st, 1st.

Rivers, Regimen of.

- Changes, Missouri River, **96**, 3823.
- Elements, Southwest Pass, **99**, 1887.
- Observing, methods, **04**, 3176.

Rivers, Regulation of.

- 01**, 2504.
- Canals, by drainage, H. D. 262, 59th, 1st.
- Channel design, mathematical computation of, **02**, 1750.
- Cost of, Missouri River, **11**, 2004.
- Cost of, U. S. and foreign, **02**, 1753.
- Dams as a factor, **03**, 1501.
- Dredging, training walls and, experimental work, Savannah, **08**, 1328.
- Experiments, from ocean bar upward, Savannah, **08**, 1328.
- Means, **00**, 3036.
- Methods, **01**, 2557.
- Mississippi River, H. D. 50, 61st, 1st.
- Pass system, California; H. D. 262, 59th, 1st.
- Reservoir system, investigation, **07**, 2264.

Rivers, Regulation of—Continued.

- Storage dams for, **07**, 2265.
- Storage study, Red River of the North, H. D. 616, 62d, 2d.
- Systems of, **00**, 3036.
- Works, types of, Missouri River history, H. D. 1120, 60th, 2d.

Rivers, Sand-Bearing.

- Dikes, proper arrangement, **72**, 139.
- Improving, discussion, **75**, ii, 511; **79**, 1008, 1051, 1173.

Rivers, Scour of.

- Hurdles for, Mississippi River, **94**, 1594.
- Logs cause of, **74**, 202.

Rivers, Sediment in.

- Arrest of, Brownlow weeds for, **78**, 640, 654.
- Channels, obtaining, locks and dams of doubtful value, Mississippi River, H. D. 50, 61st, 1st.
- Christiana River, **96**, 988.
- Deposits, large, Missouri River, **96**, 1723.
- Impounding of, **95**, 3337.
- Missouri River, H. D. 1120, 60th, 2d.
- Observations, **96**, 1241.

Rivers, Shallow.

- Improvement of, dissatisfaction with, overloaded boats true cause, **99**, 3037.
- Improvement of, jetties for, **72**, 139; **76**, ii, 399.
- Improvement of, planning for, **93**, 2334.
- Steamboats, proper loads, **95**, 2282.
- Traffic on, profit from, how obtained, **95**, 2282.

Rivers, Silting.

- 04**, 3803.
- Missouri River, greatest silt-bearing river, H. D. 1120, 60th, 2d.
- Problem (Stabler), Kaw River, H. D. 94, 62d, 1st.

Rivers, Slopes of.

- 94**, 1582.
- Changes, Mississippi River, **96**, 1724.
- Columbia River, **93**, 3383.
- Data, index to, Mississippi River, **95**, 3712.
- Determining, Mississippi River, **79**, 1928.
- Mississippi River, **98**, 3217; **00**, 4742, 4752.
- Missouri River, H. D. 1120, 60th, 2d.
- Surface slopes, St. Johns River, H. D. 611, 61st, 2d.
- Tombigbee River, **96**, 1440.

Rivers, Tidal.

- Bar formation, **67**, 421.
- Bridges, requirements of, **96**, 987.
- Dredging difficult, **72**, 875; **78**, 407.
- Improvement of, **66**, iv, 207.
- Jetties, effect of, **71**, 749, 750, 751; **72**, 830; **76**, 477; **78**, 551, 558; **85**, 681.

Rivers, Western.

- Dams and construction details, **01**, 2768.

Roads. (See pl. 67.)

- Bridges over, Yellowstone Park, **02**, 3034.
- Bridges, types, **03**, 2456.
- Building, forts. (See p. 1797 of this Index.)
- Building, Mount Rainier Park, **04**, 4207; **09**, 2514.
- Building, Yellowstone Park, **03**, 2444.

Roads—Continued.

- Care, details, **04**, 3735.
- Chipmunks, cleaned by aid of, **03**, 2466.
- Construction and maintenance, costs of, Dis-
trict of Columbia, **12**, 3459.
- Construction, details, **03**, 2456.
- Control of, forts, **02**, 653.
- Cross sections, **04**, 3734.
- Culverts, **03**, 2458.
- Details, costs, **11**, 2937.
- Gradients, **03**, 2453.
- Levees, use of, **00**, 4862.
- Machinery for, Philippines, **01**, 966.
- Maintenance, **03**, 2461.
- Oil as a builder, **02**, 2561.
- Oiling, methods, **02**, 2564; **03**, 2463.
- Oil treatment, etc., cost, District of Columbia,
11, 2974.
- Parks, National, **08**, 2554.
- Parks, National; proper types for, **05**, 2816.
- Parks, Washington, D. C., **10**, 2671.
- Philippines, **03**, 2478.
- Plans, Yellowstone National Park, **00**, 5441.
- Roller for, **04**, 3733, 3738.
- Sprinkling, **03**, 2462; **02**, 3037.
- Surfaces, best style, **05**, 2814.
- Surfacing, **03**, 2459.
- Surveys, methods, Alaska, H. D. 192, 58th, 3d.
- Types, Yellowstone Park, **03**, 3034.
- Walls, retaining, **03**, 2454.

Roads, Mountain.

- 03**, 2466.
- Estimates, etc., Mount Rainier Park, H. D.
283, 58th, 3d.

Roads, Wagon.

- Aided by U. S., H. D. 781, 60th, 1st.
- Estimates, Alaska, H. D. 192, 58th, 3d.
- Parks, National, Yellowstone, H. D. 502,
60th, 1st.
- Surveying, **05**, 2839.

Rock. (See Beds; Breakwaters; Drilling; Em-
bankment; Enrockment; Excavation; Jet-
ties; Riprap.) (See plates.)

- Accounts, keeping, **93**, 1500.
- Ballast, cribs, **99**, 2634.
- Borings in, methods, jet drill, **00**, 2769.
- Breaking, chisel boats, **67**, 267; **68**, 422, 434,
436; **69**, 237; **71**, 164, 269; **72**, 330, 331; **74**,
314; **76**, 661; **77**, 544; **78**, 708.
- Brush and, river regulation, **12**, 2158.
- Chiseling, machine for, **94**, 812.
- Cleaning, water jet for, **81**, 657, 2507.
- Cubical blocks, resistance to overturning, **01**,
2884.
- Dredging, **71**, 164; **72**, 804; **73**, 776; **74**, 33,
ii, 41; **77**, 229; **78**, 800, 1136.
- Dredging, cost of, **72**, 804; **77**, 229; **78**, 800,
1136; **04**, 2183.
- Débris, dredging, difficult, **95**, 925.
- Delivery of, jetties, **00**, 4242.
- Depth to, Mississippi River, **78**, 918, 1058.
- Distribution, jetties, Charleston Harbor, **95**,
1424.
- Drilling, Arch Rock, San Francisco Bay, **01**,
3412.
- Dumping, jetties, **96**, 3253.

Rock—Continued.

- Excavated, measurement, scow displacement,
68, 424.
- Excavating, channels, **96**, 2224.
- Excavating, concrete batteries, **99**, 697, 701.
- Excavation, cost and methods, Rock Island
Rapids, **05**, 1633.
- Excavation, Mississippi River, **99**, 2137.
- Foundations of, Falls of St. Anthony, **79**, 1161.
- Foundations of, jetties, **00**, 4245.
- Gravel and, crib better than, piers, **98**, 1761.
- Hand drilling, **76**, ii, 663.
- Hand drilling, Detroit River, **77**, 935.
- Hand drilling, rate by, **68**, 425.
- Handling, jetties, **94**, 2567.
- Jetties. (See Jetties.)
- Large, San Francisco Harbor, **98**, 2924.
- Measurements, prism and scow, relation be-
tween, **75**, 326; **77**, 239; **78**, 1136.
- Obtaining, cost of, Aransas Pass, H. D. 639,
61st, 2d.
- Placing, rock jetties, **99**, 3185.
- Placing, tramway for jetties, **94**, 2544.
- Quarrying, **96**, 1876; **99**, 2129.
- Small rock preferable to mattresses, jetties,
00, 4245.
- Softening of, cause of, air exposure, **99**, 1426.
- Soundings, over, **72**, 867.
- Stability, in different forms, **01**, 2884.
- Test of, jetties, **96**, 3217.
- Unloading, with scrapers, **02**, 2494.
- Various explosions, effect on, **68**, 91; **73**, 776
77, 355.
- Various sizes, wave resistance of, **93**, 3502.
- Weight of, tests, Duluth Harbor, **99**, 2634.
- Wood instead of, advantages, breakwaters,
93, 3202.

Rock, Bed.

- Depths to, bridge foundations, **78**, 918, 1059.
- Mississippi River, H. D. 50, 61st, 1st.

Rock Bottom.

- Piles, securing, **82**, 2137.

Rock, Broken.

- Dredging, **94**, 1847.
- Explosives and, ratio, blasting, **68**, 423, 425;
69, 19, 248; **71**, 733; **72**, 877; **73**, 935; **74**;
ii, 39, 160; **75**, ii, 82; **76**, ii, 326, 545; **77**, 352,
79, 61, 62, 379, 533, 535, 1135, 1508.

Rock, Pinnacle.

- Underwater, method of blasting, **01**, 3483.

Rock, Removal of. (See Blasting; Chisel Boats;
Chiseling; Drilling.)

- 88**, 604, 764; **89**, 2547; **90**, 2051; **92**, 882, 1746,
1788, 1804, 2021.
- Ahnapee, **76**, ii, 346, 356, 360; **79**, 1507; **80**,
1912; **83**, 1680, 1681.
- Appomattox River, **78**, 465.
- Ashtabula River, **70**, 179.
- Bath, Me., **71**, 845.
- Blast hole, depth of; and effect, **01**, 1433.
- Blasting and drilling methods, **01**, 1427.
- Blasts, surface, effect of, **71**, 924.
- Blossom Rock, **68**, 883; **69**, 485, 488, 491, 493;
70, 510; **71**, 905, 923.
- Broken, solid and, ratio, **86**, 685.
- Bulkhead, used ore in bags, **99**, 3279.

Rock, Removal of—Continued.

Canals, cofferdam, **94**, 1932.
 Chisel boats, **68**, 422, 434, 436.
 Chiseling machine, **94**, 812.
 Cofferdams for, **85**, 1753; **86**, 1450, 1461.
 Cofferdams for, Des Moines Rapids, **69**, 225; **76**, 657, 660.
 Cofferdams for, Hell Gate, **70**, 434.
 Cofferdams for, Kanawha River, **77**, 299, 301; **78**, 468.
 Cofferdams for, Rock Island Rapids, **67**, 295; **68**, 421, 437; **69**, 238, 243, 249; **74**, 312; **77**, 543.
 Cofferdams for, use of, **69**, 491; **71**, 926.
 Columbia River, **72**, 997; **76**, ii, 663; **80**, 2293, 2295; **83**, 2051; **84**, 2255; **85**, 2436; **87**, 2482.
 Cost, **91**, 2796; **92**, 801, 1999, 2271.
 Cost, Appomattox River, **78**, 466.
 Cost, Ashtabula, Ohio, **70**, 180; **76**, ii, 563.
 Cost, Blossom Rock, Cal., **71**, 905, 924.
 Cost, Boston Harbor, **77**, 184; **78**, 217.
 Cost, Detroit River, **76**, ii, 544; **77**, 936.
 Cost, Dunkirk, N. Y., **74**, 226.
 Cost, Eagle Harbor, Mich., **69**, 72, 76; **70**, 91; **78**, 1133, 1138.
 Cost, East River, **69**, 55.
 Cost, Falls of the Ohio, **70**, 386; **78**, 770.
 Cost, Georgetown Harbor, D. C., **78**, 508.
 Cost, Hallets Point, **77**, 227, 239.
 Cost, Harlem River, **76**, 55, 245.
 Cost, Hell Gate, N. Y., **68**, 728; **69**, 55, 391; **76**, 238, 241.
 Cost, James River, **76**, 292; **77**, 286.
 Cost, Kennebunk River, **72**, 930.
 Cost, Muscle Shoals, **72**, 494; **78**, 757.
 Cost, New Haven, Conn., **71**, 770, 774.
 Cost, New River, Va., **78**, 499.
 Cost, Oak Orchard, Ohio, **75**, 328.
 Cost, Rock Island Rapids, **69**, 247; **71**, 264; **290**; **72**, 332; **74**, 312, 315; **76**, 661, 668; **78**, 709; **79**, 1132.
 Cost, St. Marys Canal, **71**, 163.
 Cost, Sullivan River, Me., **71**, 835.
 Cost, Umpqua River, Oreg., **72**, 986.
 Cost, various years, **00**, 2702.
 Cost, Vermilion Harbor, Ohio, **75**, 299.
 Daily amount, chisel boats, **74**, 314; **78**, 709; **79**, 1134.
 Delaware River, **81**, 753; **83**, 608.
 Des Moines Rapids, **67**, 280; **69**, 220; **76**, 658; **80**, 1556, 1557; **82**, 1780.
 Detroit River, **76**, ii, 543; **77**, 935; **80**, 2081, **81**, 2277; **82**, 2374; **85**, 2166; **86**, 1343; **87**, 2267.
 Diamond drills, **69**, 388; **71**, 725; **72**, 803; **73**, 776, 935; **74**, ii, 39, 42.
 Diamond drills, steel and, comparison, **72**, 803.
 Dredging without drilling, **71**, 164.
 Drilling, blasting, and chiseling, comparison, **79**, 1134.
 Drilling, cost, small when compared with other items, **68**, 738.
 Drill scow, **94**, 1846.
 Drills, arrangement of, Rock Island Rapids; **79**, 1135.

Rock, Removal of—Continued.

Drills, comparison, **72**, 803, 877; **73**, 777, 935; **75**, ii, 252.
 Drills, experiments, Hallets Point, **75**, ii, 204.
 Drills, experiments, Hell Gate, **76**, 238.
 Drills, steel for, experiments, **75**, ii, 204.
 Eagle Harbor, Mich., **76**, ii, 323; **77**, 845; **78**, 1133.
 East River, N. Y., **67**, 499; **69**, 55; **72**, 802, **73**, 934; **78**, 413.
 Even bottom, obtaining, Rock Island Rapids **76**, 668.
 Explosives, small charges, **95**, 925.
 Falls of the Ohio, **70**, 386; **78**, 770.
 Flotation, Boston Harbor, **70**, 465.
 Flotation, Taunton River, **74**, ii, 222.
 Georgetown Harbor, D. C., **77**, 351; **78**, 508; **84**, 967.
 Handwork, **00**, 4496.
 Hell Gate, **68**, 728, 732; **69**, 388; **70**, 433; **71**, 723; **74**, ii, 160; **75**, ii, 209; **76**, 238; **80**, 499-504; **81**, 621-628; **82**, 651, 653; **83**, 533-540; **85**, 715-723; **86**, 676-690; **87**, 691.
 Inspection of, methods, **98**, 2751.
 James River, **73**, 776; **80**, 650; **81**, 863; **85**, 951.
 Kanawha River, **77**, 299, 301; **78**, 468.
 Lime Point, Cal., **68**, 20; **69**, 19.
 Methods, **93**, 1013, 2378; **98**, 1914, 2751; **99**, 3529; **00**, 1997, 3677.
 Methods, Kootenai River, **99**, 3279.
 Methods, novel, Boston Harbor, **70**, 465.
 Methods, percussion, **94**, 812.
 Mines, exploding, batteries, arrangement of, **77**, 237.
 Narragansett Bay, **81**, 558.
 New Haven, Conn., **68**, 751; **70**, 445; **72**, 876; **74**, ii, 260.
 New River, Va., **78**, 496, 499.
 New River, W. Va., **80**, 681; **81**, 908.
 Night work, **94**, 1932.
 Noonday Rock, Cal., **75**, ii, 719.
 Oak Orchard, Ohio, **74**, 245.
 Ohio River, **99**, 2549.
 Percussion, **94**, 812.
 Plane, definite, working to, difficulty of, **69**, 246.
 Portsmouth, N. H., **81**, 501; **82**, 505.
 Providence River, R. I., **71**, 733.
 Red River, **85**, 1484.
 Rincon Rock, San Francisco Harbor, **73**, 1137; **74**, ii, 371; **75**, ii, 694.
 Rock Island Rapids, **80**, 1536; **86**, 1452-1461.
 St. Marys River, Mich., **85**, 2103; **87**, 2240.
 Shafts and galleries, Hallets Point, **69**, 391; **75**, ii, 200; **77**, 228, 232; **79**, 61, 378, 384.
 Site, sweeping, **96**, 4063.
 Steam drills, Gardiner's patent, failure, **68**, 422.
 Tennessee River, **72**, 494; **76**, 711; **78**, 757.
 Tower Rock, Mass., **68**, 811.
 Willamette, Oreg., **80**, 2276-2288.

Rocks.
 Western Lake Superior, **01**, 2887.

Rocks, Submerged.
 Surveying, method of, **01**, 1017.

Rock, Trap.Specific gravity, **78**, 1136.**Rock Waves.**Nitroglycerin, explosion from, **77**, 233.**Rockwork.** (See Breakwater; Canals; Jetties;
Quarries.) (See pls. 46, 49, 50, 51, 55, 57.)**Rods.** (See Levels.)Bear-trap sluice gates, **07**, 1580.Lengths of, precise levels, **93**, 3961; **96**, 1955.**Rods, Locking.**Concrete piers, **04**, 3802.**Rods, Tie.**Holes for, concrete piers, **05**, 1987.**Roller Paths.**Setting gun carriages, **95**, 515.**Rollers.**Roads, **04**, 3733.**Roofing.**Buildings, steel, **04**, 3843.

Forts. (See p. 1797 of this Index.)

Rope, Wire.Tests, **92**, 491.**Routes.** (See Rail.)Commerce, factors governing, Nantucket
Sound, H. D. 536, 62d, 2d.Surveys, Atlantic coast canals, H. D. 391,
62d, 2d.**Routes, Inside.**Waterways, coastal; economic value of, H. D.
1236, 60th, 2d.**Routes, Rail and Water.**

Cooperative necessity, H. D. 769, 62d, 2d.

Routes, Traffic.

Great Lakes, H. D. 769, 62d, 2d.

Routes, Transportation.

World routes, map, H. D. 492, 60th, 1st.

Rubble Mounds. (See Breakwaters; Dikes;
Jetties.)Building, breakwaters, **98**, 2767.Jetties, **04**, 3216.Sandstone as finish, breakwaters, **12**, 2466.**Rubblestone Heating.**Breakwaters, concrete superstructure, **99**, 3098.**Rubblework.** (See pl. 59.)**Run-off.** (See Meteorology.)Arid regions, **98**, 2875.Calculating, method of, **02**, 1765.Forests and stream flow, Merrimac River,
H. D. 9, 62d, 1st.Minnesota River, **00**, 2835.Mississippi River, **97**, 2169.Mountainous and prairie country, difference,
96, 3013.Muskingum River, **96**, 3014.Otter Tail Lake, **00**, 2832.Rainfall, and, watershed, Mississippi River,
96, 1862.Rainfall and, relation, **96**, 3013.Rainfall and, relation, above Pokegama Falls,
05, 1678.Rainfall and, relation, Mississippi River, reser-
voirs, **96**, 1843; **97**, 2169.Red Lake River, **00**, 2828.Rivers, watersheds of, **97**, 2169.Weststone River, **00**, 2835.**S.****Salt.**Concrete, effect on, **82**, 2348.Deposits of, West Virginia, **77**, 320.Formation of, Corpus Christi, **79**, 936.Hydraulic cement, effect on, **82**, 2350.**Salt Water.** (See Water.)Cement, effect on, **95**, 2955.Fresh and, cement, effect on, **95**, 2918.Fresh and, quantities, determining, harbors,
96, 979.Iron, effect on, **79**, 447.Rivers, ascending, **75**, ii, 34.Screw piles, effect on, **79**, 447.Sediment, effect on, **75**, ii, 36.**Sand.** (See Quicksand; Railroads.)Accumulations of, **95**, 3142.Accumulations of, movable dams, effect on,
98, 2146.**Sand—Continued.**Accumulations of, teredo proofing, **73**, 800,
1131; **74**, 757; **75**, ii, 692.Arrest of, Brownlow weed for, **77**, 500; **78**,
640, 654; **79**, 1014, 1054, 1058, 1061, 1070, 1077,
1088.Banks, sand movement, checking, **97**, 679.Bars, forming of, causes, **97**, 2753.Bars, Mississippi River, **76**, ii, 179.Bars, removing, water jet for, **68**, 671; **69**, 310;
70, 340.Bars, removing, use of, **95**, 2062.Belt, along coasts, **76**, 378.Catchment piers, **74**, 52.Cement, effect on, **95**, 2924.Centrifugal pump, raised by, dredges, **72**, 668;
75, ii, 40.Channels, excluding from, revetment for, **80**,
1906, 1914, 1916; **81**, 2078.

Sand—Continued.

Concrete, for, character, **02**, 2470.
 Concrete, sea walls, **05**, 3025.
 Constitution of, Mississippi River mouth, **74**, 886.
 Core of, for jetties, **04**, 3216.
 Covering of, for forts. (See Forts, p. 1797 of this Index.)
 Dams of, brush and rock and, comparison, **98**, 1758.
 Depth at which it is disturbed, **76**, 380.
 Deposits of, Dunkirk Harbor, **87**, 2345.
 Deposits of, fresh water, salt and, meeting of, **80**, 953.
 Deposits of, jetties between, **99**, 1598.
 Different varieties, values, mortar, **94**, 2319.
 Dimensions of, Mississippi River, **78**, 1383, 1924, 1927, 1933.
 Dimensions of, various localities, **76**, ii, 259.
 Disturbance, bottom velocities, effect of, **70**, 563, 629.
 Dredging, methods, **00**, 1997.
 Dredging, side-wheel dredges suggested, **06**, 1300.
 Dust, crusher, superior to sand, for concrete, **02**, 2457.
 Embankments, placing, forts. (See p. 1797 of this Index.)
 Excavating, methods, **93**, 603.
 Floods, action of, **68**, 366; **72**, 132; **76**, ii, 5.
 Formations of, jetties, vicinity of, **95**, 3276.
 Forms assumed, Lake Erie, **95**, 3109.
 Foundations, dams, **74**, 414.
 Foundations, excessive settlement on, dikes, **72**, 839; **76**, 629; **79**, 1051.
 Gabion jetties filled with, **74**, 732, 733, 757; **75**, 846, 859; **76**, 564, 574, 582; **77**, 446, 447, 450, 470; **78**, 426, 603; **79**, 911.
 Gabion jetties filled with, settlement of, **79**, 911.
 Gravel and, comparison, concrete, **00**, 978.
 Heaviest in upper part of river, **72**, 149.
 Impounded, jetty extension, **94**, 2562.
 Levees of sand, clay placing, **76**, ii, 626.
 Mortar, tests of, **96**, 2634.
 Movement, Nicaragua coasts; Isthmian Canal Reports, 1899, page 92.
 Piles, driving in, **68**, 515.
 Placing of, gun batteries, **00**, 970.
 Pressure-bearing ability, **72**, 766.
 Revetment filled with, **68**, 154.
 Silt and, tidal currents, effect of, **71**, 525; **73**, 994.
 Specific gravity, **80**, 1504.
 Stone and, sharp and smooth, advantages, concrete, **98**, 2280.
 Stratas of, banks caving, causes of, **00**, 3189.
 Tar and, pile heads, protecting, **92**, 1541.
 Tests of, **93**, 3013; **94**, 2311; **95**, 2935; **96**, 506, 2804; **97**, 2627; **00**, 2257.
 Tests of, cement, **96**, 506.
 Tidal currents, effect of, **71**, 525.
 Water and, ratio, centrifugal pumping, **72**, 666, 668; **73**, 750; **74**, ii, 11, 71; **75**, ii, 38, 40, 69; **76**, 445.
 Water held by, amount of, **79**, 1241.
 Water slope in, natural, **76**, 393.

Sand—Continued.

Water velocity required to move, **69**, 436; **75**, ii, 40; **78**, 1296; **79**, 406.
 Weight of, **72**, 147, 149; **74**, 268; **76**, ii, 259.

Sandbags. (See pl. 65.)

Leakage, cofferdams, **11**, 2030.
 Levees, protecting, **12**, 3724.
 Mattresses, sinking, **94**, 2600.

Sand Blast.

Apparatus, plans, **03**, 2420.
 Improvised, cleaning rusty ironwork, **98**, 1926.
 Improvised, rusty steelwork, cleaning, **00**, 2788.
 Machine, **00**, 4330.
 Rusty ironwork, cleaning, **98**, 1801, 1926.
 Rusty steel, cleaning, **00**, 4330.

Sand Bolls.

Levees, **99**, 3571.
 Levees, Mississippi River, **12**, 3724.

Sand Catches.

Light structures, ineffectual, **12**, 101.
 Movement, checking, **88**, 462.
 Shore protection, **77**, 115, 116; **88**, 462; **02**, 1209.

Sand Closure.

Preventing, harbor entrances, **96**, 3101.

Sand Covering.

Teredo attacks, checking, **73**, 800.

Sand Deposits.

Harbors sheltered by jetties, etc., Great Lakes, **03**, 2087.

Sand Drift.

Breakwater harbors, Hawaiian Islands, H. D. 593, 61st, 2d.
 Canals, effect on, **74**, 796.
 Canals, into, avoiding, **01**, 3515.
 Forts. (See p. 1797 of this Index.)
 Removal, by jetties, Biscayne Bay, **08**, 1372.

Sand Dunes.

Movement of, **76**, 380.
 Reclamation, **90**, 2954.
 Reclamation, Holland grass promising, **94**, 2567.

Sand Fences. (See Sheet Pile.)

Old, effective but not durable, **93**, 3142.
 Restricted value of, **93**, 2879.
 Sand drift, checking, **67**, 457; **75**, 314, 316, 338; **77**, 116, 966, 969.
 Sand movement, checking, **80**, 2016; **81**, 2211, 2236; **83**, 475.
 Sand movement, preventing, **94**, 2581.

Sand Fences, Rigid.

Superiority of, **01**, 1495.

Sand Fence, Sheet Pile.

93, 3138.

Sand Movement. (See Accretion.)

76, 380, ii, 569; **98**, 2285, 2719.
 Atlantic coast, **95**, 1601; **97**, 1236.
 Beaches, effect on Atlantic City, H. D. 747, 61st, 2d.
 Catches for, **88**, 462.
 Checking, battery parapets, **97**, 679.
 Checking, brush for, **00**, 989.
 Checking, embankments, **97**, 690.

Sand Movement—Continued.

- Checking, experiments, **00**, 4278.
Checking, fences, **98**, 2681.
Checking, grass for, **98**, 2964; **00**, 993, 4278.
Checking, parapets of batteries, **97**, 679.
Checking, sand embankments, **97**, 679, 690.
Checking, sheet piling, **94**, 2462.
Controlling, **89**, 1071, **90**, 2949; **91**, 2692; **92**, 1358.
Controlling, dikes, **95**, 2577.
Controlling, fences, **80**, 2016; **81**, 2211, 2236; **83**, 475.
Controlling forces, St. Andrews Bay, H. D. 12, 61st, 1st.
Controlling, jetties for, **98**, 3011.
Control of, by pile dike, Grand Marais, Mich., **05**, 2008.
Control of, works for, Grand Marais, Mich., **08**, 1936.
Dredging, channels, **96**, 3140.
Dredging, obliteration of, bar channels, **98**, 2691.
Governing, breakwater for, Point Judith, H. D. 911, 60th, 1st.
Great, **00**, 4436, 4443.
Great Lakes, **97**, 2777.
Harbors, **96**, 1190.
Destruction of harbors, Greytown, Nicaragua, Isthman Canal Reports, 1899, page 91.
Heavy, South Pass, **99**, 1824.
Jetties, at, mouth of Mississippi River, **05**, 1433.
Jetties, effect of, **98**, 1127; **03**, 2287.
Jetties, effect of, Columbia River, **10**, 2407.
Jetties, channels, **94**, 2468.
Jetties, vicinity, **94**, 2637; **00**, 4201.
Lake Erie, **95**, 3109.
Lake shores, **96**, 2970.
Measuring, **02**, 2502.
Measuring, bars, **02**, 2502.
Mississippi River, **93**, 1800.
Observations, Jamaica Bay, H. D. 1506, 60th, 2d.
Observations on, **74**, ii, 372.
Ocracoke Inlet, **94**, 1001, 1013.
Pacific coast, **00**, 4200.
Passes, outside of, St. Andrews Bay, Fla., H. D. 12, 61st, 1st.
Preventing, **93**, 2879; **96**, 574; **98**, 2714.
Preventing, embankments, **00**, 972.
Preventing, fences, **81**, 2211, 2236; **83**, 475; **94**, 2581.
Preventing, grass for, **98**, 2964.
Preventing, jetty extension, **98**, 1328.
River entrances, Columbia River, **03**, 2284.
Rivers, **93**, 1800; **98**, 1680.
Rivers, beds of, **69**, 601; **75**, ii, 502, 504; **79**, 1751, 1757, 1759, 1892, 1967.
St. Francis River, **98**, 1680.
Sandy Hook, **82**, 404.
Shoaling and, **03**, 2092.
Study of, Great Lakes, **03**, 2086.
Surveys compared, Mississippi River, H. D. 577, 59th, 1st.
Unforeseen, Hudson River, **98**, 1054.
Water in, **02**, 2506.

Sand Splts.

- Bars, effect on, **93**, 3451.

Sandstone.

- Breakwaters, rubble mounds, finishing, **12**, 2466.
Crushing strength of, **75**, ii, 849.
Crushing strength of, Great Kanawha, tests, **89**, 1950; **90**, 421.
Failure of, as riprap, **01**, 2886.

Sand Surfaces.

- Shifting, grass to prevent, **02**, 2465.

Sand-Tightening. (See Piles, Piers; Revetment.)

- Beams for, pile piers, **75**, 243; **78**, 1213; **79**, 1659.
Beams for, revetments, **75**, 243; **78**, 1213; **79**, 1659.
Brush for, piers, **80**, 1906.
Brush for, pile piers, **73**, 201; **75**, 195; **78**, 1211.
Brush mats and, piers, **78**, 1211.
Crib piers, **96**, 2674; **97**, 2924.
Piers, **92**, 2332.
Piers, sheet piling in, **80**, 1906, 1914, 1916; **81**, 2078; **82**, 2138.
Planks for, pile piers, **75**, 243; **79**, 1512, 1514.
Shavings, pile piers, **79**, 1622.
Sheet-piling for, piers, **80**, 1906, 1914, 1916; **81**, 2078; **82**, 2138; **99**, 2907.
Slab piers, **75**, 193; **76**, ii, 505.

Sand Waves.

- Action of, **74**, 804.
Columbia River, **79**, 1757.
Mississippi River, **79**, 1892, 1967.
Movement, rivers, **83**, 2195, 2197, 2210, 2216, 2224, 2230; **85**, 569; **87**, 1351.
Ohio River, **74**, 404, 411, 414; **76**, ii, 5.
Rivers, **75**, ii, 502, 504, 507; **76**, ii, 402; **79**, 1757, 1892, 1967.
Rivers, beds of, **81**, 1579, 1653; **83**, 2195, 2197, 2210, 2216, 2224, 2230; **85**, 569; **87**, 1351.
Sacramento River, **79**, 1760.
Wisconsin River, **76**, ii, 256, 402.

Sandy Areas.

- Reclamation, with Holland grass, **08**, 803.

Sandy Peninsulas.

- Preserving, methods, **93**, 3101; **96**, 3104; **97**, 3243.
Preserving, trees for, **97**, 3100.
Preserving, trees for, successful, **96**, 3105.

Sawdust.

- Accumulations of, effect of, in streams, **01**, 994.
Bars of, dredging of, permanent value, **00**, 1107.
Cement mortar, effect in, **96**, 2803.
Injury to rivers and harbors from, **68**, 858; **70**, 500; **71**, 249, 622, 840; **72**, 203, 924, 930; **73**, 379, 382, 389, **74**, 104, ii, 291; **75**, 111, 112, ii, 68, 382; **76**, 289; ii, 152; **77**, 34, 154; **78**, 190, 452; **79**, 43, 245, 502.

Sawmill Waste.

- Waterways choked with, might be improved conditionally, H. D. 748, 61st, 2d.

Saw Plant, Floating.

- Pile cutting, **96**, 2517.

School, Engineer.

- Advantages of Fort Totten as site for, **01**, 930.
- Course, **01**, 937; **02**, 799.
- Requirements, **01**, 929.
- Transfer to Washington, **02**, 802.

Schoolhouses. (See pl. 71.)**School, Trade.**

- Engineer troops, **02**, 801.

Schooners.

- Barges and, cost of building, H. D. 391, 62d, 2d.

Scour. (See Breakwaters; Channels; Fill; Hurdles; Jetties; Piles; Power Houses; Rivers; Shoals.)

- Advance, jetties, **94**, 2515.
- Augmenting, with flashboards, **01**, 2626.
- Breakwater, **99**, 1345.
- Bear-trap dams, above and below, **05**, 1844.
- Bear-trap gates, produced by eddies of, **11**, 2141.
- Causes, study of, **00**, 4201.
- Causes, dikes, **00**, 4336.
- Cessation, curved jetties, **96**, 628.
- Channels, action on, **98**, 2621.
- Conditions governing, St. Johns River, **95**, 1599.
- Control of, jetties, **94**, 2545; **03**, 1169, 1175.
- Currents, wind, and barometric pressure; effect of, Sandusky Harbor, **01**, 575.
- Dikes, due to, **94**, 1023.
- Dikes, effect, **94**, 1023; **00**, 4336.
- Dredged channels, **97**, 1548.
- Fill and, dredged channels, **93**, 3050; **94**, 2390; **97**, 3041, 3055.
- Fill and, jetties, **96**, 3286.
- Fill and, jetties, vicinity, **96**, 1536.
- Fill and, rock jetties, **93**, 3493.
- Foundations under water on, material likely to scour, **75**, ii, 621.
- Hindrance, dikes, **95**, 2323.
- Hurdles, at, **94**, 1594.
- Jetties, **93**, 1441; **99**, 1553; **00**, 4181, 4288.
- Jetties, effect of, shoals, **97**, 2016.
- Jetties extending, **00**, 4288.
- Jetties, produced by, Columbia River, **10**, 2407.
- Jetties, sides of, **82**, 1196.
- Lock chambers, floods, **03**, 1674.
- Lock gates, concealed scour under, **02**, 1892.
- Logs causes of, rivers, **74**, 202.
- Mattress sill, dam, **96**, 3827.
- Mattress, sinking of, **93**, 1441.
- Pensacola Harbor, **95**, 1647.
- Pier ends, **84**, 1966.
- Piles, preventing at, **98**, 2955.
- Platting scour and fill, **01**, S., 232.
- Portable jetties, effect of, **95**, 2077.
- Preventing, dams, **00**, 3258.
- Preventing, jetties, **98**, 2949.
- Preventing, jetties, building, **98**, 2955.
- Preventing, mattresses for, **98**, 2949, 3030.
- Preventing, mattresses for, dams, building, **98**, 3030.
- Preventing, mattresses for, discarding, jetties, **98**, 2949.
- Preventing, piles, at, **98**, 1698, 2955.
- Preventing, piles, omitting, jetties, **98**, 2955.
- Principles of, determining, difficult, **99**, 3022.

Scour—Continued.

- Protection against, bowlders, natural deposit, **71**, 884; **72**, 896; **74**, ii, 276.
- Stone jetties, **00**, 4181.
- Survey methods, scour and fill, Mississippi River, **01**, S., 44, 128.

Scouring Bolls.

- Rivers, **98**, 3168.

Scows. (See Barges; Cribs; Derricks; Drilling.)

- Crib, scows used as, **93**, 626.
- Currents, moving across, **97**, 3459.
- Doors of, closing, apparatus, **92**, 1505.
- Railroad track on, stone, handling, **96**, 2788.
- Rock drilling, **73**, 937, 1135, 1154; **00**, 3677.
- Soundings from, **98**, 2758.
- Steel trusses of, **91**, 2333.
- Storage of, **01**, 3225.

Scows, Derrick.

- 00**, 4117.
- Large stones handled with, **94**, 1102.

Scows, Displacement of.

- Dredging, **79**, 917.

Scows, Measurements of.

- Prism and, relation, rock, **75**, 326; **77**, 239; **78**, 1136.

Scows, Self-Dumping.

- Description of, **85**, 498.

Scrapers.

- Dredging, **67**, 370; **68**, 320, 480, 669; **70**, 324, 329, 340, 447; **71**, 65, 508; **72**, 138, 552.

Scrapers, Road.

- Bank grading, **01**, 2225.

Screening. (See Limestone.)**Screens.** (See Dikes; Poles.)**Screens, Pole.**

- Dikes, **95**, 2236.

Sea-Level Canal. (See The Panama Canal, p. 2357 of this Index.) (See Canal.)**Seaports.**

- New seaports, establishing, St. Andrews Bay, H. D. 670, 61st, 2d.
- Development of seaports and internal waterways (Sperry), Sen. D. 301, 61st, 2d.

Searchlights. (See Projectors.)

- Portable searchlights, details, **01**, 942.

Seas. (See Breakwaters.)

- Breakwater, control of, **98**, 2720.
- Breakwater, slopes, effect of, **98**, 2665.

Seas, Heavy.

- Jetties, concrete caps for, **12**, 2771.

Section. (See Cross Sections; Jetties; Levees; Rivers.)

- River, discharge, effect on, **69**, 589.

Sediment. (See Deposits; Fill; Locks; Rivers; Silt.)

- Accumulations of, **00**, 2290.
- Action of, Mississippi River, **77**, 433.
- Amount of, determining, **72**, 1000, 1004.
- Amount of, determining, St. Johns River, **89**, 1302.
- Amount of, determining, various depths, **79**, 1757, 1964.

Sediment—Continued.

- Amount of, velocity not proportionate to, **74**, 863; **75**, 966; **77**, 433.
Arrest of, Brownlow weeds for, **78**, 640, 654.
Danube River, **74**, 847.
Deposits, **00**, 4032, 4050.
Deposits, causes of, **98**, 2313.
Deposits, large, rivers, **96**, 1728.
Deposits, Missouri River, H. D. 1120, 60th, 2d.
Deposits, reservoirs, **98**, 2823.
Deposits, study of, **00**, 4032, 4050.
Depths, at various, **79**, 1758, 1927, 1964.
Experiments, boxes placed on bottoms, **74**, ii, 372.
Floods, effect of, **76**, ii, 5.
Impounding, rivers, **95**, 3337.
James River, **76**, 300.
Locks, **76**, 759; **77**, 611, 618; **78**, 743, 781, 787; **79**, 1294.
Locks, Louisville and Portland Canal, **78**, 781, 789.
Mississippi River, **67**, 321; **69**, 325; **72**, 439; **74**, 804, 855, 863, 882; **75**, 541, 954, 966; **77**, 433; **79**, 1009, 1927, 1964.
Missouri River, **87**, 3090.
Movement, cribs, decay of, **94**, 2406.
Movement, Ocracoke Inlet, **94**, 1001.
Movement, South Pass, **94**, 1345.
Nile, **74**, 804.
Observations, **87**, 3090, 3121, 3123; **98**, 1612; **00**, 2557.
Observations, Cypress Bayou, **93**, 2081.
Observations, data, index to, Mississippi River, **95**, 3706.
Observations, Missouri River, **87**, 3121.
Observations, rivers, **96**, 1241.
Obstructions, lock gates, operating, **76**, 759; **77**, 611, 618; **78**, 743, 781, 787; **79**, 1294.
Ohio River, **77**, 616; **79**, 1360.
Red River, **93**, 1977; **94**, 1440, 1449.
Reservoirs, deposits, **98**, 2823.
Reservoirs, effect of, on sediment-bearing rivers, H. D. 50, 61st, 1st.
Rivers, **96**, 988.
Rivers, depth of, reductions of, **75**, 548, ii, 171.
Rivers, filling up, **95**, 3860.
Running water, effect of, **76**, ii, 5.
Sacramento River, **79**, 1752, 1759.
Salt water, effect of, **75**, ii, 36.
Suspension of, **81**, 1653; **82**, 2762; **83**, 781; **86**, 1299.
Transportation of, amount, **75**, ii, 481.
Velocity of rivers, effect on, **75**, ii, 477.
Wisconsin River, **79**, 1535.

Seepage. (See Leakage; Leaks; Levees.)

- Levees, **99**, 3563.
Preventing, levees, **98**, 3353.

Selches. (See Oscillations; Pulsations.)

- Connecticut River, **73**, 988, 1001.
Investigations of, **71**, 989.
Observation on, **66**, iv, 93; **67**, 599; **68**, 983; **69**, 600; **72**, 1033, 1040; **73**, 1193.

Settlement. (See Cribs; Locks.)

- Checking, bear-trap piers, **08**, 1798.
Floor slopes reversed by, **01**, 923.
Mattresses, mouth of Mississippi River, **05**, 1434.

Settlement—Continued.

- Unequal settlement, avoiding, forts. (See p. 1797 of this Index.)

Sewage.

- Deposits, channels, **98**, 2422.
Dredging, hindrances to, **95**, 2707.
Dredging, increased by, **99**, 2827.
Discharge, regulations of, Calumet River, **93**, 2816.
Disposal of, Chicago, **93**, 2797.
Harbors, shoaling of, **97**, 1251.
Levees, breaks in, due to, **05**, S., 212.
Navigable waters, discharge into; ineffectual attempts to prevent, H. D. 913, 59th, 1st.
Reservoirs, Fort Monroe, **95**, 514.
River channels, filling, **95**, 2707.
River, effect on, **93**, 2796.
Settlement of, harbors, **98**, 2669.
Shoaling from, Chicago Harbor, **11**, 2351; **12**, 2541.

Sewage Tank.

- Building, **96**, 499.

Sewers.

- Forts. (See p. 1797 of this Index.)
Laying, across moat, **96**, 500.

Sewerage.

- Systems of, Fort Monroe, **93**, 642; **95**, 511; **96**, 498; **97**, 663.

Shackles.

- Torpedoes, **89**, 491.

Shafts. (See Mines; Tunnels.)

- Lock valves, **95**, 2359.
Tunnels, **72**, 1154, 1161; **76**, ii, 126; **77**, 697, 707, 708.

Shafts and Galleries.

- Rock drilling and blasting, Hallets Point, **69**, 391; **75**, ii, 200; **77**, 228, 232; **79**, 61, 378, 384.

Shale.

- Breaking of, dredge bucket used, **95**, 979.

Shavings.

- Sand tightening, pile piers, **79**, 1622.

Sheathing. (See Breakwaters; Piers; Revetments.)

- Breakwaters, **97**, 3080; **00**, 4068, 4075, 4092.
Breakwaters, deterioration, preventing, **00**, 4075, 4092.
Piers, **00**, 4062.
Piles and, revetments, **96**, 2966.
Rapid decay, recesses, lock gates, **95**, 2360.
Timber breakwaters, decay, preventing, **00**, 4092.
Timber piers, **00**, 4062.

Sheathing, Iron.

- Breakwaters, ice protection from, **74**, 210, ii, 135, 228; **75**, 320.

Sheathing, Oak.

- Cribs, protecting, **71**, 107.

Sheathing, Steel.

- Impracticable to drive through riprap, **11**, 2263.

Sheeting.

- Wave action broken by, bulkheads, **04**, 3620.

Shell. (See Oysters.)

- Use of, for hearting, and for riprap foundations, **88**, 1082.

Ship Basins.

Details, Stamford, **08**, 1024.

Shipping.

Barges cheapest, **04**, 1390.

Character of shipping seeking harbors of refuge, H. D. 472, 62d, 2d.

Great Lakes, boats of; unsuitable for Mississippi River, H. D. 50, 61st, 1st.

Swash dangerous, Monterey Bay, H. D. 557, 59th, 1st.

Ships. (See Boats; Lightship; Vessels.)

Conversion to dredges, **04**, 3545.

Dimensions, increasing, effect on Panama Canal, locks enlarged, H. D. 267, 62d, 2d.

Draft, Atlantic coast trade, H. D. 551, 61st, 2d.

Drafts, Great Lakes, **12**, 2633.

Lock gates, ramming of, **11**, 2424.

Sizes increasing, Great Lakes, H. D. 266, 59th, 2d.

Ships, Modern.

Canals, cross section, Chesapeake & Delaware, S. D. 215, 59th, 2d.

Shipyards.

Advantages of, for U. S. plant, **11**, 2057.

Shoaling. (See Breakwaters; Channels; Harbors; Piers.)

Breakwaters, **99**, 1353.

Causes of, **00**, 2121, 4436.

Causes of, canal entrances, **97**, 2671.

Causes of, channels, **00**, 4436.

Causes of, due to lack of logging, Ontonagon Harbor, H. D. 444, 60th, 1st.

Causes of, propeller agitation of grounded steamer, **99**, 3037.

Causes of, wharves, protection beyond, bulkhead line, **88**, 1046.

Checking, piers, between, **97**, 2779.

Jetties, ends beyond, **98**, 1458.

Jetties, vicinity of, **94**, 2633.

Jetty ends, **84**, 1245.

Mouth of Mississippi River, **80**, 1138; **81**, 1263; **82**, 1329; **83**, 1041; **84**, 1243; **85**, 1386; **86**, 1235; **87**, 1355.

Piers, between, **96**, 3134; **98**, 2331.

Preventing, Great Lakes, H. D. 900, 59th, 1st.

Sand movement, Great Lakes, **03**, 2092.

Sewage a cause, Chicago River, **11**, 2351; **12**, 2541.

Sewage and, causes of, harbors, **97**, 1251.

Snow a cause of, Chicago River, **11**, 2351.

Shoaling, Excessive.

Causes, Elk and Little Elk Rivers, H. D. 770, 62d, 2d.

Causes, rivers, **95**, 2273.

Shoals. (See Bars; Jetties; Rivers.) (See pls. 55, 65.)

Advancement of, **97**, 1548.

Causes, agitation of, propellers, **99**, 3077.

Causes, rivers, mouths of, **97**, 3310.

Channels, rivers, **93**, 3404.

Dangerous character of, Great Lakes, **07**, 847.

Dangerous, Saginaw Bay, **96**, 4062.

Examination, sweeping method, **96**, 4062.

Finding, with wire sweep, Great Lakes, **07**, 847.

Shoals—Continued.

Improvement of, **96**, 3801.

Lake Erie, **97**, 4123.

Movement of, St. Andrews Bay, H. D. 12, 61st, 1st.

Portable jetties, effect of, **97**, 2016.

Raking better than dredging for gravel shoals, **06**, 1985.

Rapid increase, causes, **97**, 3310.

Scour through, portable jetties for, **97**, 2016.

Seaward movement, jetties, effect, **98**, 1283.

Work required at, H. D. 360, 62d, 2d.

Shoals, Persistent.

Probable causes of, **12**, 1806.

Shore Lines.

Channel sections and, Mississippi River, **05**, S., 196.

Protection of, forts. (See Forts, p. 1794 of this Index.)

Protected with groins and jetties, **05**, 3010.

Revetment and, Mississippi River, **05**, S., 196.

Shore Protection.

89, 2577; **91**, 3601; **92**, 162, 163, 2225 (atlas), 3145, 3153, 3291, 3294.

Abattis and fascine works, Missouri River, **01**, S., 398, 401.

Alabama River, **95**, 1666.

Beach grass, **67**, 46; **73**, 1098, 1101; **76**, 179, 189; **78**, 220; **79**, 271, 936, 1746.

Brush, efficiency of, **75**, 316.

Brush and sand bags, **79**, 410.

Brush groins for, **74**, ii, 323.

Brush mats for, **76**, ii, 408; **77**, 492; **79**, 976, 979, 1030, 1032, 1052, 1057, 1061, 1063, 1068, 1078; **93**, 1699.

Brush mats for, woven in place, **79**, 1080.

Brush wattling, **88**, 842.

Cane carpets, **78**, 616; **79**, 876, 931.

Cribwork for, **89**, 770.

Dikes, length of, relation to, **73**, 453; **74**, 332; **76**, 629.

Duxbury, Mass., **66**, ii, 36.

Economical methods, **82**, 1366, 1602, 1732.

Great Brewster Island, **68**, 837.

Importance of, **72**, 435; **76**, ii, 566; **79**, 1173, 1176.

Jetties for, **71**, 893; **74**, ii, 325.

Jetties for, failures of, **75**, 490; **79**, 997.

Length of, jetties, vicinity of, **72**, 139, 357; **74**, 332; **76**, 629; ii, 406.

Length of dike or jetty, relation to, **73**, 453; **74**, 332; **76**, 629.

Length of, wing dams, **75**, ii, 460.

Mattresses for, **89**, 770; **93**, 1699; **94**, 1597.

Mattresses for, building, **94**, 1597.

Methods, mill edgings, use of, **80**, 1580.

Methods, Sandy Hook, **96**, 864.

Mississippi River (upper), **72**, 435; **78**, 681.

Missouri River, **78**, 667, 673.

Oaks and cedars, **79**, 931.

Pile and plank revetment, **75**, 57.

Piles for, **77**, 475.

Plymouth, **71**, 893; **74**, 323.

Poplar trees, **71**, 205, 208.

Provincetown Harbor, Mass., **67**, 457; **74**, ii, 325.

Shore Protection—Continued.

- Revetment, **71**, 202; **72**, 233; **76**, 708.
Sand catches, **77**, 115, 116; **88**, 462.
Sandy Hook, **95**, 954.
Stone paving, **69**, 439.
Storms, effect of, **72**, 107.
Timber for, **89**, 770.
Training dikes effective, **01**, 1661.
Wattled piles, **76**, 497.
Willows for, **73**, 342; **74**, 51, 225; **75**, 52, 280;
76, 105, 237; **79**, 1468, 1618, 1621, 1628; **82**,
1595.
Willows for, failure, **75**, 316; **76**, ii, 564.
Willows for, planting, **81**, 1556; **82**, 1595; **86**,
1009.

Shore Protection, Natural.

- Afforded by loose stone, **71**, 884; **72**, 896; **74**,
ii, 276.

Shores. (See Currents; Lakes; Littoral.) (See
pl. 60.)

- Breakwaters and, gaps between, closing, **97**,
2690.
Breakwaters, should be connected with, to
prevent silting, H. D. 969, 60th, 1st.
Changes in, various periods, Jamaica Bay,
H. D. 1506, 60th, 2d.
Drift of, accumulation of, piers, at, **82**, 582.
Ends, shore; small stone for, jetties, **02**, 1159.
Erosion, considerable, Erie Harbor, **98**, 2738.
Erosion, preventing, methods, **96**, 1559.
Erosion, rapid, causes, **96**, 1559.
Extension, remarkable, Cranes Creek, Va.,
95, 1273.
Gap between shores and jetties, advantageous
effect from closing, Aransas Pass, H. D. 639,
61st, 2d.
Groins, effect of, St. Augustine, H. D. 580,
62d, 2d.
Islands, revetment, **02**, 218.
Jetties for protecting, **05**, 3010.
Jetties, effect of, Galveston, H. D. 328, 61st, 2d.
Lake survey, **93**, 4372.
Lines, advancement of, piers, vicinity of, **95**,
2772.
Lines, breakwaters, effect of, **94**, 2474.
Lines, lakes, **75**, ii, 857.
Lines, survey methods, **92**, 3428.
Lines, surveys, **95**, 4040.
Lines, surveys, substitutes for tertiary flags,
94, 2799.
Lines, unstable character, Gulf of Mexico,
79, 929.
Pier connections, **04**, 3172.
Recession, jetties and, **04**, 3168.
Recession, jetties, South Pass, **99**, 1819.
Recession, rate of, Erie Harbor, H. D. 83, 60th,
1st.
Reclamation should be for harbors, not parks,
H. D. 700, 59th, 1st.
Revetment of, jetties, vicinity of, **96**, 3255.
Sand drift, **71**, 131; **72**, 896; **74**, ii, 188; **76**,
ii, 472, 480, 569.
Storms, effect of; protections against, H. D.
328, 61st, 2d.
Surveys, lakes, **93**, 4372.
Wave action, **72**, 107.

Shoring.

- Buildings, **04**, 3826, 3860.
Underpinning and, buildings, **04**, 3860.

Shoring Piles.

- 95**, 2416.

Shovels. (See pl. 50.)**Shrubs.**

- List of, Executive Mansion, **00**, 5245.
List of, Washington, D. C., **90**, 3556; **00**, 5286.

Side Dams. (See Dams.)**Side Wheels.**

- Proposed for dredges operating in sand, **06**, 1300

Signaling.

- Mirage effect, lake, **67**, 575.

Signals. (See Bridges; Triangulation.)

- Lighting and other signals, improvements,
Point Judith Harbor of Refuge, H. D. 911,
60th, 1st.

Signals, Fog.

- Hearing, difficulty, Nantucket coasts, H. D.
536, 62d, 2d.

Signal Towers.

- Paint for, canals, **09**, 1861.

Signs.

- Device for printing, maps, **85**, 2898.

Sill Dams. (See Dams.)**Sills.** (See Cofferdams; Gates; Locks; Mattresses.)

- Bridges, under, **11**, 1582.
Dams, **04**, 2107. (See Dams.)
Designing, lock gates, **95**, 3040.
Locks, **04**, 3775. (See Locks.)
Locks and dams, **01**, 2766. (See Dams;
Locks.)
Mattresses, method of sinking, **01**, 1880.
Placing cofferdams, locks, **00**, 3533.

Sills, Ground.

- River bottoms, rising of, sills to prevent, **98**,
1411.

Sills, Mattress.

- Building of, **95**, 3409.
Scour of, dam, **96**, 3827.

Sills, Miter.

- Bolting, locks, **00**, 2926.
Failure, lock gates, **72**, 452, 460; **78**, 734, 736,
742.
Fitting, Plaquemine, **05**, 1451.
Leakage, preventing, lead lining for, locks, **98**,
1432.
Lock gates, effect on, **72**, 460; **78**, 736, 743.
Locks, **04**, 3761.
Locks, repair of, **99**, 1704.
Repairing, cofferdam for, **05**, 1942.

Sills, Pass.

- Lakes, **94**, 1987.
Movable dams, **96**, 2313.

Sills, Permanent Cofferdam.

- Locks, pumping out of, **00**, 3533.

Sills, Protection.

- Building, **95**, 3409.

Silt. (See Rivers; Sediment.)

- Arrest of, hurdles for, **94**, 1577; **96**, 1717; **97**,
2012.

Silt—Continued.

- Deposits of, bear-trap sluice gates, **07**, 1580.
- Movement, unforeseen, Hudson River, **98**, 1054.
- Problem of, Kaw River, H. D. 94, 61st, 1st.
- Rivers, Missouri River greatest silt-bearing river, H. D. 1120, 60th, 2d.
- Sand and, tidal currents, effect on, **71**, 525; **73**, 994.

Silting.

- Breakwaters should be connected with shore to avoid, San Pedro, H. D. 969, 60th, 1st.
- Causes, various, Mare Island, H. D. 1103, 60th, 2d.
- Deposit, average annual rates of, **03**, 2060.
- Docks, silt-tight, should be insisted on, **08**, 734.
- Study of, rivers, Great Lakes, **04**, 3803.
- Tunnel, water supply, District of Columbia, **01**, 3667.

Silver.

- Amounts mined, Comstock mines, **72**, 1139, 1156, 1161.

Silver Ore.

- Raising, cost of, Comstock mines, **72**, 1158.

Siphonage.

- Discharge acceleration by, flood waters, **04**, 3612.

Siphons.

- Waterways, intracoastal, H. D. 391, 62d, 2d.

Sites. (See Breakwaters; Bridges; Dams; Harbors of Refuge; Lands; Lighthouses; Locks; Reservoirs.) (See pls. 41, 46.)

- Land sheet, lock and dams, **00**, 2786.
- Locks and dams, surveys, **05**, 945.
- Marking, lighthouse, Chicago Harbor, **94**, 2133.
- Public works; sites should not be disclosed, **01**, 2758.
- Reference marks, Chicago Harbor, **94**, 2133.
- Surveys, **01**, 1833.

Sites, Soft.

- Foundation, batteries, **98**, 747.

Slabs.

- Piling and, breakwaters, maintenance in, expensive, **94**, 2024.

Slack Water. (See Navigation.)

- Abandonment of Muscle Shoals Canal in favor of slack-water navigation, H. D. 781, 60th, 1st.

Slack-Water Channels. (See Channels.)**Slack-Watering.**

- Backwater, determining curve of, Mississippi River, H. D. 50th, 61st, 1st.
- Coal industry helped, Allegheny River, H. D. 540, 62d, 2d.
- Details, construction, Tennessee River, H. D. 360, 62d, 2d.
- Estimates, detailed; Tennessee River, H. D. 360, 62d, 2d.
- Interests favoring, Allegheny River, H. D. 540, 62d, 2d.
- Justification, grounds for, Tennessee River, H. D. 360, 62d, 2d.
- Project for, Mississippi River, H. D. 50, 61st 1st.

Slack-Watering—Continued.

- System, modification, Little Kanawha, H. D. 480, 62d, 2d.

Slack-Water Navigation. (See Canals; Dams; Locks; Rivers.)

- Canals, comparison, **74**, ii, 97, 119; **75**, 365.
- Guard locks, height of, **00**, 2960.
- Lock and dam work, details, **02**, 1437.
- Plans, Kanawha River, **71**, 626, 641.
- Plans, Youghiogheny River, **76**, ii, 86.
- Private systems, value of, determining, Monongahela River, **96**, 2144.
- Systems of, Monongahela Navigation Co., **97**, 2412.
- Systems of, planning, **00**, 2959.
- Various places, cost, **96**, 2144.

Slack-Water Systems.

- Beneficial effect on rates, **11**, 743.
- Coal freights saved, **10**, 690.
- Effect of, on rates, very great, **09**, 617.

Slack-Water Works.

- Proposed, Coosa River, **05**, 1372.

Slag, Furnace.

- Crib filling, **77**, 626.

Slides. (See pl. 48. See Panama Canal Index, p. 2357 of this Index.)**Slopes.** (See Banks; Batteries; Breakwaters; Channels; Concrete; Cribbs; Embankments; Jetties; Levees; Riprap; Rivers; Sluices; Water.)

- Best, breakwater, **98**, 2284.
- Brazos River, **97**, 1838.
- Breakwaters, **66**, 40; **67**, 518; **70**, 488; **71**, 827; **72**, 168; **73**, 884, 1124; **74**, ii, 180, 181, 242; **76**, ii, 596, 598; **79**, 295, 1767; **92**, 933, 934; **96**, 2365.
- Canals, bottom of, **67**, 234; **68**, 444; **69**, 537; **72**, 326.
- Canals, surfaces of, **70**, 483; **73**, 1007; **78**, 294.
- Catawba River, **76**, 370.
- Colorado River, **79**, 1776.
- Connecticut River, **71**, 765; **72**, 839, 842; **74**, ii, 254; **78**, 255, 267, 273, 301, 350.
- Core well, effect of, Moline, **12**, 2150.
- Crib breakwaters, **94**, 2090.
- Cross section and, terms of current velocity, **72**, 139; **79**, 1579.
- Cumberland River, **71**, 469, 473; **72**, 465.
- Delaware River, **73**, 900, 924.
- Des Moines Rapids, **79**, 1150.
- Development of, breakwaters, **84**, 572, 573.
- Discussion, breakwaters, **84**, 573.
- Elk River, **76**, ii, 166, 168.
- Formulas for, **82**, 2480; **83**, 1349; **86**, 1302.
- Guadalupe River, Tex., **75**, 925.
- High and low water, **75**, ii, 501.
- Illinois River, **68**, 444, 448; **79**, 1578.
- Increased, flow, measuring, rivers, **95**, 3668.
- James River, **75**, ii, 78; **76**, 296, 298, 301; **78**, 456.
- Kanawha River, **71**, 642; **73**, 837; **75**, ii, 91, 95; **76**, ii, 160, 164; **77**, 644, 744, 749.
- Kansas River, **79**, 1090.
- Lake Huron to Lake Erie, **00**, 5362.
- Lakes Michigan and Huron, between, **78**, 1411.
- Levees, **78**, 1384; **95**, 3808.

Slopes—Continued.

- Licking River, **79**, 1425.
 Measuring, St. Clair River, **00**, 5362.
 Minnesota River, **71**, 404; **73**, 438, 440; **75**, 361, 404, 406, 411.
 Mississippi River, **67**, 277, 316; **68**, 468; **69**, 211; **75**, 954, ii, 435, 442; **76**, ii, 178; **78**, 934; **79**, 1130, 1150, 1232, 1928, 1934, 1970; **94**, 1582, 2757, 2784, 2845.
 Missouri River, **75**, 518; **76**, 630, 632; **78**, 666, 670, 690; H. D. 1120, 60th, 2d.
 Monongahela River, **72**, 414.
 Niagara River, **68**, 273.
 Observations, Mississippi River, **93**, 3696.
 Ohio River, **71**, 397; **72**, 408; **73**, 493; **74**, 416.
 Ouachita River, **72**, 368; **74**, 352.
 Planes and, study of, Mississippi River, H. D. 50, 61st, 1st.
 Potomac River, **74**, 502.
 Protection of, Bermuda grass, **75**, 773; **76**, 748; **79**, 936.
 Red River, **75**, 616.
 Retention, wattling, use of, **72**, 709.
 Revetting, advantages of, jetties, **95**, 3315.
 Rock Island Rapids, **67**, 277; **68**, 421, 426, 433; **69**, 239, 243.
 Rivers, **94**, 1582.
 Rivers, banks of, **76**, 374, ii, 284.
 Rivers, improvements, consistency with, **76**, 374, ii, 284.
 Rivers, surfaces of, Mississippi River, **00**, 4607.
 Sand to hold, forts. (See Forts, p. 1797 of this Index.)
 Seas, effect on, breakwaters, **98**, 2665.
 Sill dams, **98**, 2447.
 Sluices, **75**, ii, 609; **79**, 537.
 Stone breakwaters, **93**, 3261.
 Study of, Altamaha system, H. D. 443, 62d, 2d.
 Surfaces, St. Johns River, H. D. 611, 61st, 2d.
 Tennessee River, **68**, 584; **72**, 495; **75**, ii, 660; **77**, 579.
 Water in sand, **76**, 393.
 Wave movement over, breakwaters, **98**, 2284.
 Waves, effect on, breakwaters, **96**, 2375.
 Wisconsin River, **68**, 363; **76**, ii, 263, 276.
 Yellowstone River, **79**, 1102.
 Youghiogheny River, **74**, 561; **76**, ii, 86, 114, 123.

Slopes, Calculated Water.

- Measured and compared, **76**, 298.

Slopes, Maximum.

- Dams, **76**, 374; ii, 284.

Slopes, Measured Water.

- Calculated and, comparison, **76**, 298. -

Slopes, Natural.

- Breakwaters, **99**, 1350.
 Stone jetties, **93**, 3490.
 Water slopes, sand in, **76**, 393.

Slopes, Seasonal.

- Discharge, Niagara River, **00**, 5380.

Sloughing.

- Levees, Mississippi River, **03**, S., 315.

Sloughs. (See Levees.) (See pl. 17.)

- Treatment of, levees, **97**, 3820.

Sluice Gates. (See Gates.)**Sluices.** (See Culverts; Dams; Logs.)

- Disadvantages of, **75**, ii, 610.
 Flow through, **69**, 589; **74**, 346; **75**, ii, 610; **77**, 745.
 Grade of, **83**, 1701.
 Lining, locks, **00**, 2772.
 Objections to, dams, **75**, ii, 609.
 Plans for, Falls of Alexandria, **75**, 905.
 Plans for, Kanawha River, **77**, 745.
 Plans for, New River, **73**, 78, 843, 848, 852; **77**, 62, 331.
 River discharge through, **75**, ii, 610; **77**, 745.
 Slopes required, **75**, ii, 609; **79**, 537.
 St. Anthony's Falls, **80**, 1565.
 Water in, flow of, **80**, 1621, 1623.

Sluices, Log.

- 96**, 1838.
 Flooring, dams, **96**, 1836.

Sluices, Navigable.

- Rivers, **75**, ii, 610.

Sluiceway. (See Guard lock.)

- Guard lock, **94**, 2176.

Sluicing.

- Deposits removed, canal, **88**, 2166.

Smoke.

- Pacific coast, **95**, 3459.
 Prevalence of, Pacific coast, **00**, 4505.

Snag Boats. (See pls. 54, 56.)

- 95**, 1394, 2054.
 "Arkansas," details, **01**, 2102.
 Construction and operating details, **05**, 3034.
 Cost of, **89**, 1350.
 Cost of, western rivers, **67**, 377, 382; **68**, 329.
 Description of, **66**, 9; **68**, 58, 590, 599, 603, 609, 632; **69**, 201, 295, 363; **73**, 613; **75**, 519; **76**, ii, 7; **77**, 628; **80**, 1838, 2234, 2284; **85**, 1596; **87**, 1555; **89**, 1644.
 Dimensions of, **68**, 632; **72**, 403; **77**, 530, 534.
 Dredging and, proposed combination, **00**, 1844.
 Equipment of, **99**, 3217.
 Hauling out of, inclined ways for, building, **98**, 1853.
 Improvements in, **96**, 3347; **97**, 2351.
 Improvements of, proposed, **08**, 2290.
 Iron and wooden hulls of, comparison, **74**, 369.
 Ironwork for, **05**, 3034.
 Metal hulls, economy of, **97**, 1951.
 Repairing, docking for, small side dock, **98**, 1619.
 Requirements of, **67**, 390; **71**, 310, 382.
 Western rivers, **70**, 391; **71**, 307; **73**, 486; **74**, 368.
 Wrecking hook for, **95**, 2058.
 Wreck of, submarine mine explosion, **99**, 2009.
Snagging. (See Logging; Snag Boat; Water Jet.) (See pl. 56.)
 Appropriations, liberal, desirable, in view of gasoline-boat traffic, **11**, 34.
 Barge for, **97**, 2267.
 Boats for, **95**, 2044.
 Cost of, **79**, 1188.
 Dynamite for, **73**, 616, 618; **74**, ii, 358; **78**, 538, 539; **79**, 626, 651, 1187.
 Methods, **94**, 2805; **95**, 2044; **00**, 3513.

Snagging—Continued.

- Obstructions removed, Mississippi River, 1871-1911, **11**, 1900.
- Photographs, Yamhill River, **99**, 3238.
- Plant for, **93**, 1826, 1828, 1836; **96**, 3625.
- Plant for, Mermentau River, **94**, 1372.
- Profitable, markedly, **04**, 2127.
- Water jet for, Red River, **73**, 614, 616.
- Western rivers, **72**, 337; **73**, 488; **76**, 618; **77**, 495; **78**, 649.

Snags. (See Obstructions; Stumps.)

- Dimensions of, **68**, 610; **80**, 1743; **85**, 1793; **86**, 1534.
- Dynamite, removing with, **73**, 616, 618; **74**, ii, 358; **78**, 538; **79**, 626, 651, 1187.
- Origin of, **68**, 624.
- Peculiar, Perquimans River, N. C., **78**, 538.
- Removing, methods, **93**, 1908.
- Weight of, average, Ohio River, **77**, 628.

Snow.

- Channel shoaling from, Chicago River, **11**, 2351.
- Melting of, effect of forests on, **03**, 2446.

Soils.

- Bearing power, testing, **04**, 3821.
- Buildings, **04**, 3821.
- Filtration, rate of, **76**, ii, 67; **79**, 1239.
- Foundations, locks, **98**, 1472.
- Sustaining power, foundations, **72**, 766.

Soils, Compressible.

- Foundations, **74**, 829, 830; **75**, ii, 621.

Soils, Sandy.

- Pile driving, **83**, 1249.

Soils, Soft.

- Triangulation stations, buildings, **00**, 2073.

Solids, Suspended.

- Running water, effect of, **76**, ii, 5.

Soundings. (See Breakwaters; Catamarans;

- Reels; Rock.) (See pl. 72.)
- 67**, 217; **68**, 143; **71**, 177; **78**, 546.
- Catamaran, breakwaters, **00**, 4134.
- Catamaran for, **02**, 2774; **03**, 2764.
- Cross sections, float to obtain, breakwaters, **03**, 2096.
- Currents, rapid, **93**, 3162.
- Defective, lines, expansion of, **74**, 687.
- Discharge measuring, **00**, 5327.
- Discharge observations, methods, Mississippi River, **11**, 1947.
- Drifting method, **96**, 3669.
- Irregularity of, oyster beds, over, **73**, 818.
- Lake survey, **85**, 2103.
- Lead line for, sinking rate, **83**, 2268.
- Lines for, requirements of, **74**, 685.
- Machine for, **68**, 423, 429; **70**, 319; **71**, 278; **72**, 315, 334; **75**, 454, 466; **03**, 2686.
- Making, methods, **00**, 3052.
- Methods, **88**, 423, 642, 1110, 1145; **89**, 1409; **90**, 4013; **91**, 2154; **92**, 1333; **95**, 4231, 4240; **97**, 1543; **00**, 5331.
- Methods, Arkansas River, **85**, 1609.
- Methods, Exeter River, **97**, 820.
- Methods, inshore, details, **02**, 2818, 2866.
- Methods, lakes, **71**, 997; **72**, 1088.
- Methods, rocks, over, **72**, 867.

Soundings—Continued.

- Methods, various, **01**, 2532; **02**, 1805, 2866; H. D. 231, 58th, 3d.
- Mississippi River, **80**, 1517; **93**, 3786.
- Observations of, error, reduced, **99**, 3637.
- Reduction of, **97**, 1543.
- Reduction of, Altamaha surveys, H. D. 443, 62d, 2d.
- Reduction of, low-tide, to, methods, **75**, ii, 77
- Reels, **95**, 4170, 4240.
- Reels, Ripley-Haskell, **95**, 4170.
- St. Marys River, **80**, 2072; **86**, 1803; **95**, 4230.
- Sandusky Harbor, **95**, 3090.
- Scow for, **98**, 2758.
- Sill dams, **99**, 3637.
- Static methods, **00**, 5327.
- Sweep apparatus for, **96**, 4066.
- Sweeping, **92**, 3418; **94**, 3428.
- Tagged cord, **93**, 1415.
- Wire reel, **00**, 5331.

Soundings, Deep-Sea.

- Northern and Northwestern Lakes, **71**, 997.

Soundings, Static.

- 00**, 5327, 5330.

Spall Bed. (See pl. 14.)**Spalls, Quarry.**

- Handling of, clam-shell dipper, **99**, 2156.

Spawling. (See Revetment; Riprap; Stone.)

- Banks, **03**, 2443.

Speaking Tubes.

- Fort. (See p. 1797 of this Index.)

Specifications.

- Bridges, **02**, 2666, 2674.
- Canal, Maryland and Delaware ship canal, S. D. 215, 59th, 2d.
- Dikes, Missouri River, **96**, 3841.
- Dredges, hydraulic, **04**, S., 103.
- Levees, California rivers, H. D. 262, 59th, 1st.
- Sea wall, concrete, **05**, 3024.

Speed.

- Canals, various, H. D. 391, 62d, 2d.

Spillway. (See pl. 19.)

- Barriers, Yuba River, **06**, 2078.
- Flood control, California rivers, H. D. 81, 62d, 1st.

Spillways.

- Reservoirs, storage, Ouachita system, H. D. 588, 62d, 2d.

Sponge Racks.

- Fort. (See p. 1797 of this Index.)

Sprinkling.

- Roads, parks, **02**, 3037; **03**, 2462.

Spuds.

- Cribs, sinking of, **76**, ii, 538.

Spur Dams. (See Dams.)**Spurs.** (See Breakwaters; Dikes; Groins; Hurdles; Jetties; Levees.)

- Bank erosion, preventing, **97**, 3818.
- Bank protection, **99**, 3590.
- Breakwaters, effect on, **96**, 3154.
- Building, dikes, **98**, 3442.
- Building, stone dikes, **93**, 2447.
- Erosion, preventing, bank angles, **97**, 3818.
- Jetties, **00**, 4451.

Spurs—Continued.

- Jetties, effect on, **94**, 2548.
- Jetties, building, Winyah Bay, **95**, 1352.
- Pile dams, **93**, 1562.
- Rock jetties, **00**, 4451.
- Undermining of jetties, preventing, **94**, 2548.

Spur Systems.

- Mississippi River, **02**, S., 139.

Squat.

- Steamships under way, study of, **04**, 3748.

Stadia.

- Distance measuring, surveys, **72**, 1107.
- Use of, excellent result, **73**, 638.

Stages.

- Discharge and, rivers, effect on, **00**, 5383.
- Indicator, water levels, **04**, 4063.

Stairways.

- Cheap forms. (See Forts, p. 1797 of this Index.)

Stanchions.

- Railings and. (See Forts, p. 1797 of this Index.)

Standpipes.

- Fire protection, buildings, **04**, 3850.

Stars.

- Latitude, **94**, 3391.
- Longitude work, **94**, 3338.

States.

- Canalization, assessment districts created for, **08**, 841; **09**, 883.
- Cooperation with, in waterway improvement, H. D. 1374, 61st, 3d.
- Rights of, in waterways, interference with, New York, H. D. 887, 62d, 2d.
- Riparian rights, etc., brief, etc., Sen. D. 351, 61st, 2d.
- U. S. and, rights of, waterways, Connecticut River, H. D. 818, 61st, 2d; H. D. 953, 61st, 2d.

State Work. (See Private Work, Vol. I, p. 22.)**Stations.** (See Triangulation.)

- Index, U. S. lakes surveys, **03**, 2745.
- Judgment firing, submarine mines, **98**, 744.
- Secondary triangulation, Mississippi River, **96**, 3515.
- Twist of, lake survey, **72**, 1103; **73**, 1184; **75**, ii, 913.

Stations, Triangulation.

- Galveston, **02**, 1358.

Statistics. (See Commerce; Dams.)**Statues.** (See Washington, D. C., p. 2040 of this Index.) (See pls. 68, 69.)

- Driveways, treatment of, District of Columbia, **05**, 2646.
- Foundations, **99**, 3841.
- Memorial work, District of Columbia, details, **12**, 3510.
- Stonework details, **04**, 3948, 3949.
- Views, District of Columbia. (See p. 2073 of this Index.)

Staves.

- Gauges, **97**, 1938.

Steam.

- Ice, clearing from sluice gates, **09**, 2010.

Steamboating.

- Logging and, regulation, difficult, **00**, 2809.

Steamboats. (See Canals; Lakes.)

- Chimneys of, height of, **75**, ii, 681; **78**, 908, 928, 934.
- Earliest, introduction of, Lake Champlain, **73**, 405.
- Lake Champlain, **73**, 408.
- Proper loads, shallow rivers, **95**, 2282.
- Swept over dam, Monongahela River, **08**, 1767.
- Western rivers, **68**, 440, 487; **71**, 448; **72**, 423 **78**, 927, 1030; **79**, 1315.
- Wrecks of, Mississippi River, **67**, 387, 391.

Steamer.

- Torpedoes, planting, **90**, 399.

Steam Plant.

- Details of, hydraulic dredges, **04**, S., 113.
- Pile driving, **83**, 1185, 1270, 1272.

Steam Power.

- Compressed air preferable, rock drilling, **98**, 1952.
- Stone handling, locks, **74**, 164; **76**, 661.
- Water and, compared, **78**, 753.

Steamships.

- Dimensions, growth, H. D. 1506, 60th, 2d.
- Squat, **04**, 3743.
- Tonnage, increasing, H. D. 1506, 60th, 2d.

Steamships, Ocean.

- Draft, New York Harbor, **99**, 1280.

Steam Tenders.

- Hydraulic dredges, **98**, 3306.

Steel. (See Drills; Gates; Iron; Sheathing.)

- Bear-trap gates of, superiority of steel, **11**, 2139.
- Bridges, plans, **98**, 3606.
- Buildings of, failure to withstand fires, **04**, 3830.
- Chains, use of, experience against, locks, **98**, 2127.
- Concrete and, breakwater, Algoma, **08**, 1954. (See Concrete.)
- Concrete and, bridges, **03**, 2474. (See Concrete.)
- Concrete and, telephone booths, forts. (See p. 1797 of this Index.)
- Drills, best steel for, rock removing, **75**, ii, 204.
- Drills, diamond and, comparison, rock removing, **72**, 803.
- Frames, weirs, **00**, 5003.
- Lining of, concrete forms, **98**, 2254.
- Mooring posts, setting of, **97**, 2206.
- Properties of, for buildings, **04**, 3833.
- Shipments by water, special barges, Ohio River, H. D. 492, 60th, 1st.
- Skin of, bear-trap gates, **11**, 2142.
- Tapes of, base-line measuring, **87**, 2943, 2952, 3124.
- Tapes of, 500-foot, **95**, 4230.
- Tapes of, tests of, **93**, 1926.
- Trusses, scows, **91**, 2333.

Steel Buildings. (See Buildings.)**Steel, Forged.**

- Preferred for lock gate wheels, **09**, 1780.

Steel, Rusty.

- Cleaning, sandblast, **00**, 4330.
- Sand blast, improvised, **00**, 2788.

Steelwork.

- Careful work, economy of, **04**, 3834.
- Columns of, designing factors, **04**, 3834.
- Connections, easily made, **04**, 3834.
- Government Printing Office, **01**, 3808.
- Paint, red lead and special dryer best, **99**, 2290.

Stiffeners.

- Steel used for, bear-trap gates, **11**, 2142.

Stone. (See Breakwaters; Buildings; Dams;

- Dikes; Enrockment; Jetties; Locks; Piers; Quarries; Revetment; Rock; Sand.)
- Absorption, various stones, **94**, 2310.
- Arches of, bridges, **98**, 3606.
- Artificial, failure, Cherbourg Breakwater, **67**, 516.
- Barges for, **97**, 1799.
- Barges for, 1,500-ton, **99**, 3262.
- Barges for, jetties, **97**, 1799.
- Barges for, side-dumping, 800-ton, **99**, 3156.
- Beach erosion, to prevent, **72**, 897.
- Bed of, resistance, effect, **75**, ii, 843.
- Bins for, building, **96**, 513.
- Bins for, materials, **96**, 513.
- Blocks, concrete, replaced by, revetments, **01**, 1107.

- Breakage of, **98**, 2953.

Breakwaters, stone.

- cross sections of, **00**, 4090.
- cross sections, best, **00**, 1831.
- designing, **93**, 3259.
- end of, **00**, 4134.
- extending, plans for, **95**, 3153.
- planes of rest, **93**, 3261.
- sections of, **00**, 4062.
- sections of, Sandy Bay, **00**, 1186.
- settlement of, **00**, 4118.
- slopes, designing, **93**, 3261.
- specifications for, **00**, 4076.
- stability of, **00**, 4065.
- substructure, designing, **93**, 3261.
- superstructures, designing, **93**, 3262.

- Brush and, crevasses, closing, **71**, 207.
- Brush and, dams, building, **95**, 2230.
- Capping of, breakwaters, **00**, 4116.
- Chips, usefulness of, jetties, **94**, 1231.
- Classes of, jetties, for, 1615.
- Coping, **99**, 3826.
- Concrete, in, **00**, 978.
- Concrete, locks, **94**, 1996.
- Cost of, Great Lakes, **95**, 3157.
- Crib dams, stone in, plans of, **96**, 1434.
- Cribs, amount in, **96**, 2578.
- Cribs, foundations of, **72**, 122, 161, 164, 165; **73**, 206, 353; **76**, ii, 436.
- Cribs, removed from, storms, **75**, 276; **77**, 896, 903.
- Crushing, crushers, **95**, 2899.
- Crushing, machine, **96**, 514.
- Crushing, plant, **94**, 2176; **95**, 1678; **00**, 757.
- Crushing, strength, **80**, 689.
- Cubes and slabs, pressure on, effect of, **75**, ii, 841.
- Cutting, **94**, 2307; **00**, 2930.
- Cutting, Des Moines Rapids, **70**, 298.
- Cutting, locks, **93**, 3001, 3006; **96**, 1939; **97**, 2281.
- Cutting, locks, St. Marys Falls, **94**, 2304.

Stone—Continued.

- Cutting, specifications for, **98**, 1918.
- Delivery of, jetty, **94**, 2503.
- Deterioration of, jetties, **95**, 3314.
- Deterioration of, pier superstructure, **99**, 2772.
- Dikes, cost, **88**, 666.
- Dikes of, stabler than cribwork, Great Lakes, **06**, 1699.
- Dikes, spur, building, **93**, 2447.
- Dumping, device to clear stone from track, **02**, 2131.
- Dumping, jetties, **95**, 3360.
- Excessive weight, Port Jefferson Harbor, **74**, ii, 271.
- Filling, weight of, cribs, **68**, 230.
- Foundations, crib, **72**, 122, 161, 164, 165; **73**, 206, 353; **76**, ii, 436.
- Foundations, economy of, cribs, **82**, 2321; **87**, 2407.
- Foundations, sections, cribs, **00**, 3878.
- Fracture of, discussion, **75**, ii, 824.
- Gravel and, comparison of, concrete in, **00**, 978.
- Green stone, deterioration of, causes, frost, etc., **98**, 1916.
- Handling, cable hoists, **96**, 1794.
- Handling, jetties for, **94**, 1102; **97**, 1799.
- Handling, large, derrick scows, **94**, 1102.
- Handling, locks, **94**, 2305.
- Handling, locks, steam power at, **74**, 164; **76**, 661.
- Handling, plant, **98**, 1885.
- Handling, scows with railroad track on them, **96**, 2788.
- Joints, asphalted, **02**, 2494. (See Forts, p. 1797 of this Index.)
- Lead sheets, interposition of, effect of, **75**, ii, 826.
- Lewis-holes, **93**, 3007.
- Lewis-holes, styles, **94**, 2308.
- Masonry, Colbert Shoals Canal, **99**, 2271.
- Mattress and stone, dams, building, **95**, 2228.
- Mattress and stone, jetties, building, **00**, 4243.
- Mattress and stone, jetties, section, **94**, 1378, **00**, 4243.
- Movement of, wave force, **78**, 242.
- Paving, shore-protecting, **69**, 439.
- Pile and stone, jetties, storm, effect of, **94**, 2547.
- Piling, method, **94**, 2308.
- Placing, breakwaters, **93**, 3260.
- Placing, jetties, **96**, 1194.
- Placing, jetties, undermining of, preventing, **95**, 3312.
- Placing, trestle, breakwaters, **93**, 3227.
- Placing, trestlework, jetties, **94**, 2517.
- Planer, **94**, 1826, 2306.
- Protective action, beaches, **71**, 884; **72**, 896; **74**, ii, 276.
- Quarries, California coast, **00**, 4189.
- Quarries, great waste, California coast, **00**, 4189.
- Quarrying, methods, **93**, 3353; **94**, 2363; **95**, 2295; **96**, 1746, 1942; **97**, 2259; **98**, 1766, 1885, 1887, 2032, 2772; **00**, 2170, 2713, 2916, 2928, 3514, 4124, 4476, 4837.
- Quarrying, expense, items of, **97**, 2277.

Stone—Continued.

- Quarrying, plant, **96**, 514; **98**, 2772.
Records, locks, **93**, 3008.
Replacing, crib piers, **96**, 2945.
Reservoirs, dams, **98**, 2824.
Sand and, sharp and smooth, advantages, concrete, **98**, 2280.
Setting of, breakwaters, **00**, 4134.
Situation of, Great Lakes, vicinity of, **95**, 3159.
Size of, breakwaters, **67**, 516; **70**, 452; **71**, 741; **72**, 166, 918; **73**, 884, 948; **79**, 1767.
Size of, jetties, **98**, 2864.
Size, man size preferable, revetments, **11**, 1431.
Specific gravity, **80**, 2264.
Specific gravity, determining, **75**, ii, 822.
Stability of rock of different density, **01**, 2384.
Statuary, details, District of Columbia, **04**, 3948.
Steam handling of, locks, **74**, 164; **76**, 661.
Storage of, costly, Harlem River, N. Y., **99**, 1237.
Superstructure, cribs, **67**, 222; **74**, 151; **76**, ii, 390.
Superstructure, ice movement, effect of, **89**, 2073.
Superstructure of, replacing timber superstructure, breakwaters, H. D. 240, 59th, 1st.
Superstructure, piers, **04**, 3818.
Superstructure, sections, breakwaters, **97**, 3298.
Surfaces of pressure, various, rupture, effect on, **75**, ii, 824, 843.
Tests, **75**, ii, 819; **92**, 490; **94**, 2308.
Timber and stone, breakwaters, **91**, 2933.
Towing of, cost of, Mississippi River, **11**, 3292.
Transfer from cars to barge, cheap method, **01**, S., 253.
Undermining, preventing, jetties, **95**, 3312.
Varieties of, character and strength, **75**, ii, 819.
Various, absorption, **94**, 2310.
Various, specific gravity, **94**, 2310.
Volume of, space filled, ratio, **86**, 840.
Walls, sea, concrete for, **05**, 3025.
Wall, training dike, cheaper than, **99**, 1507.
Wave action on, **76**, ii, 596.
Weighing, displacement method, not satisfactory, **94**, 1392.
Weighing, jetties, **94**, 1392.
Wooden cushions, effect of, **75**, ii, 845.
Work, cost, locks, **87**, 2484.
Work, jetties, **84**, 1108.
Yard, St. Marys Falls, **94**, 2299.

Stone, Artificial.

- Breakwaters, use in, **67**, 516; **70**, 457; **73**, 1125.
Canals, **94**, 2164.

Stone Barges.

- Measurement of displacement, **02**, 2511.

Stone, Broken.

- Voids in, ratio, **74**, ii, 377; **78**, 1136.

Stone, Building.

- Ohio, **96**, 3083.

Stone, Cut.

- Storing, **00**, 2922.

Stone, Large.

- Breakwaters, **93**, 3260.
Economical, Great Lakes piers, **06**, 1821.

Stone, Large—Continued.

- Handling, derrick scows for, **94**, 1102.
Handling, plant, **00**, 4117.
Jetties, placing in, **94**, 1102.
Jetty ends, objectionable at, **01**, 1431.
Not removable by hydraulic dredges, **07**, 1029.
Omitted, concrete masonry, **94**, 2166.

Stone, Lava.

- Breakwaters, Hawaii, H. D. 407, 59th, 2d.

Stone, Loose.

- Natural shore protection, **71**, 884; **72**, 896; **74**, ii, 276.

Stone, Small.

- Shore ends of jetties, **02**, 1159.

Stone, Submarine.

- Setting, water telescope, usefulness of, **00**, 4134.

Stonework. (See pl. 58.)

- Breakwaters, during construction, **01**, 3318.
Buildings, **04**, 3854.

Storage. (See Dams; Water Supply.)

- Scows, **01**, 3225.
Plant, U. S., wharf, Cleveland, H. D. 270, 59th, 2d.
River regulation, Red River of the North, H. D. 616, 62d, 2d.
Water, drinking, H. D. 342, 61st, 2d.

Storage Depot.

- Need for, U. S. works, **03**, 2136.

Storage Platforms.

- Jetties, **00**, 4448.

Storage Shed.

- Torpedoes, **98**, 649.

Storage, Water.

- Utilization of, Mississippi River, **01**, 2400.

Storehouses.

- Building, Alaska, **97**, 3494.
Various types, **02**, 2734.

Storms. (See Hurricanes; Rain.)

- Beaches, effect on; St. Andrews Bay, H. D. 12, 61st, 1st.
Breakwaters, concrete, effect, **01**, 3318; **09**, 53.
Channels, effect on, Pacific coast, H. D. 961, 60th, 1st.
Effect of, Fort Caswell, **00**, 900.
Effect of, St. Andrews Bay, Cal., H. D. 12, 61st, 1st.
Force of, Great Lakes, **06**, 1700.
Great Lakes, character of storms, H. D. 900, 59th, 1st.
Jetties, effect on, **01**, 403; **03**, 1126.
Jetties, withstanding terrific storms, Galveston, **01**, 1926.
Protection from, Gulf coasts, **03**, 1348.
River bars, cause of, **68**, 111; **77**, 967.
River currents, effect on, **97**, 2777.
Shores, effect of storms on, H. D. 328, 61st, 2d.
Vessel damage, entrance to harbors, Great Lakes, H. D. 82, 59th, 2d.
Waves, effect on, jetties, **94**, 1105.

Strains. (See Dams; Gates; Locks; Stresses.)

- Calculations, hydraulic gates, **75**, 911.
Discussion, lock gates, **72**, 452, 460; **75**, 910; **78**, 734, 742, 1338.
Discussion, movable dams, **97**, 3956.

Strains—Continued.

Movable dams, **75**, 690, 910; **76**, ii, 42.
Tubular arch bridges, **75**, ii, 680; **77**, 1099, 1102.

Strata. (See Borings; Land.)

Artesian well, S. C., **96**, 504.

Streams. (See Rivers; Waterways.)

Bear-trap dams, utility, **96**, 1641.
Bottom tester, **88**, 931.
Corporations, rights of, **05**, 910.
Diversion of, reservoir sites, **96**, 3963.
Flow of, diagramming, Tennessee River, H. D. 781, 60th, 1st.
Flow of, general equation, H. D. 779, 61st, 2d.
Pulsations in, **69**, 594; **71**, 989; **72**, 1033, 1040.

Streams, Navigable.

Definition of, U. S. and State, Grand and Green Rivers, H. D. 953, 61st, 2d.
Water power, riparian rights, H. D. 781, 60th, 1st.
Water-power works, cost of, Muscle Shoals, H. D. 781, 60th, 1st.

Streets.

Paving, ancient Roman cities, **67**, 527.

Stresses. (See Gates; Locks; Strains.)

Calculating, lock gates, **95**, 3037.

Stumps. (See Snags.)

Blasting, methods, parties, **96**, 1622.
Removing, economical methods, **96**, 1622.

Substructures. (See Breakwaters; Jetties; Piers; Superstructures.)

Breakwater, **99**, 1350, 1351.
Designing, stone breakwaters, **93**, 3261.
Passes, movable dams, **97**, 2546.
Walls of, parting, breakwater, **99**, 3140.

Suction Dredges. (See Dredges.)

Altering from end to side, Mississippi River, **05**, 1652.

Suction Head.

Forms of, hydraulic dredges, and effect of various forms, **03**, S., 146.

Sugar.

Cultivation of, a principal industry of the Hawaiian Islands, H. D. 609, 62d, 2d.

Sulphur.

Cement briquettes, for repair of, **01**, 922.

Superstructures. (See Breakwaters; Concrete; Cribs; Masonry; Piers; Stones; Substructures.)

Average durability, cribs, **84**, 2020; **87**, 2111.
Breakwaters, **94**, 2412; **95**, 2770; **99**, 1350, 1351; **00**, 4068.
Building, improved methods, crib piers, **96**, 2966.
Cast-iron facing, cribs, **87**, 2060.
Concrete and stone, crib piers, **97**, 3075.
Crib breakwaters, placing in, **00**, 4134.
Cribs, **71**, 216; **78**, 1188; **89**, 2365; **90**, 2814; **96**, 2952.
Modified form, cribs, **83**, 1808.
Parapet, form of, cribs, **84**, 2144; **85**, 2279, 2307; **87**, 2382.
Parapet, piers, **84**, 2144; **85**, 2279, 2307.
Sheathing of, breakwaters, **00**, 4068.
Stone breakwaters, **93**, 3261.

Superstructures, Concrete in. (See Breakwaters.)

Advantages, breakwaters, **95**, 3138.
Breakwaters, **82**, 793, 2270; **86**, 119; **87**, 483, 504, 2060, 2069, 2111, 2353, 2363; **98**, 2676; **00**, 4125.
Breakwaters, building, **96**, 2365, 2367, 2385; **97**, 3080; **98**, 2753; **99**, 3057; **00**, 4125.
Building, **90**, 1629.
Building, piers, **00**, 4102.
Cribs, **87**, 2060, 2111, 2353, 2363; **96**, 2945.
Failure of, breakwaters, **81**, 2674.
Piers, **98**, 2226; **99**, 2644; **00**, 4062.
Piers, over, **03**, 1888.
Repairing, breakwaters, **00**, 4102.
Rubblestone hearting, breakwaters, **99**, 3098.
Sections of, breakwaters, **98**, 2676.

Superstructure, Masonry.

Disadvantages, piers, **66**, iv, 157, 163; **67**, 137, 222, 226, 228.
Foundations, cribs, **67**, 222; **74**, 151; **76**, ii, 390.
Foundations, failing, **67**, 222.
Piers, **66**, iv, 157, 163; **76**, ii, 390; **78**, 1166; **79**, 1524.

Superstructure, Old.

Removing, breakwaters, **00**, 4127.

Superstructures, Sloping.

Piers, **71**, 215.

Surfaces. (See Canals; Rivers.)

Slopes of, St. Johns River, Fla., H. D. 611, 61st, 2d.

Surfaces, Sloping.

Wave action on, **70**, 196.

Surfacing.

Roads, **03**, 2459.

Surveys. (See Bases; Battlefields; Bench Marks; Borings; Bridges; Canals; Dams; Dikes; Dredging; Examinations; Harbors of Refuge; Ice; Lakes; Levees; Leveling; Locks; Meters; Plotting; Soundings; Topography; Triangulation; also Vol. I, p. 22.) (See also pl. 72.)

Astronomical observations, **97**, 4076.
Austrian, **76**, iii, 158, 166.
Barometer, use of, P. P. No. 15, C. E.
Bars, **97**, 1638.
Base lines, coast survey, **68**, 939.
Base lines, Mackinac, **97**, 4077.
Base lines, measurements, Mackinac, **98**, 3747.
Base lines, measuring, **93**, 4360.
Base lines, measuring, Galveston, **98**, 1497.
Base lines, measuring, Soo, **93**, 4360.
Bases, measuring, Red River, **93**, 1926.
Battlefields, **74**, ii, 476.
Belgian, **76**, iii, 214.
Bench marks, Great Lakes, **03**, 2693.
Black Hills, **74**, ii, 628.
Borings, **96**, 3901.
Bottom tester, **88**, 931.
Brass tapes, tests of, **93**, 1926.
Bridges, **96**, 3890; **98**, 3576.
Bulletins, methods of issue, Great Lakes, **08**, 2533.
Camps, **95**, 4248.

Surveys—Continued.

- Canals, **95**, 3424; **96**, 1088, 2390; **97**, 2870; **99**, 1735.
- Canals, Atlantic coast, H. D. 391, 62d, 2d.
- Canals, methods, Puget Sound waters, **96**, 3365.
- Chart reproduction, special methods, **08**, 2516.
- Commercial necessity for, great; Great Lakes, **07**, 849.
- Comparison of recent with other surveys, Mississippi River, **05**, S., 43.
- Comparisons, unreliability of, when made short time apart, **11**, 1592.
- Comparator, use of, lake surveys, **68**, 944.
- Computing, Missouri River, **94**, 1753.
- Conducting, instructions of Gen. Warren, **68**, 303.
- Cost, Mississippi River, **11**, 1928, 3281.
- Cross-section work, Illinois and Mississippi Canal, **94**, 2178.
- Data, index to, Mississippi River, **95**, 3705.
- Dikes, **97**, 3927.
- Dredging, **94**, 2615; **95**, 3695.
- Electric power dams, **94**, 1780.
- Elevation monument, setting, Jefferson City, Mo., **94**, 3085.
- English, **76**, iii, 132.
- European, organization, **76**, iii, 127.
- European, government, **76**, iii, 128.
- Expense, reducing, Mississippi River, **10**, 3041.
- Feeder lines, canals, **96**, 2656.
- Field organization, survey, Mississippi River. 14-foot channel, H. D. 50, 61st, 1st.
- Field work, instructions, Lockport to St. Louis, H. D. 263, 59th, 1st.
- Geodetic monument, setting, Jefferson City, Mo., **94**, 3085.
- Great Lakes ship channel, **94**, 2263.
- Gurley's transit, inferiority of, **73**, 639; **74**, 726.
- Harbor of refuge, methods, Cape Lookout, **97**, 1432.
- Heliotrope, use of, **67**, 564; **78**, 1397.
- Instructions, general, **03**, 1910.
- Instruments, data, index to, Mississippi River, **95**, 3709.
- Instruments, lake survey, **70**, 552.
- Irish, **76**, iii, 138.
- Italian, **76**, iii, 168, 180.
- Lakes, instruments, errors, determining, **72**, 1048, 1103; **76**, iii, 64.
- Lake shores, methods, **93**, 4372.
- Land office and other, connecting, difficulties of, **68**, 302.
- Levees, **96**, 3721; **97**, 2127.
- Levees, connecting, **00**, 2500.
- Lighthouse, site, Chicago Harbor, **94**, 2133.
- Locks and dams, **11**, 1851.
- Locks and dams, for, methods, Allegheny River, **96**, 2214.
- Magnetic dip, lakes, **98**, 3769.
- Magnetic declination, lakes, **98**, 3769.
- Magnetic work, **97**, 4076.
- Meridian stone, setting, Jefferson City, Mo., **94**, 3085.
- Metallic tapes, comparison of, **93**, 1933.
- Methods, **88**, 1095; **90**, 1333, 1375, 1674; **91**, 1622; **92**, 547; **95**, 4221, 4228; **00**, 2071.

Surveys—Continued.

- Methods, Alabama River, **96**, 1402.
- Methods, Allegheny River, **99**, 2420.
- Methods, Aransas Pass, **00**, 2338.
- Methods, Bayou Teche, La., H. D. 527, 59th, 1st.
- Methods, best, Red River, **00**, 2491.
- Methods, Big Sandy River, **00**, 3403.
- Methods, Biscayne Bay, **97**, 1594.
- Methods, Black and Ouachita Rivers, **00**, 2512, 2549.
- Methods, Boston, **98**, 890.
- Methods, Brazos River, **97**, 1836; **00**, 2436.
- Methods, Cape Lookout, **00**, 1835.
- Methods, Cleveland Harbor, **98**, 2732.
- Methods, Columbia River, **68**, 877; **93**, 3391, **95**, 3538.
- Methods, Congaree River, **00**, 1866.
- Methods, Connecticut River, **68**, 757; **78**, 288, 304; H. D. 231, 58th, 3d; H. D. 1294, 61st, 3d.
- Methods, Coosa River, **98**, 1420; **05**, 1370; H. D. 219, 58th, 3d.
- Methods, Crystal River, **00**, 2030.
- Methods, details, Great Lakes surveys, **02**, 2839.
- Methods, Dismal Swamp Canal, **96**, 1088.
- Methods, Doboy Bar, **97**, 1542.
- Methods, Exeter River, **97**, 818.
- Methods, exploration, 40th parallel, **71**, 1028.
- Methods, final survey Arch Rock, San Francisco Bay, **01**, 3412.
- Methods, Forked Deer River, **95**, 2270; **97**, 2237.
- Methods, Fox River, **97**, 2730.
- Methods, French Broad River, **00**, 3021, 3052.
- Methods, Gasconade River, **96**, 3800.
- Methods, Grand River, La., **01**, 1897.
- Methods, Grays Harbor, **98**, 3063.
- Methods, Kalamazoo River, **98**, 2539.
- Methods, lake survey, **68**, 931; **72**, 1081; **76**, iii, 9, 70, 120; **92**, 3417.
- Methods, Licking River, **00**, 3164.
- Methods, Merrimac River, **96**, 618.
- Methods, Mississippi River, **72**, 334; **77**, 1106, 1196; **78**, 1095; **94**, 2767; **96**, 3721; **99**, 2149, 3372; **04**, S., 241; **05**, S., 78.
- Methods, Missouri River, **93**, 2315; **94**, 1749; **96**, 3797.
- Methods, Ohio River, **93**, 2459; **97**, 2338; **98**, 2059; **00**, 3199, 3203, 3223.
- Methods, Olympia Harbor, **93**, 3417.
- Methods, Orange River, **00**, 2037.
- Methods, Ouachita and Black Rivers, **96**, 1595; **98**, 1604.
- Methods, Puget Sound waters, **93**, 3421; **95**, 3424.
- Methods, Punta Rosa to Charlotte, **00**, 2046.
- Methods, Red River, **93**, 1925; **94**, 1339.
- Methods, reservoir sites, **98**, 2879.
- Methods, Rock Island Rapids, **72**, 334.
- Methods, Rockland Harbor, **96**, 582.
- Methods, St. Johns River, **00**, 1976.
- Methods, Sabine Lake, **97**, 1789.
- Methods, Sandusky Harbor, **98**, 2716.
- Methods, Sarasota Bay to Lemon Bay, **00**, 2062.
- Methods, shore lines, **92**, 3428.

Surveys—Continued.

- Methods, Southwest Pass, **99**, 1871.
 Methods, Starve Island Reef, Lake Erie, **98**, 2707.
 Methods, Tampa Bay, **97**, 1598.
 Methods, Tennessee River, **93**, 2335; **96**, 1946, 2035.
 Methods, upper Illinois and Des Plaines Rivers, **00**, 3862.
 Methods, upper White River, **00**, 2600.
 Methods, Warrior River, and Five Mile Creek, **99**, 1735.
 Methods, Wellfleet Harbor, Mass., **72**, 969.
 Methods, White River, **97**, 2487.
 Methods, Willamette River, **96**, 3318.
 Methods, Yazoo River, **96**, 1615.
 Military trail, Alaska, H. D. 192, 58th, 3d.
 Mississippi River, **97**, 3620; **98**, 3214.
 Missouri River, index to, **94**, 3113.
 Movable dams, **95**, 1899.
 Moving camps, methods, **98**, 1837.
 Nomenclature, Lockport to St. Louis; H. D. 263, 59th, 1st.
 Northern and northwestern lakes, **70**, 535; **71**, 982; **72**, 1031; **73**, 1170; **74**, ii, 402; **76**, iii, 3; **77**, 1105.
 Observations, lake surveys, **73**, 1195; **74**, ii, 440; **77**, 1181.
 Ohio Canals, **96**, 3005.
 One hundred meter tapes, tests, **00**, 2323.
 Organization, Mississippi River, H. D. 50, 61st, 1st.
 Organization, parties, **01**, 2532; **05**, 1369.
 Parties, Missouri River, **94**, 1749.
 Parties, organization, ice surveys, **95**, 4236.
 Plan, St. Marys River, **95**, 4228.
 Platting, abscissas and ordinates, by, **68**, 430, 431.
 Platting, Missouri River, **94**, 1753.
 Property required, **01**, 1833.
 Prussian, **76**, iii, 140, 156.
 Quarter boats, **97**, 2338.
 Refraction, **91**, 1899.
 Reservoir sites, **98**, 2878, 2879.
 River dams, **00**, 3203.
 Roads, Alaska, H. D. 192, 58th, 3d.
 Roads, wagon, **05**, 2839.
 Rocks, submerged, **01**, 1017.
 Russian, **76**, iii, 214.
 Scotch, **76**, iii, 138.
 Shore lines, methods, **95**, 4040.
 Shore-line work, substitutes for tertiary flags, **94**, 2799.
 Shores, lakes, **93**, 4372.
 Signals, lake surveys, **72**, 1103.
 Sites, locks and dams, **05**, 945.
 Spanish, **76**, iii, 181.
 Stadia, use of, distances, measuring, **72**, 1107.
 Standard measurements of, comparison, **68**, 940; **71**, 987, 991; **74**, ii, 444, 446.
 Standard measurements of, correction, **71**, 983, 986, 991; **74**, ii, 405, 410.
 Standard measurements of, determination of, **68**, 937; **72**, 1046; **77**, 1110.
 Standard measurements of, lake survey, **75**, ii, 854, 904; **76**, iii, 6, 79.

Surveys—Continued.

- Standard measurements of, length of, **68**, 931, 937, 947.
 Stations, index to, Great Lakes, U. S. standard datum, **03**, 2745.
 Stations, twist of, **72**, 1103; **73**, 1184; **75**, ii, 913.
 Steel tapes for, tests of, **93**, 1926.
 Swede, **76**, iii, 193, 212.
 Sweep, wire, economy of, **09**, 2496.
 Swiss, **76**, iii, 139, 192.
 Tapes, measure of, formula for, **93**, 1928.
 Targets, **95**, 4248.
 Targets, St. Marys River, **95**, 4248.
 Transit for, **72**, 1048, 1103.
 Traverse line, methods by, **98**, 1606.
 Tents, portable foundations, **98**, 1837.
 Water-power values, determining, **05**, 919.
 West of 100th meridian, **75**, ii, 923.
 Without instruments, methods, **94**, 2572.

Surveys, Geological.

- Fortieth parallel, **76**, iii, 217.

Surveys, Hydrographic.

- Methods, novel, **02**, 2773.
 Platting methods, novel, **02**, 2512.

Surveys, Topographical.

- Missouri River, **94**, 3113.

Surveys, Re-

- Astronomical work, **94**, 3322.
 Details, Lake Superior, **02**, 2840.
 Details, St. Clair River, etc., **02**, 2314.
 Methods, St. Marys River, **93**, 4358; **94**, 3422; **97**, 4074.
 St. Marys River, **93**, 4358; **94**, 3317; **95**, 4160; **97**, 4070.

Suspension Bridges.

- 69**, 398; **71**, 218, 405, 425, 432, 446; **78**, 1075.
 Niagara, **71**, 218; **78**, 1075.
 Ohio River, **71**, 405, 425; **79**, 1463.
 Wheeling, **71**, 405, 425.

Swamps. (See Lands.)**"Swash."**

- Underwater movement dangerous to shipping, Monterey Bay, H. D. 557, 59th, 1st.

Sweeping. (See Examinations.)

- Apparatus, soundings, **96**, 4066.
 Obstructions, finding, **04**, 4064. (See Surveys.)
 Rock removing, **96**, 4063.
 Shoals, examination of, **96**, 4062.
 Soundings, **92**, 3418; **94**, 3428.

Sweep, Wire. (See Surveys.)

- Great Lakes surveys, **09**, 2496; **08**, 2527.
 Shoals, finding, **07**, 847.

Swell.

- Formula, dams, **87**, 1306.
 Preventing, Duluth, H. D. 82, 59th, 2d.

Switchboard.

- Electric plant, gun batteries, **00**, 850.

Switches. (See Forts, p. 1797 of this Index.)

- Torpedoes, **89**, 493.

T.

Tamper.

Concrete work, **03**, 2424.

Tamping.

Blasting rock, **69**, 433.

Tanks. (See Cables.)

Dredges, hydraulic, **04**, S., 123.

Tape Lines.

Base lines, measuring, **05**, 3016.

Tapes. (See Brass; Surveys.)

Base-line measuring, **87**, 3124; **89**, 2759; **94**, 2729.

Correction of, base-line measuring, **94**, 2729.

Measuring, formula, **93**, 1928.

Measuring, tension balance for, **93**, 1926

Measuring, vernier for, **93**, 1926.

Tapes, Metallic.

Comparison, surveys, **93**, 1933.

Target Practice.

Platforms, building, **96**, 474.

Willets Point, **85**, 446.

Targets. (See Surveys.)

Targets, Phaseless.

Triangulation, **01**, S., 58.

Tar. (See Coal.)

Sand and, pile-head protecting, **92**, 1541.

Tarred Paper.

Concrete, adhesion of, preventing, **98**, 776.

Taxation.

Levees, **02**, S., 17. (See Levees.)

Teaming.

Cost, **04**, 3735.

Telaotographs. (See Forts, p. 1797 of this Index.)

Telegraph.

Longitude, determining, **73**, 1224; **74**, ii, 425, 434; **79**, 1895.

Transmission by, velocity, S. Ex. D. 42, 35th, 1st.

Telephones. (See Forts, p. 1797 of this Index.)

Lines, cost and maintenance, etc., **03**, 1612.

Telescopic Speaking Tube.

Forts, see p. 1797 of this Index.)

Telescopes, Water.

Breakwater construction, use in, **01**, 3318.

Temperature.

Barometers, effect on, **75**, ii, 971.

Concrete mortars, effect on, **94**, 2335.

Lakes, **71**, 1021.

Temperature, Minimum.

Depth of, lakes, **71**, 1021.

Templets.

Anchor bolts set without, gun platforms, **96**, 536.

Concrete pier construction, **04**, 3802.

Tenders.

Hydraulic dredges, **98**, 3181.

Tents. (See Surveys.)

Portable foundations, survey parties, **98**, 1837.

Teredo.

Absence from piles, unexpected, Columbia River, **08**, 2271.

Brush mats, destruction of, **76**, 316; **86**, 1312.

Cane proof against, **79**, 932, 937.

Chestnut timber proof against, **73**, 999.

Croosoted timber, effect on, **81**, 818, 819; **82**, 782.

Cribs, destruction of, **75**, ii, 99.

Mattresses, jetties, **82**, 1188; **86**, 1312.

Palmetto proof against, **68**, 512; **71**, 548.

Pile jetties, **00**, 4475.

Piles, destruction of, **92**, 2858.

Piles, different kinds of, effect on, **68**, 508, 512, **71**, 531, 536, 548; **79**, 937.

Piles attacked, tests to discover, **97**, 3373.

Pilework, protection, **06**, 758, 2014.

Protection against, hydraulic cement for, **76**, 570.

Protection against, hydrocarbon processes a failure, **73**, 1131.

Protection against, piles, **80**, 1212.

Protection against, sand accumulations, **73**, 800, 1131; **74**, 757; **75**, ii, 692.

Protection against, timber, special treatment of, **71**, 942.

Ravages of, cypress stumps, **76**, 327.

Ravages of, Galveston Bay, **68**, 512; **76**, 570.

Ravages of, Lewes, Del., **71**, 667.

Ravages of, Wilmington Harbor, Cal., **78**, 1292.

Sand-embedded timbers proof against, **73**, 800; **74**, 757.

Scarcity of, Humboldt Bay, **94**, 2550.

Timber, Aransas Pass, **88**, 1314.

Trestle work, depredations in, Columbia River, **07**, 2199.

Terminals.

Commerce, decline of, neglect of terminals a cause, Missouri River, H. D. 1120, 60th, 2d.

Congestion, New York, H. D. 1506, 60th, 2d.

Facilities at, important, waterway improvement, **10**, 2976.

Harborage, new, plans for terminals, Jamaica Bay, H. D. 1506, 60th, 2d.

Inadequacy, responsibility for, Charleston, S. C., H. D. 288, 62d, 2d.

River traffic, notable modern features, terminals, **12**, 2202.

Value, Tennessee River, H. D. 360, 62d, 2d.

Waterways, intracoastal, H. D. 391, 62d, 2d.

Terra Cotta.

Buildings, **96**, 4011; **04**, 3844, 3852.

Cement mortar, effect on, **96**, 2803.

Tertiary Triangulation. (See Triangulation.)**Tests.**

100-meter tapes, surveys, **00**, 2323.

T-heads. (See Dikes.)

Strengthening dikes, **98**, 1863.

Thermometers.

Errors, correction of, **79**, 1952.

Tests of, Lake Survey, **74**, ii, 456.

Tidal Action.

76, 380.

Tidal Basins.

Views, Washington, D. C., **10**, 2670.

Tidal Computing.

St. Johns River, **93**, 1634.

Tidal Data.

Brunswick Harbor, **95**, 1495.

Tidal Observations.

Alabama River, **79**, 829.

Annapolis Harbor, **81**, 872, 874.

Atlantic City, **81**, 833; **87**, 815.

Baltimore, **83**, 685.

Brazos River, **97**, 1839.

Buzzards Bay, **74**, ii, 283.

Calais, Me., **87**, 478.

Cape Fear River, **76**, 318; **77**, 339; **80**, 699, 706,

712; **81**, 927, 940; **86**, 997.

Charleston Harbor, **76**, 430; **78**, 544, 546, 549.

Columbia River, **81**, 2539, 2550.

Connecticut River, **68**, 764, 765; **78**, 378; **86**, 626.

Delaware River and Bay, **79**, 240; **80**, 715, 730, 733; **81**, 822.

Exeter Harbor, N. H., **81**, 496; **82**, 504.

Galveston Bay, **68**, 502; **74**, 732; **77**, 463; **80**, 1219; **86**, 1300, 1316.

Galveston Harbor, **95**, 1801; **96**, 1529.

Gulf of Mexico, **74**, 782, 791; **77**, 461.

Hartford, Conn., **80**, 404.

Housatonic River, **71**, 779, 785; **73**, 1013.

Hudson River, **66**, iv, 207, 209, 214; **68**, 716;

75, ii, 234; **85**, 679; **94**, 726.

Jacksonville, Fla., **87**, 1229.

James River, **73**, 778; **74**, ii, 43; **75**, ii, 75, 81; **76**, 294; **77**, 288; **78**, 456, 460; **80**, 650, 651;

81, 896; **83**, 685; **94**, 916.

Jonesport, Me., **80**, 361; **81**, 461.

Kennebec River, **88**, 422.

Lake Michigan, **66**, iv, 93; **72**, 1035.

Long Island, **72**, 913.

Mississippi River, **76**, 550; **00**, 4757.

Nanticoke River, Md., **80**, 731.

Nantucket Harbor, **80**, 429; **85**, 565.

Narragansett Bay, **81**, 561.

Newburyport Harbor, **81**, 501.

New Haven Harbor, **72**, 879.

New York Harbor, **80**, 532; **85**, 777.

Ocracoke Inlet, **94**, 999.

Pawtucket River, **71**, 736, 738; **74**, ii, 230, 237.

Pensacola Harbor, **91**, 1725.

Penobscot River, **88**, 429.

Portland Harbor, Oreg., **87**, 2507.

Potomac River, **76**, 357; **83**, 781.

Providence Harbor, **73**, 971; **80**, 379, 387.

Rancocas River, N. J., **81**, 798.

Tidal Observations—Continued.

St. Augustine, **88**, 1131.

St. Croix River, **67**, 503.

Sabine Pass, **82**, 1431; **86**, 1280.

Savannah Harbor, **73**, 738; **79**, 748; **82**, 1167; **94**, 1137.

Savannah River and Harbor, **88**, 1067; **89**, 1303; **90**, 1267; **91**, 1576; **92**, 1305, 1333.

Stonington Harbor, **72**, 919; **74**, ii, 246; **79**, 326.

Taunton River, **73**, 959.

Thames River, **72**, 830.

Woods Hole, Mass., **81**, 546.

Tidal Range.

Boston, **88**, 445.

Connecticut River, **88**, 530.

Jetties, various, **95**, 3531.

Manchester, Mass., **88**, 467.

Raritan Bay, N. J., **88**, 634.

Wellfleet Harbor, **88**, 480.

Tidal System.

North Atlantic coast, **74**, ii, 189, 190.

Tidal Volumes.

Savannah Harbor, various years, **96**, 1235.

Tidal Waves.

Action of, **68**, 766.

California, **77**, 990.

Height, ratio of decrease, Savannah River, **94**, 1137.

Rate of movement, **73**, 993.

Shape of, **68**, 766.

Tides. (See Floods; Gauges; Harbors; Records; Tidal Observations.)

Bars, effect on, harbors, **96**, 1190.

Bottom during ebb and flood, **92**, 1341.

Bridges, flow by, **74**, ii, 234.

Bridges, piers of, effect of, **74**, ii, 156, 234.

Changes in, Harlem River, **96**, 848.

Channel bottoms, effect on, **92**, 1341.

Complicated, Pacific coast, **75**, ii, 756.

Discharge, Charleston Harbor, **95**, 1422.

Diversion, Savannah, **76**, 435.

Estuaries, action in, **66**, iv, 66, 214; **68**, 919; **74**, ii, 379; **75**, ii, 196; **76**, 460.

Galveston Harbor, **98**, 1505.

Gauges, self-reading, **02**, 2514.

Gauging, **94**, 1138.

Harbors, exclusion from, effect, **76**, 471.

Harbors, Harlem River, **96**, 841.

Harbors, Savannah Harbor, **96**, 1222.

Heights of, Christiana River, **96**, 975.

Heights of, Hudson River, **96**, 826.

Hudson River, **95**, 901.

Influence of, reach of, Ocracoke Inlet, **94**, 1012.

Jetties, effect of, **71**, 750; **72**, 830; **78**, 558.

Jetties, effect upon, Biscayne Bay, Fla., H. D. 554, 62d, 2d.

Lakes, **66**, iv, 93; **72**, 1035; **73**, 1172.

Locks, tidal, factors governing choice, **04**, 1408.

Locks, tidal, intracoastal waterways, H. D. 391, 62d, 2d.

Northern and northwestern lakes, **73**, 1172.

Observations, improvement in methods, St.

Johns River, H. D. 611, 61st, 2d.

Tides—Continued.

- Obstructions, bridge piers, **68**, 717; **69**, 383; **74**, ii, 156, 234.
- Obstructions, rivers, effect, **74**, ii, 50, 156.
- Oscillation of, **73**, 988, 1001.
- Oscillation of, Ocracoke Inlet, **94**, 999.
- Peculiar action of, Boston, **98**, 888.
- Retardation, Staten Island, **73**, 943.
- Rivers, effect on, **68**, 919; **78**, 583.
- Shallow water, effect of, **75**, ii, 272.
- Strong currents, **95**, 1422.
- Theory of, **72**, 1036.
- Tidal curves, St. Johns River, H. D. 611, 61st, 2d.
- Tide gauges, **72**, 865.
- Tide gauges, self-registering, **99**, 3477.
- Tide gauges, Swinomish Slough, **95**, 3439.
- Tide range, Charleston Harbor, **96**, 1189.
- Tide range, jetties, various, **95**, 3531.
- Torrential velocity of, Swinomish Slough, **98**, 3077.
- Velocity of, Galveston Bay, **68**, 510.
- Velocity of, Long Island Sound, **73**, 993.
- Velocity of, Mississippi River, Breton Island Pass, **74**, 790.
- Velocity of, Ocracoke Inlet, **94**, 999.
- Velocity of, tidal basins, **73**, 993; **74**, ii, 276, 279; **78**, 558.
- Volumes, changes in, Savannah Harbor, **96**, 1222.
- Wind, effect of, **73**, 988, 1001.

Tides, Ebb.

- Flood tides and, bottom during, **92**, 1341.
- Flood tides and, computations, **90**, 1277.
- Flood tides and, gauging, Savannah River, **94**, 1138.

Tides, Flood.

- Determining, gauge readjustments, **96**, 1469.
- Ebb tides and, bottom during, **92**, 1341.
- Ebb tides and, computations, **90**, 1277.
- Ebb tides and, gauging, Savannah River, **94**, 1138.
- Planes of, changes of, South Pass, **96**, 1482.

Tides, Low.

- Current observations at low tide unsatisfactory, Mobile Harbor, H. D. 657, 61st, 2d.
- Soundings, reducing, **75**, ii, 77.

Tides, Opposing.

- Confluence of, bars at, **74**, ii, 35.

Tie-rods. (See Iron.)

- Buckling, correcting, **99**, 3818.

Tie-rods, Iron.

- Cribs, strengthening of, **98**, 1044.
- Pile piers, **68**, 156.

Ties.

- Strand ties, dikes, **03**, 2439.

Tile, Hollow.

- Walls of, forts. (See p. 1797 of this Index.)

Tiles, Sized.

- Water gauges of, **99**, 2504.

Tiling. (See Batteries.)

- Brick better than, fireproofing, **04**, 3837.
- Flooring, **04**, 3838.
- Gun batteries, **00**, 898, 982.
- Gun batteries, ceilings of, **99**, 786; **00**, 849.
- Gun batteries, walls, **99**, 786; **00**, 849.

Timber. (See Cribs; Gates; Locks; Lumber; Piers.)

- Absorption of water, **99**, 2638.
- Artificial preservation, **71**, 942.
- Chestnut timber, teredo-proof, **73**, 999.
- Compressive strength, **76**, 341.
- Concrete to replace, dam abutments, **11**, 2106.
- Creosoting, effect of, **68**, 144; **74**, 211, 212.
- Decay, preventing, **00**, 4092.
- Dikes of concrete and, **87**, 970.
- Dovetails, holding power, **84**, 2069.
- Driftbolts, holding power, **84**, 2051.
- Factors governing use of, piers, **01**, 2903.
- Floating of timber and logs, regulations, **01**, 2330.
- Foundations of, concrete piers, **96**, 2226.
- Foundations of, dams, **00**, 2771.
- Foundations of, locks, **00**, 2771.
- Old timber in breakwaters, **01**, 1072.
- Preserving, hydrocarbon processes, **69**, 28; **72**, 1006; **79**, 392.
- Preserving, hydrocarbon processes, failure, **79**, 1653.
- Preserving, lock gates, **78**, 780.
- Preserving, processes, Seely's, **68**, 38, 144.
- Protection of, coal tar, cribs, **69**, 28.
- Protection of, hydrocarbon process a failure against teredo, **73**, 1131.
- Rafts of, bridge piers, effect of; **77**, 820; **78**, 931.
- Securing, piers, **97**, 3069.
- Shore protection, **79**, 931; **89**, 770.
- Superstructures, decay of, **66**, iv, 71.
- Superstructures of, replaced by concrete, breakwaters, **01**, 3314.
- Structures of, life of, Great Lakes, **95**, 4187.
- Teredo-proofing, **71**, 942.
- Teredo-proofing, sand covering, **74**, 757.

Timber, Chestnut.

- Teredo proof, **73**, 999.

Timber, Creosoted.

- 81**, 815, 818; **84**, 2145; **85**, 2278.
- Cost, **81**, 690; **84**, 2145.
- Durability, breakwaters, **99**, 3142.
- Economy, breakwaters, **93**, 3213.
- Effect, **68**, 144; **74**, 211, 212; **81**, 818.
- Oil used, **81**, 815, 818.
- Teredo and, **81**, 818, 819; **82**, 782.

Timber Heads.

- Protecting, cribs, **96**, 2937.

Timber, Kyanized.

- 82**, 2456.
- Cost, **82**, 2457.
- Strength, **82**, 2459.

Timber, Sand-Embedded.

- Teredo proof, **73**, 800; **74**, 757.

Time.

- Determination, formula, **94**, 3339.

Tinning.

- Dredges, hydraulic, **04**, S., 112.

Titles.

- Forming in concrete, **05**, 3033. (See Forts, p. 1797 of this Index.)
- Lands, reclaimed, Anacostia River, H. D. 194, 59th, 1st.
- Reservoir sites, **98**, 2872, 2878.

Tollets.Buildings, steel, **04**, 3848.**Tolls.** (See Canals; Rates.)Canals, **78**, 274.Canals, Louisville and Portland, **72**, 449. (See p. 942 of this index.)

Canals, ship, H. D. 391, 62d, 2d.

Canals, Monongahela River, **96**, 2160.Green River, **80**, 1800.

Private channels, right of owner to collect, Grant Pass, H. D. 967, 60th, 1st.

Private companies, right of, Connecticut River, H. D. 818, 61st, 2d.

Rail charges and, comparison, **82**, 2497; **86**, 1944.Suez Canal, **80**, 985.Waterways, value of waterways determinable by, probably, **01**, 1564.**Ton Mileage.** (See Rates.)**Tonnage.** (See Commerce; Freight; Waterways.)

Barges, Sault Ste. Marie Canal, H. D. 263, 59th, 1st.

Great Lakes, H. D. 263, 59th, 1st.

Lakes, **74**, 590.

River and rail, by, Mississippi River, H. D. 50, 61st, 1st.

Tool Handles.Attacks of teredos, guarding against, **10**, 1080.
Engineer tool box, **10**, 1080.**Topographical Work.**Data, index to, Mississippi River, **95**, 3705.Instructions, general, **03**, 1910.Methods, **91**, 3481; **93**, 1974; **94**, 1751, 2800, 3325, 3420; **95**, 3699, 3701, 4169; **96**, 3520; **98**, 1610; **00**, 2555.

Methods, Lockport to St. Louis, H. D. 263, 59th, 1st.

Recording, details, **02**, 2817.Sketching, improving, **93**, 3601.**Topography.** (See Photo; Surveys.)

Observing, Altamaha surveys, H. D. 443, 62d, 2d.

Torches. (See Gas.)**Torpedo Cable.**Clamp, **05**, 3008.**Torpedo Defense.** (See Forts, p. 1793 of this Index.)**72**, 25; **74**, 30; **75**, 29; **76**, 30; **79**, 35.Current observations, **78**, 34.Forts and, close connection, **82**, 58.**Torpedoes.** (See Mines.)Automatic switches, **89**, 493.Bronze case, **89**, 492.Charge, **80**, 57.Coast defense, value of, **70**, 5; **84**, 5.Cut-off boxes, **89**, 492.Defensive purpose, **79**, 35.Dynamite for, experiments, **76**, 31.Electric motors, **83**, 54.Experiments, **83**, 54; **87**, 10, 418; **01**, 966.Explosives, tests, **84**, 59; **85**, 51; **86**, 51.Firing, **89**, 493.Formulae, **79**, 36; **80**, 57.**Torpedoes—Continued.**Fuses, tests, **89**, 495.Handling, trained force required, **81**, 13; **82**, 58.Mooring rope, **89**, 491.Materials, tests of new devices, **89**, 489.Planting, steamer for, **90**, 399.Platinum fuses, **84**, 60.Removing, Mobile Harbor, **66**, 54.Shackles, **89**, 491.Sims-Edison, trials, **93**, 657.Sympathetic explosions, **80**, 57.Tests, **88**, 352.Torpedo shed, **93**, 617; **94**, 456; **98**, 649.Trials, **77**, 25; **78**, 30; **79**, 36; **82**, 59.Trials, photography, value of, **82**, 448.Wire fuses, **84**, 59.Wires, McIntire jointer, **89**, 494.**Torpedoes, Fish.**Patrick, tests of, **89**, 497.Secondary importance, **84**, 60.Sims, **89**, 496.Tests, **89**, 481.**Torpedo, Sims.**Motors, **89**, 481.**Torpedo System.** (See Forts, p. 1797 of this Index.)**Torsion.**Preventing injurious torsion, locks, valves, **01**, 2659.**Tourist Routes.**Map of, Yellowstone National Park, **02**, 3048.**Towboats.** (See pl. 56.)Details, **01**, 2726.

Economical, barge transportation, Mississippi River, H. D. 50, 61st, 1st.

Towers. (See pl. 70.)Counterpoising, sluice gates, **09**, 2010.Range finders, **97**, 661.**Towing.** (See Canals; Rafts; Steam; Tunnels.)Belgium canals, **77**, 595.Cables for, **80**, 788.Canal tunnels, **77**, 695.Coal tows, size of, **84**, 1685.Experiments, canals, **77**, 690, 695, 700.Experiments, canal tunnels, **74**, 513, ii, 90; **77**, 686, 692, 694, 700.Horses, effective power of, **77**, 688, 690, 692.Kanawha, **75**, ii, 96.Locomotives, canal towing, **79**, 1251.Ohio tows, **79**, 1315; **82**, 1990.Rafts, rules, **95**, 2536.Rate, canals, **74**, 535; **75**, ii, 537.Small sections, effect of, canals, **76**, ii, 79.Steam power, canals, **69**, 536; **73**, 833; **74**, 498; ii, 90, 101; **75**, ii, 537; **77**, 688, 690, 694, 703; **79**, 1251.Stone, Mississippi River, **11**, 3292.Submerged cable, canals, **77**, 691, 695, 700.System of, coal barges, etc., Ohio River, **84**, 1685; **04**, 2434.**Towing, Steam.****77**, 695.

Towns, New.

Channels to, Smiths Creek, N. C., H. D. 774,
61st, 2d.

Tows. (See Coal.) (See pl. 35.)

Track.

Trestle and, economy of, dikes, 02, 1401.

Tracks, Elevated.

Concrete placing, 98, 620.

Tracks, Floating.

Dredgings, conveyance of, 99, 2921.

Dump cars on, 00, 3900.

Trackage.

Ports. (See p. 1797 of this Index.)

Traction.

Canal tunnels, 74, ii, 90; 76, ii, 79; 77, 686,
689, 700.

Trade, Coastwise.

Importance justifies Federal improvement,
Nantucket Sound, H. D. 536, 62d, 2d.

Trade, Foreign.

Growth, Boston, due to improvements, 08,
956.

Traffic. (See Commerce.)

Locks, Monongahela River, 11, 2114.

Mississippi River, 01, S., 33.

Profit from, shallow rivers, 95, 2282.

Roads, mountain, 03, 2466.

Supervision of, harbors, New York Harbor,
12, 3441.

Traffic, Coal.

Special advantages from canalization, 11, 743.

Traffic, Commercial.

St. Marys River, 01, 566.

Traffic, Inland.

Decline of (B. E. R. H.), Sen. D. 301, 61st, 2d.

Traffic, River.

Character and volume, Mississippi River, 01,
S., 33.

Diagrams, phases, Mississippi River, 01, S.,
40.

Factors of success, 10, 2976.

Shipping of Great Lakes unsuitable for, H. D.
50, 61st, 1st.

Steel shipped by special barges, Ohio River,
H. D. 492, 60th, 1st.

Trall, Military.

Surveying, Alaska, H. D. 192, 58th, 3d.

Training Walls. (See Walls.)

Trains. (See Wagons.)

Tramways. (See Jetties; Trestles.)

Building, stone jetties, 93, 3352; 94, 2566.

Extension, jetties, 93, 3334; 94, 2564; 95,
3362.

Jetties, 00, 4278.

Repair of, jetties, 94, 2635.

Rock placing, jetties, 94, 2544.

Stone jetties, 60, 4278.

Strengthening, stone jetties, 93, 3492.

Sway braces, omission of, 94, 2564.

Systems, dikes, 94, 2893.

Transfers, Freight.

Should be provided by local interests, Kansas
River, H. D. 94, 62d, 1st.

Transit.

Surveys, 72, 1048, 1103; 73, 639; 74, 726.

Translake Ferries.

93, 2905.

Transportation. (See Canals; Coal; Rail; Sedi-
ment; Water.)

Capacity for, canals, 71, 646; 74, 512, ii, 110,
118, 123; 76, 424.

Coal, 77, 639, 648, 654.

Competition between rail and water lines of
transportation, Chicago Harbor and vicinity,
H. D. 710, 62d, 2d.

Competition, effect of, 74, 599.

Cost of, canals, 69, 541; 71, 630, 639, 644, 646;
73, 221, 833; 74, ii, 111; 75, ii, 555; 78, 784.

Cost of, ship canals, 97, 3207.

Economical, 04, 1422.

Efficiency, high, coal shipments, Ohio River,
H. D. 492, 60th, 1st.

Freight and insurance rates, decline in, con-
sequent upon river and harbor improve-
ments, 88, 974, 1011.

Harbor design and, Great Lakes, H. D. 710,
62d, 2d.

Methods and facilities, Tennessee River, H. D.
360, 62d, 2d.

Methods of, growth of various, Maumee Val-
ley, H. D. 769, 62d, 2d.

Methods, various, by railroads and, compari-
son, 71, 630, 644.

Methods, various, relative advantages, vicinity
of St. Andrews Bay, Fla., H. D. 12, 61st, 1st.
Novel methods of, 68, 493.

Principles applicable in a study of transpor-
tation, rail and water way transportation
H. D. 769, 62d, 2d.

Rail rates, control through water rates, Cape
Fear River, H. D. 287, 62d, 2d.

Rates, comparison, U. S. and foreign countries,
Sen. D. 301, 61st, 2d.

River improvement, effect of, 87, 1921, 2116.

Routes, maps of, Great Lakes-Seaboard-Ohio
River territory, H. D. 769, 62d, 2d.

Traffics, coastal, H. D. 391, 62d, 2d.

Waterway and railway, relation, Sen. D. 301,
61st, 2d.

Transportation, Great Lakes.

Advantages over river transportation, through
absence of currents, etc., H. D. 492, 60th, 1st.

Transportation, Inland.

Decline of, on waterways, Sen. D. 301, 61st, 2d.

Transportation, Intensive.

Development of, by conditions, Great Lakes-
Seaboard-Ohio River territory, H. D. 769,
62d, 2d.

Transportation, Local.

Study of, in systematic improvement of Chi-
cago Harbor and vicinity, H. D. 710, 62d, 2d.

Transportation, Rail and Water.

Chicago Harbor and vicinity, H. D. 710, 62d,
2d.

Transportation Routes.

World routes, map, H. D. 492, 60th, 1st.

Transportation System.

Great Lakes to be considered as, 07, 849.

Transportation, Water.

- Revival of commercial interest, Mississippi River, **10**, 2976.
- Control over, none, Texas, H. D. 1290, 61st, 3d.
- Cost, Great Lakes, **09**, 1943.
- Decrease due to unreliability of streams, H. D. 492, 60th, 1st.
- Disadvantages from lack of, **04**, 2208.
- Rates lower by, Great Lakes, **10**, 2096.

Trap Gates. (See Gates.)**Travelers, Concrete.**

- Concrete pier construction, **04**, 3802.

Traverse Lines. (See Triangulation.)

- Methods, **99**, 1736.
- Running, **98**, 1606.
- Triangulation, substitute for, **00**, 2550.

Traverses. (See Forts, p. 1797 of this Index.)**Trees.**

- List of, Executive Mansion, **00**, 5245.
- List of, Washington, D. C., **90**, 3556; **00**, 5286.
- Monuments, as, **04**, 4046.
- Planting, erosion preventing, **98**, 2739.
- Sandy peninsulas, preserving, **96**, 3105; **97**, 3100.

Trees and Shrubs.

- List of, Washington, D. C., **05**, 2757.

Trees, Historic.

- Washington, D. C., **04**, 4046.

Trees, Locust.

- Erosions, preventing, **98**, 2739.

Trees, Poplar.

- Shore protection, **71**, 205, 208.

Trenches.

- Excavating, **98**, 2769.
- Foundations, cribs, **75**, 305; **76**, ii, 571.
- Trestles, concrete pier construction, **04**, 3802.

Trenching.

- Sea walls, **05**, 3024.

Trestles. (See Dams; Tramways.)

- Breakwater, stone; depositing, **93**, 3227.
- Calculations, movable dams, **97**, 2558.
- Concrete pier construction, **04**, 3802.
- Construction, considerations governing, jetties, **08**, 823.
- Destruction of, a hindrance to rockwork, Columbia River jetties, **08**, 2271.
- Engineer troop, **02**, 816.
- Jetties, building of, **98**, 2954.
- Maneuvering, movable dams, **96**, 2315.
- Movable dams, **96**, 2313.
- Repairing, jetties, **98**, 2952.
- Repairing, rock jetties, **97**, 3370.
- Strengthening, rock jetties, **97**, 3373.
- Teredo attacks, Columbia River; **07**, 2199.
- Track and economy of, dikes, **02**, 1401.

Trestlework.

- Stone placing, jetties, **94**, 2517.
- Strengthening, rock jetties, **96**, 3212.

Triangles.

- Length of triangulation, **67**, 564, 573; **70**, 544.

Triangulation. (See Base Lines; Bench Marks; Surveys; Traverse Lines.)**Triangulation—Continued.**

- 88**, 1144; **90**, 1413, 1845, 2759; **91**, 3474; **92**, 1332; **93**, 1935; **94**, 3410; **95**, 4179; **96**, 4023.
- Accuracy, insuring, **01**, S., 58.
- Adjustment and adaptation, Great Lakes surveys, to U. S. C. and G. datum, **02**, 2883, 2903.
- Adjustment, St. Marys River, **96**, 4033.
- Angles, measuring, **94**, 3325; **95**, 4167, 4216.
- Angles, reading, **94**, 3409.
- Astronomical observations, **96**, 4025.
- Astronomical work for, methods, **93**, 4348.
- Base lines, measuring, 500-foot steel tape, **95**, 4230; **05**, 3016.
- Connecting, Great Lakes, **97**, 4104.
- Data, index to, Mississippi River, **95**, 3703.
- Detroit River, **96**, 2756.
- Field work, **96**, 4029.
- Forts. (See p. 1793 of this Index.)
- Geographical positions, Mississippi River, **94**, 2733.
- Geographical positions, Missouri River, **93**, 3942.
- Great Lakes, **97**, 4108; **02**, 1243; **10**, 2716.
- Great Lakes ship channel, **94**, 2263.
- Methods, Missouri River, **83**, 1334.
- Methods, lakes, **93**, 3422.
- Mississippi River, **92**, 3576.
- Missouri River, **96**, 3797.
- Missouri River Commission and U. S. C. G. S., connection, Kansas City, **94**, 3085.
- Mortar projectile, location of, **91**, 550.
- Observed angles, possible errors, **73**, 1178.
- Planning, **94**, 3323.
- Planning, St. Marys River, **96**, 4028.
- Red River, **93**, 1935.
- Reference points, milestones for, **96**, 1402.
- Refraction coefficient, **73**, 1189.
- Refraction, effect of, **67**, 575.
- Refraction, Lake Superior, **96**, 4037.
- St. Marys River, **95**, 4166; **96**, 4058.
- Secondary, instructions, **91**, 3474.
- Signals, **87**, 1228.
- Signals, northern and northwestern lakes, **67**, 573, 575.
- Signals, remarks on, **78**, 1397.
- Southwest Pass, **99**, 1872.
- Stations, **95**, 4174, 4233; **96**, 4029.
- Stations, building, **93**, 4355.
- Stations, building, soft soil, **00**, 2073.
- Stations, concrete, **94**, 1378.
- Stations, form of, Coosa River, **98**, 1420.
- Stations, Galveston Bay, **02**, 1358.
- Stations, gas pipe for, **03**, 2685; **04**, 4064.
- Stations, St. Marys River, **95**, 4174, 4233; **00**, 3954.
- Substitutes, traverse line, **00**, 2550.
- Targets, phaseless, **01**, S., 58.
- Triangles, sides of, length, **67**, 564, 573; **70**, 544.

Triangulation, Primary.

- Planning, **93**, 4352.
- St. Marys River, **94**, 3396, 3403, 3404, 3409; **95**, 4185; **96**, 4023, 4038.

Triangulation, Secondary.

- Base line, Missouri River, **94**, 3113.
- Base lines, tape measurements, **94**, 2729.

Triangulation, Secondary—Continued.

- Geographical positions, Missouri River, **93**, 3942.
- Methods, **99**, 3339.
- Mississippi River, **93**, 3589; **95**, 3688; **96**, 3501.
- Missouri River, **94**, 3113.
- Potagannissing Bay, **97**, 4084.
- Stations, Mississippi River, **93**, 3596 (upper); **94**, 2746; **95**, 3735; **96**, 3515; **99**, 3385.

Triangulation, Tertiary.

- Cypress Bayou, **93**, 2077.
- Detour passage, **97**, 4091.
- Methods, Lockport to St. Louis, H. D. 263, 59th, 1st.
- Mississippi River, **93**, 3603; **96**, 3510.
- Missouri River, **94**, 1750.
- Potagannissing Bay, **97**, 4087.
- Red River, **93**, 1937.
- St. Marys River, **95**, 4192; **96**, 4046.

Tributaries.

- Control of, floods of main streams, H. D. 81, 62d, 1st.

Tributaries and Rivers.

- Floods of, combining of, **98**, 2853, 2887.

Tripods.

- Dams, **96**, 1931.
- Drilling platform, rock drilling, **74**, ii, 260; **76**, 670; ii, 323.

Tripping.

- Apparatus for, movable dams, Big Sandy River, **07**, 1777.

Tripping Device.

- Movable dams, **91**, 2353.

Troops. (See Engineers.)**Tropical Plants.**

- Rare tropical plants, list of, Washington, D. C., **05**, 2756.

Trusses. (See Bridges.)

- Arch bridges, disadvantages of, **74**, 641, 652, 661; **75**, ii, 680; **76**, 334; **77**, 1102.
- Bridges, **69**, 195; **70**, 245, 251, 262, 263; **72**, 286, 291; **90**, 3596.
- Roads on, **69**, 195; **70**, 251, 263; **72**, 286, 291.

Trusses, Arched.

- Bridges, **75**, ii, 680.

Tunneling.

- Explosive work, fine record, **94**, 3199.

Tunnels. (See Batteries; Blasting; Canals; Mines; Railroads; Rivers; Water Supply.)

- 76**, ii, 124.
- Arch experiments, **99**, 3806.
- Backing, filling voids, **99**, 3803.
- Batteries, **00**, 898.
- Blasting, **76**, ii, 124.
- Blossom Rock, **71**, 926.
- Boats in, velocity, **77**, 685, 700.
- Bridges and, comparison, **74**, 603, 620.
- Building, Falls of St. Anthony, under, **70**, 283; **71**, 294; **72**, 304.
- Canal boats, effect on, **76**, ii, 80.
- Canals, **76**, ii, 79, 124; **77**, 685.
- Canals, objections to, **77**, 690.
- Conduits, Washington Aqueduct, **96**, 3929.

Tunnels—Continued.

- Cost of, **72**, 1165; **74**, 496, 497, 549, ii, 100; **76**, ii, 103, 124; **77**, 696.
- Detroit River, **74**, 598, 608, 619, 631; **90**, 3462.
- Digging. (See pl. 50.)
- Drilling, **76**, ii, 124.
- Dry rubble backing, **99**, 3803.
- Gas, effect of, **77**, 692.
- Gas, gathering of, **77**, 693.
- Hell Gate, **71**, 724; **72**, 803; **73**, 934; **74**, ii, 161.
- Hudson River, **70**, 440.
- Lime Rock, **68**, 20.
- Lining, iron, **99**, 3802.
- Lowering, opposition to, city streams, Chicago, **06**, 1774.
- Moisture in, preventing, lining, **96**, 472.
- Obstructions, across navigable waters, Chicago, **05**, 2073.
- Percolation, water supply, District of Columbia, **01**, 3666.
- Progress on, **76**, ii, 124; **77**, 697, 707, 708.
- Removal difficult, under city streams, **05**, 2073.
- River depths, restricting, **77**, 2796.
- Rock drilling, **76**, ii, 124.
- St. Anthony Falls, **70**, 283; **71**, 294; **72**, 304; **73**, 408; **74**, 277; **75**, 356.
- St. Gothard, **77**, 708.
- Shafts, **72**, 1154, 1161; **76**, ii, 126; **77**, 697, 707, 708.
- Silting in, water-supply system, District of Columbia, **01**, 3667.
- Sutro tunnel, **72**, 1126.
- Towing through, canals, **74**, 513; ii, 90.
- Ventilation, **77**, 693.
- Wall over, building, **95**, 2437.
- Washington Aqueduct, **84**, 2304; **85**, 2453; 2469, 2480, 2496; **86**, 2045; **87**, 2537, 2547.
- Water flow, formula, **94**, 3199.
- Water power, designing, Ouachita system, H. D. 588, 62d, 2d.
- Water supply, **96**, 3936.
- Work, lighting, **99**, 3805.

Tunnels, Celebrated.

- 77**, 707.
- Canals, **71**, 628, 638; **76**, ii, 81.

Tunnel, Sutro.

- Report on, **72**, 1126.

Turbidities. (See Water Supply; and see p. 2040 of this Index.)

- Checking, water supply, District of Columbia, **08**, 879.

Turbines. (See Power; Pumping.)

- Culverts, valves, locks, **96**, 3273.
- Efficiency of, **74**, 554.
- Locks, operating, **97**, 2977; **11**, 2109.
- Pumping, locks, **95**, 2905.
- Pumping plant, **98**, 2981.
- Tests, Niagara Falls, **11**, 3028; **12**, 3550.

Turnbuckles.

- Stripping of threads, lock gates, **11**, 2109.

Turntables.

- Flat cars and, **04**, 3738.

Typical Cribs.

- Cross sections of, **96**, 2578.

U.

Undermining. (See Caving; Dams; Jetties; Revetment.)

- Jetties, stone placing to prevent, **95**, 3312.
- Preventing, cribs, **97**, 3065.
- Preventing, dams, **00**, 3258.
- Preventing, jetties, **95**, 3312, 3315.
- Preventing, slopes, revetment of, jetties, **95**, 3315.
- Preventing, spurs for, jetties, **94**, 2543.
- Protecting against, stone jetties, **93**, 3490.
- Revetment to prevent, jetties, **95**, 2216.
- Sheet-pile dams, **98**, 1487.
- Stone, to prevent jetties, **95**, 3312.

Underpinning.

- Buildings, Government Printing Office, **01**, 3817.
- Buildings, **04**, 3826, 3860.

United States. (See States; Waterways.)

- Canals aided by, H. D. 781, 60th, 1st.
- Commerce, development of, participation of U. S. in, H. D. 781, 60th, 1st.

United States—Continued.

- Improvements, private, aid of, H. D. 781, 60th, 1st.
- Railroads aided by, H. D. 781, 60th, 1st.
- Rights of, and States, Connecticut River, H. D. 818, 61st, 2d.
- Roads, wagon, aid of, H. D. 781, 60th, 1st.
- South, resources of, **04**, 1420.
- State and U. S. waterways, definition, H. D. 953, 61st, 2d.
- Water power on navigable streams, participation in development of, H. D. 781, 60th, 1st.

United States Dredges. (See Dredges.)

- Commendation, strong; maintenance work, **08**, 1161.
- Operating, expenses, **08**, 1076. (See p. 2337 of this Index.)

United States Improvements. (See Improvements.)**Unloading.**

- Methods, materials for construction, **02**, 2493.

V.

Valleys.

- Lands of, protection against floods, California, H. D. 262, 59th, 1st.
- Reservoirs in, **98**, 2821.

Valleys, Open.

- Reservoir sites, **98**, 2821, 2828.

Valves. (See Gates; Locks.) (See pl. 63.)

- Breakdown due to vibration, locks, **11**, 2110.
- Coverings, locks, **09**, 1705.
- Dams, bear-trap, **01**, 2314.
- Dredges, hydraulic, **04**, **8**, 115.
- Levees, **02**, 1642.
- Lock culverts, **96**, 3271.
- Lock gates, **76**, ii, 416.
- Locks, **91**, 2370, 2742; **04**, 3758.
- Operating, difficulty, causes of, locks, **00**, 3389.
- Operating, locks, filling of, **98**, 2019.
- Operating, machinery, locks, **98**, 1921.
- Safety latch, lock gates, **93**, 1734.
- Torsion, preventing injurious, locks, **01**, 2659.
- Turbine culverts, locks, **96**, 3273.
- Types, best, locks, **11**, 2035.

Vegetation. (See Bars.)

- Starting, bars, **98**, 1786.
- Water for, amount required, **68**, 963; **79**, 1238.
- Waves, effect of, **72**, 215.

Velocities. (See Boats; Currents; Sediment; Waves; Winds.)

- Depth and relations, rivers, **76**, 451.
- Measuring, St. Lawrence, **02**, 2799.
- Measuring, Mississippi River, **11**, 1946.

Ventilation. (See Forts, p. 1797 of this Index.)

- Batteries, **99**, 787; **00**, 860, 893, 1023.
- Buildings, **04**, 3856.
- Comstock mines, **72**, 1131.
- Condensation, governing, forts. (See Forts, p. 1797 of this Index.) (NOTE.—An important subject in connection with construction of waterproof concrete works.)
- Tunnels, **77**, 693.

Vernier.

- Tapes, measuring of, **93**, 1926.

Vessels. (See Boats; Lakes; Ships.)

- Anchorage for, area required, **84**, 579, 585; **85**, 531.
- Ballast, depositing of, places, **96**, 1342.
- Casualties, Great Lakes, **10**, 2098.
- Damages from ice, **77**, 111.
- Damages, harbor entrances, Great Lakes, H. D. 82, 59th, 2d; **09**, 1941.
- Depth of, increasing, canals, H. D. 340, 59th, 2d.

Vessels—Continued.

- Dimensions, **74**, 817, 845.
Dimensions, New York lines, **85**, 781.
Dimensions, St. Marys River, H. D. 64, 62d, 1st.
Draft, channel depths not increasing as fast as, Wilmington, Ala., H. D. 1114, 60th, 2d.
Draft of, entering and leaving New York Harbor, **88**, 619.
Harbors, entrance to, facilitating, Marquette Mich., H. D. 573, 61st, 2d.
Injury of, preventing, narrow channels, **98**, 1046.
Lake tonnage, **68**, 164; **69**, 144; **74**, 590; **75**, 282.
Magnetic variation observation, **04**, 4133.
Masts, height of lakes, **74**, 614.
Mississippi River, H. D. 50, 61st 1st.
Ocean, lake, and canal, comparison of, **97**, 3172.
Protecting, ice, sheer booms for, **78**, 828; **79**, 1363.
Responsibilities for damage to revetments, **08**, 1926.
Size, increase in, due to river and harbor improvements, **08**, 717.
Size of, increasing, Great Lakes, H. D. 900, 59th, 1st.
Stopping, distance needed, H. D. 317, 61st, 2d.
Submarine mines, passage of, regulations for, **98**, 636.
Submarine mines, planting, **86**, 51.

Vessels—Continued.

- Types, most economical, channels and, H. D. 710, 62d, 2d.
Vessels, Deep-Draft.
Canals, practical value of, Sen. D. 301, 61st, 2d.
Vessels, Large.
Channels for, design, Jamaica Bay, H. D. 1506, 60th, 2d.
Vessels, Twelve-foot.
Becoming rare on Great Lakes, H. D. 306, 61st, 2d.
Vested Rights.
Great Lakes levels and, H. D. 263, 59th, 1st.
Vladucts. (See pl. 67.)
Concrete, forming, **03**, 2470.
Concrete, details, Yellowstone Park, **01**, 3778.
Mountains, **03**, 2470.
Vibration.
Bridges, effect on, **75**, ii, 680; **77**, 1099, 1102.
Valve breakdown due to, locks, **11**, 2110.
Vicat Needles.
Cement testing, **96**, 2670.
Voids.
Broken stone, ratio to, **74**, ii, 377; **78**, 1136.
Dry rubble backing, **99**, 3803.
Filling, rubble backing, water tunnel, **00**, 5213, 5214.
Filling, tunnel, back of, **99**, 3803.
Jetties, effect in, **82**, 1434; **85**, 681.
Volga River.
Improvement of, H. D. 1120, 60th, 2d.

W.**Wagon.**

- Tool box, Engineer, **10**, 1080.

Wagon Roads. (See Roads.)

- Alaska, H. D. 192, 58th, 3d.

Wagon, Sprinkling.

- Pumping, Yellowstone Park, **02**, 3044.

Wagon Trains.

- Bridges built by, **77**, 1354.

Walks. (See Concrete.)**Walls.** (See Concrete; Entrances; Lands; Locks; Rivers; Stones.) (See pls. 24, 32, 34, 37, 39, 67.)

- Buildings, steel, **04**, 3829, 3860.
Concrete for, composition, **01**, 911.
Concrete locks, **74**, 786, 820; **75**, 904, ii, 623.
Forts. (See Forts, p. 1797 of this Index.)
Locks, raising walls of, **11**, 2035.
Painting of, breakwater substructure, **99**, 3140.
Reinforcement of, concrete for, **98**, 2002.
Tiles, gun batteries, **99**, 786; **00**, 849.
Tunnels, building over, **95**, 2437.
Voids filled with grout, canals, **11**, 2110.
Whitening. (See Forts, p. 1797 of this Index.)

Walls, Concave Training.

- Good results, **93**, 1337.

Walls, Concrete.

- Air spaces, **97**, 631; **99**, 786; **00**, 849, 978.
Air spaces, batteries, **97**, 631; **99**, 786; **00**, 849, 978.
Booths in. (See Forts, p. 1797 of this Index.)
Building, **96**, 471; **00**, 2772.
Building, dams, **06**, 1611.
Building, locks, **94**, 2176; **00**, 3504.
Coloring, **04**, 3727.
Facings, hollow-tile. (See Forts, p. 1797 of this Index.)
Forming, levees, **98**, 3543.
Forms for, **96**, 2283; **98**, 1992; **00**, 2257, 2784.
Lining. (See Forts, p. 1797 of this Index.)
Locks, **74**, 786, 820; **75**, 904, 957, ii, 623.
Mining casemates, **96**, 471.
Reinforcing. (See Forts, p. 1797 of this Index.)
Waterproofing, **99**, 732.
Whitewashing, **03**, 2420.
Walls, Core.
Slopes, water, effect on, **12**, 2150.

Walls, Entrance.Designing, locks, **00**, 2975.**Walls, Fortification.** (See p. 1797 of this Index.)**Walls, Inlet.**Barriers, Yuba River, **06**, 2078.**Walls, Land.**Design, locks, **00**, 2973.**Walls, Lift.**Designing, locks, **00**, 2976.**Walls, Lock.**Building, **04**, 3757.Designing, waterway, Lockport to St. Louis,
H. D. 263, 59th, 1st.Stability with increased height, **05**, 1755.Ship locks, Black Rock River, **10**, 2318.**Walls, Retaining.**Colbert Shoals Canal, **99**, 2272.Building, methods of, dams, **06**, 1611.Roads, mountainous, **03**, 2454.**Walls, River.**Building, locks, **00**, 3504.Designing, locks, **00**, 2972.**Walls, Sea.**Backing, and methods of backing, **01**, 921.Beaches, protecting, **95**, 995.Boston Harbor, **72**, 1085; **74**, ii, 313; **78**, 207.Building, **95**, 509.Cement for, **05**, 3025.Concrete blocks, proposed, Galveston Bay,
71, 520.Concrete, broken stone for, **05**, 3025.Concrete, materials, of, **05**, 3026.Concrete, mattress and stone, **01**, 921.Concrete, of, cross sections, **05**, 3028.Concrete, sand for, **05**, 3025.Concrete work, cross sections, **05**, 3028.Cost, Boston Harbor, **73**, 1086; **74**, ii, 313.Cost, Galveston, **10**, 1657.Cross sections, reductions in, Lovells Island,
69, 441.Deer and Lovells Islands, **67**, 470; **70**, 461;
P. P. No. 2, C. E.Design, **92**, 460.Details and plan of construction, **01**, 921.Deterioration, **01**, 1079.Filling behind, methods, **01**, 921.

Forts. (See Forts, p. 1797 of this Index.)

Gallop Island, **71**, 888.Great Brewster Island, **67**, 467.Piling, sheet, **05**, 3025, 3028.Point Allerton, **71**, 889.Proper section for, **73**, 948.Repairing, **92**, 454.Repairs, **05**, 3010.Riprap protection, **05**, 3027; H. D. 1506,
60th, 2d.Section, Boston Harbor, **75**, ii, 406.Section, Buffalo, N. Y., **67**, 136.Section, Lovells Island, **69**, 442.Successful, Boston Harbor, **71**, 829.

Sustaining walls, P. P. No. 3, C. E.

Trenching, **05**, 3024.**Walls, Sea; Old.**Marblehead Harbor, **97**, 871.St. Augustine, condition good, H. D. 580,
62d, 2d.**Walls, Solid.**Cribs, **70**, 196.**Walls, Sustaining.**

P. P. No. 3, C. E.

Walls, Training.Altamaha River, **93**, 1562.Building, Grand River, **99**, 2924.Cribs for, Brunswick Harbor, **95**, 1491.Deposits behind, **00**, 3904.Failure of, lack of height the cause, **99**, 1562.Fascines for, **93**, 1562.Foundations, mattresses for, **95**, 1491.Locating, levee system, **04**, S., 244.Piles, **93**, 1562.Plan, Mississippi River levees, **04**, S., 244.Regulation, experimental work of, Savannah,
08, 1328.Rivers, effect on, **97**, 2250.

Types, Altamaha system, H. D. 443, 62d, 2d.

Walls, Traverse.

Forts. (See p. 1797 of this Index.)

Walls, Vertical.

Forts. (See p. 1797 of this Index.)

War.Improvement of Key West Harbor for naval
needs, H. D. 706, 62d, 2d.**War College.** (See p. 2066 of this Index.)**Warehouses.**Design of, details, to guard against flood dam-
ages, H. D. 772, 59th, 1st.**Warfare.**Defense, provisions for, designing canals,
Puget Sound, H. D. 953, 60th, 1st.**Washes, Paints and.**Concrete work, **02**, 2494.**Washington Monument.** (See Miscellaneous,
p. 2040 of this Index.)Iron framework, changes in, **98**, 3716.Movements of, **98**, 3669.Movements of, recording apparatus, **98**, 3672.**Washington, State of.**Statute governing private dredging, **01**, 3599.**Wash, Wave.**Levees, Mississippi River, **03**, S., 315; **04**,
2056.**Waste.** (See Water Supply.)**Water.** (See Canals; Rates; Transportation.)Absorption of, **99**, 2638.Acre-foot, value of, **98**, 2875.Canals, drawing from, rules, **95**, 2659.Chemical examination, **96**, 3943, 3957.Commodity, water as a, **98**, 2867.Consumption of, Washington, D. C., **01**, 3656.
(See p. 2040 of this Index.)Depth of, formula, dam crests, **77**, 742.Depth of, velocity and, relation, **84**, 1620; **87**,
2706.Displacement in, calculating, **93**, 1119.Dynamite, effect on, **79**, 1507.Evaporation, **82**, 1207.Freezing below, **75**, ii, 203.Gauges, **72**, 427.Gauges, novel arrangement, **92**, 3417.Gauges, sized tiles, gauges of, **99**, 2504.

Water—Continued.

- Gauging, conduits, **97**, 4004.
- Land and, evaporation from, **69**, 603; **70**, 570.
- Lease of, Muskingum River. (See each annual report and p. 974 of this Index.)
- Lock operating, amount required, **00**, 3167.
- Louisville Canal, analysis, **87**, 1863.
- Machinery operating locks, **96**, 3274.
- Reservoirs, deposits in, **93**, 4297.
- Stone setting in, **00**, 4134.
- Surface velocity, mean and, relation, **85**, 2580, 2597, 2613; **87**, 1229.
- Telescope, submarine stone setting, **00**, 4134.
- Transportation, rail and, comparison, **71**, 630, 644; **72**, 518; **74**, ii, 106, 116, 123; **77**, 399, 640, 645, 654.
- Transportation rates, rail and, **82**, 2497; **87**, 2129, 2130.
- Washington, D. C., **88**, 2759.
- Waste of, by cities, **02**, 598.
- Wind, depth affected by, harbors, **67**, 218; **68**, 154, 171.
- Vegetation, amount of water required, **68**, 963; **79**, 1238.
- Volume, hydraulic mining, **82**, 2611.

Water Competition.

- Necessity of, large manufacturing centers, Merrimac River, H. D. 2, 61st, 2d.

Water, Conduits for.

- 96**, 3910.
- Deposits in, **96**, 3924.
- Deposits in, removal, **92**, 3357.
- Flow in, formula, **93**, 4277.
- Inspection, **92**, 3353.
- Proper grades, **93**, 4283.

Water Connections.

- Ports. (See p. 1797 of this Index.)

Water, Deep.

- Rates, freight, effect on, H. D. 267, 62d, 2d.

Water, Drinking.

- Bacteria tests, immediate examination necessary, **06**, 2105.
- Buildings, supplying to, **04**, 3850.
- Hardness, filtration not a cause of, **06**, 2106.

Water, Elevations of. (See Water, Heights; below.)

- Cypress Bayou, **93**, 2075, 2082.
- Dismal Swamp Canal, **96**, 1090.
- Mississippi River, **93**, 2843.
- Missouri River, **93**, 2236.
- Ouachita River, **94**, 1465.
- Puget Sound, **95**, 3427.
- St. Marys River Falls Canal, **93**, 2996.
- South Pass, La., **94**, 1346.
- Tennessee River, **93**, 2364.

Water, Filtration of.

- 94**, 3203; **98**, 3642, 3650; **99**, 3808.
- Cost, **98**, 3647.
- Natural filtration, **94**, 3207.
- Works for, **94**, 3209.

Water, Filtration (Sand).

- 94**, 3243.
- Held by, amount of, **79**, 1241.
- Water in, slope, **76**, 393.

Water, Flowage of.

- Formula, conduits, **93**, 4277.
- Formula, tunnel, **94**, 3199.
- Grass, effect of, **73**, 1008.
- Sluices, **80**, 1621, 1623.

Water Freight.

- Saving over rail rates, **10**, 690.

Water, Fresh.

- Preventing salt water mingling with, gates for, H. D. 836, 61st, 2d.

Water Fronts.

- Reconstruction, Philadelphia Harbor, **99**, 1336; **00**, 2186.

Water Gauge. (See Gauge.)**Water, Heights of.** (See Water, Elevations, above.)

- Atchafalaya River, **93**, 3661.
- Big Sandy River, **96**, 2318.
- Black River, **00**, 5391.
- Brunswick Harbor, **95**, 1495.
- Contraction works, effect, **93**, 1747.
- Crevasses, effect on, **91**, 3444; **95**, 3656.
- Great Lakes, **81**, 2800; **82**, 2344; **84**, 2011; **86**, 1844; **87**, 1983, 2217, 2268, 2417; **95**, 3088.
- Lake Erie, **94**, 3431; **98**, 2712; **00**, 5400.
- Lake Huron, **00**, 5400; 1894-1900, **00**, 5401.
- Lake Michigan-Huron, **00**, 5401.
- Profile, Red River, **94**, 1440.

Water, High.

- Detrimental, lock banks, **11**, 2048.

Water Hyacinth. (See p. 572.)

- Crushing methods recommended for destroying in rivers, **99**, 1615; **02**, 326.
- Destruction of, experiments, **03**, 2433.
- Removal, catamaran scow elevator for, **11**, 461.
- Methods for removal, **11**, 561.

Water Jet. (See Jet.)

- Bank grading, **80**, 1444-1448; **81**, 1502, 1611; **82**, 1504, 1576, 1685, 1688, 1691, 1701, 1715; **83**, 1228, 1231, 1310, 1315, 1320, 1325, 2296; **84**, 2765, 2780, 2799, 2801, 2836; **85**, 2775, 2949; **87**, 2915.
- Borings with, **72**, 251; **74**, 724; **75**, 235; **79**, 393; **81**, 2049; **84**, 617; **98**, 891; **00**, 2179; **01**, 1102, 1304, 1828, 1833.
- Borings with, equipment, **97**, 2068.
- Borings with, foundations, locks, **97**, 2068.
- Borings with, rock, **00**, 2769.
- Borings with, sand borings, **74**, 724; **75**, 235; **79**, 393.
- Caisson sinking, **79**, 926.
- Channel deepening, **82**, 1595, 1610; **83**, 1238; **84**, 1302; **85**, 769; **99**, 3153.
- Clay full of bowlders broken by, **79**, 62, 382, 393.
- Currents induced by, **79**, 383.
- Detritus, rock cleaned from, **81**, 657, 2507.
- Dredging, **68**, 671; **69**, 310; **70**, 340; **79**, 383, 384; **82**, 1610; **83**, 1238; **84**, 1302; **85**, 769.
- Drill holes cleaned by, **69**, 427.
- Nozzles, pile sinking, **89**, 2794.
- Pile driving, **75**, 860; **77**, 449, 450; **79**, 464, 1514; **80**, 1912; **81**, 1508, 1554, 1621; **82**, 1007, 1677, 1711, 1719, 1723; **83**, 1185, 1249, 1270, 1289, 1292; **84**, 2770, 2832; **85**, 2384; **86**, 1981; **87**, 3100; **91**, 2683.

Water Jet—Continued.

- River bars, removing, **68**, 671; **69**, 310; **70**, 340; **79**, 383, 384; **95**, 2062.
- Screw pile, removing, **79**, 447.
- Screw pile, sinking, **72**, 759, 770; **73**, 860, 861; **78**, 432; **79**, 447.
- Snagging, **73**, 614, 616.
- Two nozzles, pile sinking, **94**, 3133.

Water Levels.

- Annual curves, Lake Erie, **97**, 4126.
- Annual curves, Lakes Michigan and Huron, **97**, 4126.
- Annual curves, Lake Ontario, **97**, 4127.
- Annual curves, Lake Superior, **97**, 4126.
- Curves, Lakes, **78**, 1412; **93**, 2996; **95**, 2893.
- Fluctuation, Lakes, **98**, 2847.
- Fluctuation, Lakes, study of, **00**, 5375.
- General data, Lake Erie, **90**, 3584.
- Great Lakes, **95**, 2897; **00**, 5400, 5401.

Water Main.

- Bridge for, **92**, 3902.
- By-pass, **90**, 3530.
- Connections, **92**, 3902.

Water, Municipal. (See Water, Drinking.)**Water, Navigable.**

- Rates, limit of effect on, **01**, 1993.
- Rates saved by navigable waterways, **12**, 2487.
- Rights of U. S., Willamette River, H. D. 99, 58th, 3d.

Water Power. (See Canals; Turbines.) (See pl. 20.)

- Canals, **95**, 2661; **96**, 2535, 3046.
- Canals, construction, lease of water power to lessen cost of, Puget Sound, H. D. 953, 60th, 1st.
- Channel improvement and, coordination, Tar and Pamlico Rivers, H. D. 270, 62d, 2d.
- Charges for, when developed by river and harbor works, H. D. 50, 61st, 1st.
- Companies, power and transmission, supervising, **12**, 3553.
- Cost per horsepower, works on navigable streams and, H. D. 781, 60th, 1st.
- Damages to, by intracoastal waterways, H. D. 391, 62d, 2d.
- Dams, flushboards on, canals, **97**, 2713; **99**, 2790.
- Dams for, proposed design, Muscle Shoals, H. D. 781, 60th, 1st.
- Demand, possible, Ouachita system, H. D. 588, 62d, 2d.
- Development, Altamaha system, H. D. 443, 62d, 2d.
- Development and marketing of, canal, Great Lakes to Mississippi River, H. D. 304, 61st, 2d.
- Development, cost, Tar and Pamlico Rivers, H. D. 270, 62d, 2d.
- Development, details, Tennessee River, H. D. 360, 62d, 2d.
- Development of, from 14-foot project, Mississippi River, probably large values, H. D. 50, 61st, 1st.
- Development of, Mississippi River, H. D. 741, 61st, 2d.

Water Power—Continued.

- Development of, one company better than many, on navigable streams, H. D. 781 60th, 1st.
- Development, Ouachita system, H. D. 588, 62d, 2d.
- Development, query as to participation of the U. S., H. D. 781, 60th, 1st.
- Development on streams adapted to Merrimac River, H. D. 9, 62d, 1st.
- Development, probable, Wabash River, H. D. 246, 61st, 2d.
- Discussion, Tennessee River, H. D. 360, 62d, 2d.
- Diversion, water, measuring at Niagara Falls, **12**, 3552.
- Electrical installation, Ouachita system, H. D. 588, 62d, 2d.
- Flow available, Mississippi River, St. Paul to Minneapolis, H. D. 218, 60th, 1st.
- Flow, measuring, Niagara Falls, **08**, 2539.
- Franchises, act of U. S. conferring, Muscle Shoals, H. D. 173, 58th, 3d.
- Franchises, Fox and Wisconsin Rivers, **98**, 2342.
- Grants for obtaining, St. Marys River, H. D. 261, 59th, 2d.
- Great Falls, **94**, 3256.
- Impounding river water, complaints, Ocmulgee River, **11**, 1612.
- Improvements, waterway, relation of, Sen. D. 301, 61st, 2d.
- Interference with river improvement, Merrimac River, H. D. 2, 61st, 1st.
- Leases, and levels, Great Lakes, H. D. 261, 59th, 2d.
- Leases, Green and Barren Rivers, **96**, 2274.
- Leases, Muskingum River, **11**, 2184. (See Vol. I, p. 977.)
- Lockage, flow for water power affecting, Willamette River, H. D. 99, 58th, 3d.
- Locks, obtaining water power at, Puget Sound, H. D. 953, 60th, 1st.
- Moline, **78**, 749.
- Navigation improvement and, coordination considered, Columbia River, H. D. 693, 62d, 2d.
- Navigation interests and, conflict, canals, **96**, 2535; **97**, 2721.
- Ownership, waterway, Troy, N. Y., Sen. D. 887, 62d, 2d.
- Power house, designing, Ouachita system, H. D. 588, 62d, 2d.
- Price, selling; Muscle Shoals Canal, H. D. 781, 60th, 1st.
- Rental. (See Muskingum River, p. 977 of this Index.)
- Rights, riparian, navigable streams, H. D. 781, 60th, 1st.
- Rights, determining value of, **05**, 916.
- Rights, existing, method of valuing, Connecticut River, H. D. 231, 58th, 3d.
- Rights, rental, Tennessee River, H. D. 360, 62d, 2d.
- Right to, navigable streams, legalization of corporations, Muscle Shoals, H. D. 781, 60th, 1st.

Water Power—Continued.

Right to, preserving, Connecticut River, **98**, 983.

St. Louis River, **96**, 2445.

Statistics of, Fox River, **97**, 2732.

Steam power and, comparison, **78**, 753.

Tunnels, designing, Ouachita system, H. D. 588, 62d, 2d.

Turbines tested, Niagara Falls, **12**, 3550.

U. S. works, effect of, on water power, Willamette Falls, **05**, 2497.

Users of, large, **04**, 3277.

Value of, determining, **00**, 4381; **05**, 919.

Water, restricting use of, Niagara Falls, **12**, 3551.

Waterways, capacities of navigable waterways for water power, H. D. 781, 60th, 1st.

Waterways more valuable for, than for navigation, H. D. 303, 61st, 2d.

Waves, river, formed from impounded water, **11**, 1581.

Works, cost of, navigable streams, Muscle Shoals, H. D. 781, 60th, 1st.

Works, effect on channel beds, etc., **01**, 3387.

Worth of, Arkansas River, etc., H. D. 206, 61st, 2d.

Waterproofing. (See Forts, p. 1797 of this Index.) (See Concrete.)

Basements, buildings, **01**, 3806.

Concrete structures, **98**, 751. (See Forts, p. 1797 of this Index.)

Concrete walls, **99**, 732.

Gun batteries, **93**, 606; and see Forts, p. 1797 of this Index, an important subject in building concrete structures.

Paraffin for brickwork, **04**, 3832.

Timber breakwaters, **98**, 2664.

Water Rates. (See Rates.)**Water Rights.**

Great Falls, **94**, 3228.

Ownership, corporate, hindrance to waterway improvement, **05**, 910.

U. S. and States, brief and memo., S. D. 351, 61st, 2d.

Various laws, **00**, 4414.

Water, Running.

Sediment, effect on, **76**, ii, 5.

Water, Salt.

Preventing mingling with fresh water, gates for, H. D. 836, 61st, 2d.

Ruinous to rice growing, H. D. 836, 61st, 2d.

Water Service.

Forts. (See p. 1797 of this Index.)

Water, Shallow.

Tides, effect on, **75**, ii, 272.

Water, Slopes of.

Brazos River, **97**, 1838.

Discharge determined from, **76**, ii, 278.

Formula for, in terms of velocity and depth, **78**, 535.

Formula for, in terms of velocity and hydraulic radius, **79**, 782.

Velocity from, **72**, 139.

Washington Aqueduct, **68**, 906.

Watersheds. (See Canals.)

Arid regions, **98**, 2914.

Colbert Shoals Canal, **98**, 1921.

Flowage from, formula, **93**, 4280.

Northern and Northwestern Lakes, **68**, 961; H. D. 779, 61st, 2d.

Rainfall, Allegheny River, **79**, 1391.

Rainfall, run-off and, Mississippi River, **96**, 1862; **97**, 2169.

Rainfall and, ratio, **70**, 287; **73**, 499; **74**, 507, 532, 538; **75**, ii, 438; **76**, 532, ii, 100; **77**, 756; **79**, 1197, 1199, 1219, 1221, 1227, 1236, 1241.

Yield, possible, Ouachita system, H. D. 588, 62d, 2d.

Water Storage. (See Canals; Rivers.)

Boise River, **98**, 2912.

Cache a la Poudre, **98**, 2840, 2841.

Reservoirs, Mississippi River, **98**, 1814; **00**, 2798.

Rivers, **98**, 2840, 2841; **98**, 2912.

Water Supply. (See Canals; Drinking Water; Filtration; Locks; Waterways.)

Aqueduct, sections, H. D. 342, 61st, 2d.

Aqueducts, study of capacities, H. D. 342, 61st, 2d.

Artesian wells, **93**, 2322.

Bacterial tests, **11**, 2947. (See p. 2081 of this Index.)

Blow-off, details, H. D. 342, 61st, 2d.

Canals, **71**, 639; **72**, 515, 521, 530; **73**, 831, 1008; **74**, 495, 504, 507, 520, 523, 538, ii, 95, 112; **75**, 411, ii, 545, 547, 552, 566, 591; **76**, 406, 519, 525, ii, 61, 97; **77**, 383, 704, 755, 756, 770, 798; **78**, 293; **79**, 1391; **96**, 2402, 2446, 3007.

Canals, reservoirs on, **96**, 3026.

Canals, summit levels, **80**, 871; **81**, 1152, 1890, 2402, 2410; **86**, 1252.

Conduits for, Washington, D. C., **96**, 3910.

Conduits, guarding against accident, H. D. 347, 61st, 2d.

Conduits, increasing capacities, H. D. 347, 61st, 2d.

Consumption per capita, **01**, 672.

Deaths from typhoid, Washington, D. C., **08**, 2364.

Details of system, Yellowstone Park, **02**, 3043.

Ditches, Yellowstone Park, **02**, 3044.

Evaporation of, canals, **71**, 639; **73**, 1008; **74**, 505, 507, 520, 523, ii, 95; **75**, ii, 547, 566; **76**, 519, 526, 528, ii, 97; **77**, 386, 704, 707, 756; **78**, 293.

Feeding, economy of canals, **76**, ii, 62.

Filtration, canals, **71**, 639; **73**, 1008; **74**, 95, 505, 507, 520, 523, ii, 95; **76**, 519, 526, 534, ii, 67, 97; **77**, 386, 704, 707; **78**, 293; **81**, 571, 1152; **86**, 1252.

Filtering, cost, **06**, 2101; **08**, 2363; **12**, 3468; (See also p. 2081 of this Index.)

Filtering, experimental studies on rates of, **08**, 2367; **09**, 2325; H. D. 342, 61st, 2d.

Flumes, drop, Yellowstone Park, **02**, 3044.

Gatehouse, H. D. 342, 61st, 2d.

Great Lakes, H. D. 779, 61st, 2d.

Gun batteries, **93**, 613, 635; **96**, 497; **98**, 665, **00**, 993.

Water Supply—Continued.

- Head gates, Yellowstone Park, **02**, 3044.
- Improvement, cities, **92**, 3363.
- Increasing, Washington, D. C., **96**, 3934; H. D. 347, 61st, 2d.
- Lake Superior and Mississippi River Canal, **96**, 2402, 2432.
- Leakage, locks, **74**, ii, 95; **76**, 528; **77**, 389, 704, 707, 756; **78**, 293; **79**, 1540.
- Lockage, **73**, 1008; **76**, 519, 526, 529; **77**, 704, 707, 724, 756, 770; **78**, 293.
- Metering, **11**, 2945.
- Meter system, advantages of, **01**, 3659.
- Meter system, best, **02**, 2698.
- Pools, canals, **69**, 535.
- Population, future, estimating for, H. D. 342, 61st, 2d.
- Providing for locks, **00**, 3168.
- Pumpage, canals, **76**, 406, 407; **81**, 1152.
- Pumping, cost of, H. D. 342, 61st, 2d.
- Pumping station, emergency, H. D. 342, 61st, 2d.
- Rainfall, canals, **76**, 533.
- Raw water, improving, H. D. 347, 61st, 2d.
- Relation of water supply to waterway improvements, Sen. D. 301, 61st, 2d.
- Reservoirs, H. D. 342, 61st, 2d.
- Reservoirs, District of Columbia, **96**, 3908.
- Reservoirs, locks, **76**, 407.
- Reservoirs, remodeling, District of Columbia, **12**, 3466. (See p. 2077-2085 of this Index.)
- Rivers, sources of, **93**, 2322.
- Silting in tunnels, **01**, 3667.
- Sources, artesian wells, James River, S. Dak., **93**, 2322.
- Storage, H. D. 347, 61st, 2d.
- Storage, coagulation as a substitute, H. D. 342, 61st, 2d.
- Tunnel for, **96**, 3936.
- Tunnels, percolation, **01**, 3666.
- Waste, abnormal, cities, **06**, 2093.
- Waste, and list of U. S. cities, etc., H. D. 342, 61st, 2d.
- Waste, preventing, H. D. 342, 61st, 2d.
- Waste, reducing, Washington, D. C., **07**, 2287; **06**, 2095.

Water Surfaces.

- Measuring, special reel, **03**, 2813.

Water, Surfaces of.

- Slopes of, Mississippi River, **94**, 1582.
- Varying levels of, Great Lakes, **95**, 3088.
- Wind, effect of, **94**, 1012.

Water, Surplus.

- Canals, **98**, 2344.

Water System.

- Forts. (See p. 1797 of this Index.)

Water, Tightening.

- Canal banks, **75**, 456; **76**, 660, ii, 74; **78**, 295, 1225.
- Concrete for, canals, **76**, ii, 74.

Water, Tunnels for.

- 00**, 5208.
- Building, **00**, 5208.
- Cross section, **87**, 2538; **88**, 2766.
- Lining, best material, **87**, 2547.
- Longitudinal sections, **87**, 2538; **88**, 2766.

Water, Tunnels for—Continued.

- Percolation, **96**, 3937; **99**, 3797; **00**, 5208.
 - Rubble backing, filling voids in, **00**, 5213.
 - Testing, **95**, 4113.
- Waterways.** (See Banks; Cut-offs; Dams; Rates; Revetment; Riparian Property; Traffic; Walls.)
- Acid in, injury of locks and dams, **11**, 2110.
 - Appropriations, Federal and other, line of division, Sen. D. 301, 61st, 2d.
 - Appropriations, steps necessary before making, H. D. 301, 61st, 2d.
 - Austria-Hungary, Sen. D. 301, 61st, 2d.
 - Banks, stable, types, Altamaha system, H. D. 443, 62d, 2d.
 - Belgium, Sen. D. 301, 61st, 2d.
 - Bridges, dimensions, determining, H. D. 700, 59th, 1st.
 - Bridges over waterways retard commerce, Chicago River, **11**, 2352.
 - Coal mining, effect of waterways on, H. D. 510, 61st, 2d.
 - Commerce, decline of, causes, Missouri River, Sen. D. 1120, 60th, 2d.
 - Construction, financing, Europe (Merchant), Sen. D. 301, 61st, 2d.
 - Corporate rights, **05**, 909, 914.
 - Cost of, growth of commerce and, Great Lakes, **10**, 2095.
 - Currents, cross, avoiding, Detroit River, H. D. 676, 61st, 2d.
 - Dams, private, hindrance from, Connecticut River, H. D. 818, 61st, 2d.
 - Description, tabular, H. D. 862, 61st, 2d.
 - Development of, future value important, Mississippi Valley, H. D. 50, 61st, 1st.
 - Drainage, relation of, Sen. D. 301, 61st, 2d.
 - Dredging, etc., by private parties, statute governing, State of Washington, **01**, 3599.
 - Drought, relation to, Sen. D. 301, 61st, 2d.
 - European vs. U. S. waterways, Sen. D. 301, 61st, 2d.
 - Flow of, influence of forests, Merrimac River, H. D. 9, 62d, 1st.
 - France, Sen. D. 301, 61st, 2d.
 - Functions, proper, in connection with railways, **10**, 2976.
 - Germany, Sen. D. 301, 61st, 2d.
 - Great Britain, Sen. D. 301, 61st, 2d.
 - Great Lakes to Gulf of Mexico, factors, H. D. 1374, 61st, 3d.
 - Holland, Sen. D. 301, 61st, 2d.
 - Irrigation, relation of, H. D. 301, 61st, 2d.
 - Mine washings, deleterious effect of, **05**, 2585.
 - Mining debris, entrance of, **07**, 2264.
 - Power development, and navigation improvement, combination possible, Connecticut River, H. D. 818, 61st, 2d.
 - Projects, steps necessary before adoption, Sen. D. 301, 61st, 2d.
 - Railroads, prosperity of, effect on, **96**, 3090.
 - Rates, freight, lower by, H. D. 510, 61st, 2d.
 - Rights of States and U. S., H. D. 818, 61st, 2d.
 - Routes, rail and water, should be cooperative, H. D. 769, 62d, 2d.
 - Tolls on, private companies, H. D. 818, 61st, 2d.

Waterways—Continued.

- Traffic, inland, decline of, memorandum of Board of Engineers on Rivers and Harbors, Sen. D. 301, 61st, 2d.
- Transportation, decline of, Sen. D. 301, 61st, 2d.
- Tunnels, removal of, Chicago, 06, 1774.
- Turning basins in, advantages, H. D. 317, 61st, 2d.
- Water, leases of, form of, H. D. 719, 61st, 2d.
- Water power and, Sen. D. 301, 61st, 2d.
- Water-power development and, Mississippi River, H. D. 741, 61st, 2d.
- Water-power development, Merrimac River peculiarly adapted for, H. D. 9, 62d, 1st.
- Water power, more valuable for, Cheboygan to Potoskey, Mich., Sen. D. 303, 61st, 2d.
- Wind, depth affected by, harbors, 67, 218; 68, 154, 171.

Waterways, Artificial.

- Cooperation with State of Illinois, H. D. 1374, 61st, 3d.

Waterways, Canalized.

- Rates in, Little Kanawha, 09, 1800.

Waterways, Coastal.

- Economic value, H. D. 1236, 60th, 2d.

Waterways, European and United States.

- Comparison, Sen. D. 301, 61st, 2d.

Waterways, Free.

- Railroads, influence on, 96, 3090.

Waterways, Improvement of.

- Bank improvement, relation to, Sen. D. 301, 61st, 2d.
- Bridges, rules for operating, Duluth-Superior, 08, 1903.
- Commercial factors necessary, 04, 2723.
- Commercial growth, improvement not a guarantee of, H. D. 1211, 60th, 2d.
- Crooked and narrow streams, 01, 1660.
- Floods, relation to, Sen. D. 301, 61st, 2d.
- Improvement should be conditional, where there are deposits of sawdust, H. D. 748, 61st, 2d.
- Interference between States and U. S., New York, H. D. 887, 62d, 2d.
- Local cooperation dilatory, H. D. 599, 62d, 2d.
- Lumber trade of Northwest interested in, H. D. 524, 61st, 2d.
- Monopoly, private, cessation of waterways improvement recommended where private monopoly is fostered by improvement, 09, 1683.
- Non-U. S. work; accurate information concerning, hard to obtain, 11, 2351.
- Plant, U. S., shipyards for, advantages of, Tennessee River, 11, 2057.
- Public opinion favorable to, H. D. 781, 60th, 1st.
- Rates, freight, lowered on cotton, H. D. 510, 61st, 2d.
- Rights, private, a barrier to public improvements, H. D. 818, 61st, 2d.
- Value of, determining by tolls, 01, 1564.
- Water-power development and, combination, H. D. 818, 61st, 2d.
- Water power, relation to, Sen. D. 301, 61st, 2d.

Waterways, Improvement of—Continued.

- Water-power rights and, Columbia River, H. D. 693, 62d, 2d.
- Water supply, relation to, Sen. D. 301, 61st, 2d.
- Work, permanent, assisted by dredging, H. D. 510, 61st, 2d.

Waterways, Inland.

- Development of (Sperry), Sen. D. 301, 61st, 2d.
- Feasibility, depth, and dimensions, Lockport to mouth of Illinois River, H. D. 1374, 61st, 3d.
- Seaports and (Sperry), Sen. D. 301, 61st, 2d.

Waterways, Inland (Intracoastal). (See Canals.)

- Advantages of, Louisiana and Texas, H. D. 640, 59th, 2d.
- Advantages of, U. S., H. D. 315, 61st, 2d.
- Conclusions concerning, 01, 1532.
- Commerce, probable effect on, Rio Grande to Mississippi River, H. D. 3, 61st, 3d.
- Commerce, statistics, H. D. 391, 62d, 2d.
- Construction, details, H. D. 391, 62d, 2d.
- Control by U. S. imperative, 01, 1534.
- Cross sections, H. D. 391, 62d, 2d.
- Cross section, factors determining best, Texas and Louisiana, H. D. 640, 59th, 2d.
- Crossings, H. D. 391, 62d, 2d.
- Curves, H. D. 391, 62d, 2d.
- Dams, movable, H. D. 391, 62d, 2d.
- Defensive purposes, H. D. 391, 62d, 2d.
- Dredging plant, U. S., economical, H. D. 3, 61st, 2d.
- Estimates, construction, H. D. 391, 62d, 2d.
- Maintenance, H. D. 391, 62d, 2d.
- Proposed plans, Virginia and North Carolina, various depths, etc., H. D. 84, 59th, 2d.
- Rates, probable effect on, Louisiana and Texas, H. D. 640, 59th, 2d.
- Rates saved by, H. D. 391, 62d, 2d.
- Reasons for, commercial, H. D. 1236, 60th, 2d.
- Tolls, H. D. 391, 62d, 2d.
- Value of, H. D. 391, 62d, 2d.
- Value of, special, Florida points, preferred to deepening harbors of coast, H. D. 675, 62d, 2d.
- Water power, damages, H. D. 391, 62d, 2d.
- Widths, formulas, H. D. 391, 62d, 2d.

Waterways, Internal.

- Impediments, H. D. 540, 62d, 2d.

Waterways, Navigable.

- Rates, effect on, reduction, 12, 809.
- Tunnels under, obstructive, Chicago River, 05, 2073.
- Water-power capacities, H. D. 781, 60th, 1st.

Waterways, Private.

- Acquiring, H. D. 391, 62d, 2d.

Waterways, Railways and.

- Building, cost, H. D. 391, 62d, 2d.
- Competition between, H. D. 710, 62d, 2d.
- Relation, Sen. D. 301, 61st, 2d.
- Relation to each other, changing, H. D. 781, 60th, 1st.
- Transportation by, relations, Sen. D. 301, 61st, 2d.

Waterways, State.

Damage from mining debris, relation of U. S. to, H. D. 262, 59th, 1st.

Waterways, Swift-Current.

Locks and dams for, 01, 3513.

Waterway Transportation.

Terminal facilities, importance of, 10, 2976.

Watting. (See Brush; Piles.)

Slope retention, 72, 709.

Wave Action. (See Waves.)

Action broken by sheeting, bulkheads, 04, 3620.

Action of, Great Lakes; C. D. 3, 59th, 2d; 06, 1821; 09, 1966; H. D. 479, 60th, 1st.

Controlling, effect, Great Lakes harbors, H. D. 62, 59th, 1st.

Controlling, Great Lakes harbors, temporary plans of doubtful value, H. D. 46, 61st, 2d.

Waves. (See Breakwaters; Earthquakes.)

Action of, 72, 976, 977, 981; 74, ii, 199, 205, 212; 91, 1635.

Arrest of, 73, 204.

Bars, effect on, 81, 676, 685; 82, 585.

Beach erosion from, 72, 897.

Beach formation, 72, 107; 74, ii, 188.

Blows, force of, measuring, Great Lakes, 02, 2557; 03, 1799.

Bottoms and shores, effect on, 72, 107.

Breakwaters, 71, 827; 74, ii, 242.

Breakwaters, deflection of, 99, 3159.

Breakwaters, effect of, 94, 2087.

Breakwaters, slopes developed by waves, 84, 572, 573; 96, 2375; 98, 2284.

Components, 76, 380.

Concrete blocks, movement of, breakwaters, 93, 3209.

Cribs, effect of, 68, 229, 230, 234; 70, 197; 71, 237.

Cribs, undermining of, 11, 2285.

Depths in which waves break, 89, 1319, 1323.

Distance from, depth of, 70, 194; 72, 107, 167; 76, 380; 79, 460.

Effect of (breakwaters), 94, 2087.

Effect of, Milwaukee (Harbor), 94, 2087.

Energy when breaking, 89, 1319, 1323.

Force, 71, 237, 260; 72, 169; 81, 2635; 85, 2279.

Force, breakwaters, 84, 573.

Force, greatest on lakes, Oswego Harbor, 99, 3140.

Force, Great Lakes, 90, 2314.

Force, measurements of, 73, 862; 90, 1575; 91, 1633.

Force, Milwaukee Harbor, 94, 2086.

Form, 89, 1319, 1323.

Form, prolate cycloid, 89, 1319, 1323.

Greytown, Nicaragua, effect at, Isthmian Canal Comsn. report, 1899-1901.

Harbors, Milwaukee, 94, 2087.

Height, 68, 228, 229; 76, ii, 329, 571; 81, 678; 87, 1965; 85, 2279.

Height, Atlantic, 89, 1319, 1323.

Height, formula, 87, 1965.

Jetties, effect on, 90, 1568.

Levees, erosion of, 00, 4861.

Movement of, 68, 234; 70, 194; 72, 168; 77, 1051; 98, 2720.

Waves—Continued.

Movement of, breakwater slopes, 98, 2284.

Movement, character, Pacific coast, H. D. 557, 59th, 1st.

Movement, control with stilling basin, in harbors, H. D. 221, 60th, 1st.

Photo of, Duluth, 01, 2832.

Preventing, piers modified for, 73, 204.

Reflection, vertical faces, 72, 169.

Resistance to, rock of various sizes, 93, 3502.

Riprap structures, effect, 90, 2320.

Sand drift, 71, 806; 72, 896.

Sand movement, 74, 804.

Sand movement, river beds, 81, 1579, 1653; 83, 2195, 2197, 2210, 2216, 2224, 2230; 85, 569; 87, 1351.

Sandy coasts, 89, 2519.

Sizes, Pacific coast, H. D. 969, 60th, 1st.

Sloping surfaces, effect, 70, 196.

Stone moved by, 76, ii, 596; 78, 242.

Study of, Great Lakes, 03, 1799.

Vegetation, action on, 72, 215.

Velocity of, 81, 683; 85, 2279.

Violent waves, 76, ii, 601.

Wash, protecting levees from, 04, 2056.

Water power, waves formed from impounded water for water power, 11, 1581.

Waves, Tidal.

Canals, sea-level, H. D. 391, 62d, 2d.

Way. (See Right of.)**Ways, Inclined.**

Building, snag boat, hauling out, 98, 1853.

Weather.

Concrete blocks, effect on, 98, 2255.

Wedges, Oak.

Bridge decay, effect on, 78, 964.

Weeds.

Obstructions, lock gate operation, 78, 741.

Weeds, Brownlow. (See Dikes.)

Artificial basin, forming of, 78, 640, 654; 79, 1014, 1054, 1058, 1061, 1070, 1077, 1080, 1088.

Cost per linear foot, 79, 1058, 1062.

Details, H. D. 46, 62d, 1st.

Dikes of, cost of, 80, 1438, 1454, 1458.

Dikes of, wire curtains, inferior to, 80, 1458.

Rivers, improving, 77, 500; 78, 640, 654; 79, 1014, 1054, 1058, 1062, 1070, 1077, 1088.

Sand, to arrest, 77, 500; 78, 640, 654; 79, 1014, 1054, 1058, 1061, 1070, 1077, 1088.

Sediment, arrest of, 78, 640, 654.

Weighing.

Barge loads, 99, 3265.

Displacement method, barges, 94, 1392, 2503.

Weights.

Bronze weights recommended for mattresses, H. D. 50, 61st, 1st.

Weirs. (See Dams; Drums.) (See pl. 22.)

Aprons below, 98, 2126.

Building, 98, 2125.

Building, cofferdams, 98, 2124.

Discharge, measuring, 02, 2777.

Discharge over, formula, 90, 2144.

Movable dams, 96, 2311.

Plans, 98, 2125.

Raising of, air bags for, 93, 2265.

River regulation, H. D. 262, 59th, 1st.

Weirs—Continued.Steel frames, **00**, 5003.Steel service bridge better than maneuvering boat, **05**, 539.Substructure of, building, **97**, 2547.**Weirs, Betwa.**Dams, adjustable tops for, **11**, 2111.**Weirs, Chittenden.**Drum weirs, **02**, 1667.Cleaning, **11**, 2012.**Weirs, Cross.**

Improvement, Mississippi River, H. D. 50, 61st, 1st.

Weirs, Diverting.

Flood control, H. D. 81, 62d, 1st.

Weirs, Drum. (See above.)**Wells.**Infiltration, **76**, 535.**Wells, Artesian.****70**, 354, 362; **93**, 637.Drilling, **92**, 467.Gun batteries, **93**, 641; **98**, 665.New Orleans, La., **70**, 352.Rivers, supply to, **93**, 2322.Strata, South Carolina, **96**, 504.**Wells, Gauge.**Piers, **01**, 2851.**Wells, Pipe.**Piers, **01**, 2857.**Wharves.** (See Piers; Piles.)

Agreement, copy of, use granted to public, H. D. 593, 61st, 2d.

Appropriations subject to regulation of charge for wharfage, **07**, 1324.

Batteries. (See Forts, p. 1797 of this Index.)

Building, forts, **97**, 700.

Control of, Brunswick, Ga., H. D. 326, 60th, 1st.

Dredging in vicinity, **08**, 1921.Enrockment for, **95**, 3494.Extent of, Duluth-Superior, **10**, 2062.

Facilities, New York Harbor, H. D. 1506, 60th, 2d.

Iron piles in, **95**, 3494.

Ownership of, relation of improvements to, Sen. D. 301, 61st, 2d.

Ownership, riparian, an interference with improvements, San Juan, P. I., H. D. 914, 59th, 1st.

Projection beyond bulkhead line, shoaling from, **88**, 1046.

Type, extension, Jamaica Bay, N. Y., H. D. 1506, 60th, 2d.

Wharves, Iron Pile.Planning, **95**, 3494.**Wharves, Municipal.**Details, Kansas City, **12**, 2202.**Wharves, Pile and Rock.**Plans, **95**, 3494.**Wharves, Projecting.**Projection beyond bulkhead line—shoaling from, **88**, 1046.**Wharves, Public.**

Advantages, Mobile, Ala., H. D. 657, 61st, 2d.

Wharves, Rock-and-pile.**95**, 3494.**Wheels.**Lock gates, **11**, 2138.**White House.** (See p. 2072 of this Index.) (See pl. 70.)**Whitewashing.**

Forts. (See p. 1797 of this Index.)

Wickets (Movable Dams). (See Dams.)Long and short wickets, **08**, 1797.**Widths (Channels, etc.).**Channel beds, **05**, 1496.Curves, **05**, 1496.

Determining, Detroit River, H. D. 676, 61st, 2d.

Discussion of adequate widths, Mobile Harbor, H. D. 657, 61st, 2d.

Willows. (See Trees.)Bars; starting vegetation on, **98**, 1786.Dike protection, **76**, 237.Piles of live willows, **73**, 621.Planting, bars, **97**, 2095.Planting, experiments, **97**, 2095; **98**, 1786.Planting, failure of, shore protection, **75**, 316; **76**, ii, 564.Revetment work, **12**, 2196.Shore protection, **73**, 342; **74**, 51, 225; **75**, 52, 280; **76**, 105, 237; **79**, 1468, 1618, 1621, 1628; **81**, 1556; **82**, 1595.**Winches.**Reservoir dams, **01**, 2314.**Windows.**

Forts. (See p. 1797 of this Index.)

Framing, **04**, 3844.**Winds.** (See Meteorology.)

Channels, effect on, Aransas Pass, H. D. 678, 61st, 2d.

Currents, effect on, **98**, 2712.Currents, mid-depth velocity of, effect on, **69**, 254.

Depths, harbor, effect on, H. D. 62, 59th, 1st.

Duluth, **01**, 2901.

Great Lakes, H. D. 62, 59th, 1st.

Hawaiian Islands, H. D. 609, 62d, 2d.

Ice movement, effect, New York Harbor, H. D. 65, 59th, 1st.

Lake harbor depths, effect on, **67**, 218; **68**, 154, 171.

Lake Superior, H. D. 221, 60th, 1st.

Nantucket Sound, H. D. 536, 62d, 2d.

Pressure of, steel buildings, **01**, 3810; **04**, S., 2835.Rainfall, effect on, **67**, 598.Resultant direction, Lambert's formula, **65**, 597.Rivers, discharge, **00**, 5383.Scour and, **01**, 575.Tides, effect on, **73**, 988, 1001.Water surfaces, effect on, **94**, 1012.Water surfaces, effect on, lakes, **97**, 2777.Water surfaces, height of, variations in, wind a cause of, **98**, 2712.

Winter.

Discharge and velocities, measuring in winter, **01**, 3774.

Wire Boards.

Forts. (See p. 1797 of this Index.)

Wire Fuses. (See Torpedoes.)**Wire Strands.**

Mattresses, **94**, 2900.

Wire Sweep. (See Sweep.)

Surveying with tension wire sweep, Great Lakes, **08**, 2527.

Wiring. (See Electricity.)

Buildings, **04**, 3836, 3849, 3856.

Electric plant, batteries, **00**, 850.

Firing circuits, mortar batteries, **97**, 753.

Forts. (See p. 1797 of this Index.)

Longitude observations, **94**, 3322.

Wood, rock substituted, advantages, breakwaters, **93**, 3202.

Wood.

Linings, forts. (See p. 1797 of this Index.)

Works.

Maintenance of, Great Lakes, **12**, 2488.

Permanency of, breakwaters, H. D. 240, 59th, 1st.

Works, Compensating.

Great Lakes, H. D. 779, 61st, 2d.

Works, Contraction.

Side contraction, Mississippi River, H. D. 50, 61st, 1st.

Works of Improvement. (See Cost; Private.)**Works, Old.** (See Walls, Sea.)

Condition, Cape Fear River, H. D. 287, 62d, 2d.

Works, Protection.

Building, movable dams, **97**, 2549.

Works, Public.

Power of counties, Washington, **96**, 3371.

Sites should not be disclosed prematurely, **01**, 2758.

Works, Regulation. (See Regulation.)

Depths, maintaining, Mississippi River, H. D. 50, 61st, 1st.

Channels made by, sediment-bearing rivers, Mississippi River, H. D. 50, 61st, 1st.

Works, River and Harbor. (See Commerce; Harbors; Rivers; Waterways.)

Beneficial effect of, on streams like Red River, **01**, 2075.

Commerce, great growth of, incident to, **09**, 665.

Manufacturing, extension of, due to, **09**, 771.

Rates, freight, effect on, **09**, 587.

Wrecking Hook.

Snag boats, **95**, 2058.

Wrecks. (See Canals; Steamboats; and p. 2263 of this Index.)

Air bags, inflated, raising, **98**, 1234.

Appropriations, insufficient, useless, "Maine," H. D. 919, 61st, 2d.

Canals, **97**, 2448.

Canals, removing in, **96**, 2232.

Charleston Harbor, **73**, 728; **74**, ii, 4.

Cofferdams, **11**, 3039.

Explosives used, **12**, 1654.

Harbor of refuge, Lake Huron, **77**, 930.

Lifting, pontoons for, **99**, 1277.

"Maine," Habana Harbor, **11**, 3039; **12**, 3565; H. D. 765, 61st, 3d.

Mississippi River, **96**, 1774.

Missouri River, **00**, 2691.

Monitor, Patapsco, **73**, 728.

Ohio River, **77**, 628.

Pacific coast, **81**, 2637, 2684.

Raising, inflated air bags for, **98**, 1234.

Removing, advertising, objections to, **94**, 606.

Removing, black powder used, **73**, 728.

Removing, dynamite, **75**, ii, 714; **94**, 714.

Removing, explosives, **68**, 591, 607; **73**, 339, 728; **75**, ii, 714; **77**, 931.

Removing, laws relating to, Rhode Island, **95**, 702.

Summary of, Straits of Fuca, etc., **95**, 3461; **98**, 3086.

Wrecked dredge, authority for removing, question, **98**, 2688.

Wrecked steamboats, list of, Missouri River, **97**, 3370.

Yazoo River, **73**, 483.

Y.**Yangtse River.**

Navigation of, S. D. 301, 61st, 2d.

Yankee Catchers (submerged defensive obstructions). (See Obstructions.)**Yankee Catchers—Continued.**

In Cape Fear River, **76**, 330.

Neuse River, **72**, 738; **79**, 704, 706.

NOTES.

Pages 1 to 1791, Rivers and Harbors.

INDEX, REPORTS, CHIEF OF ENGINEERS, UNITED STATES ARMY.

1866-1912.

Each engineering district reviewed the proofs of the matter in Vol. I of this Index, pages 23-1692, pertaining to its own reports or works; upon a second opportunity to make such a review the matter incorporated under the heading above was received, but too late for incorporation in the first volume.

SESSIONS OF CONGRESS.

| Congress. | Session. | From— | To— | Congress. | Session. | From— | To— |
|-----------|----------|----------------|----------------|-----------|----------|---------------|---------------|
| 1st..... | 1st..... | Mar. 4, 1789 | Sept. 29, 1789 | 34th..... | 1st..... | Dec. 3, 1855 | Aug. 18, 1856 |
| | 2d..... | Jan. 4, 1790 | Aug. 12, 1790 | | 2d..... | Aug. 21, 1856 | Aug. 30, 1856 |
| | 3d..... | Dec. 6, 1790 | Mar. 3, 1791 | | 3d..... | Dec. 1, 1856 | Mar. 3, 1857 |
| 2d..... | 1st..... | Oct. 24, 1791 | May 8, 1792 | 35th..... | 1st..... | Dec. 7, 1857 | June 14, 1858 |
| | 2d..... | Nov. 5, 1792 | Mar. 2, 1793 | | 2d..... | Dec. 6, 1858 | Mar. 3, 1859 |
| 3d..... | 1st..... | Dec. 2, 1793 | June 9, 1794 | 36th..... | 1st..... | Dec. 5, 1859 | June 25, 1860 |
| | 2d..... | Nov. 3, 1794 | Mar. 3, 1795 | | 2d..... | Dec. 3, 1860 | Mar. 3, 1861 |
| 4th..... | 1st..... | Dec. 7, 1795 | June 1, 1796 | 37th..... | 1st..... | July 4, 1861 | Aug. 6, 1861 |
| | 2d..... | Dec. 5, 1796 | Mar. 3, 1797 | | 2d..... | Dec. 2, 1861 | July 17, 1862 |
| 5th..... | 1st..... | May 15, 1797 | July 10, 1797 | | 3d..... | Dec. 1, 1862 | Mar. 3, 1863 |
| | 2d..... | Nov. 18, 1797 | July 16, 1798 | 38th..... | 1st..... | Dec. 7, 1863 | July 4, 1864 |
| | 3d..... | Dec. 3, 1798 | Mar. 3, 1799 | | 2d..... | Dec. 5, 1864 | Mar. 3, 1865 |
| 6th..... | 1st..... | Dec. 2, 1799 | May 14, 1800 | 39th..... | 1st..... | Dec. 4, 1865 | July 28, 1866 |
| | 2d..... | Nov. 17, 1800 | Mar. 3, 1801 | | 2d..... | Dec. 3, 1866 | Mar. 2, 1867 |
| 7th..... | 1st..... | Dec. 7, 1801 | May 3, 1802 | 40th..... | 1st..... | Mar. 4, 1867 | Dec. 2, 1867 |
| | 2d..... | Dec. 6, 1802 | Mar. 3, 1803 | | 2d..... | Dec. 2, 1867 | Nov. 10, 1868 |
| 8th..... | 1st..... | Oct. 17, 1803 | Mar. 27, 1804 | | 3d..... | Dec. 7, 1868 | Mar. 3, 1869 |
| | 2d..... | Nov. 5, 1804 | Mar. 3, 1805 | 41st..... | 1st..... | Mar. 4, 1869 | Apr. 22, 1869 |
| 9th..... | 1st..... | Dec. 2, 1805 | Apr. 21, 1806 | | 2d..... | Dec. 6, 1869 | July 15, 1870 |
| | 2d..... | Dec. 1, 1806 | Mar. 3, 1807 | | 3d..... | Dec. 5, 1870 | Mar. 3, 1871 |
| 10th..... | 1st..... | Oct. 16, 1807 | Apr. 25, 1808 | 42d..... | 1st..... | Mar. 4, 1871 | May 27, 1871 |
| | 2d..... | Nov. 7, 1808 | Mar. 3, 1809 | | 2d..... | Dec. 4, 1871 | June 10, 1872 |
| 11th..... | 1st..... | May 22, 1809 | June 28, 1809 | | 3d..... | Dec. 2, 1872 | Mar. 3, 1873 |
| | 2d..... | Nov. 27, 1809 | May 1, 1810 | 43d..... | 1st..... | Dec. 1, 1873 | June 23, 1874 |
| | 3d..... | Dec. 3, 1810 | Mar. 3, 1811 | | 2d..... | Dec. 7, 1874 | Mar. 3, 1875 |
| 12th..... | 1st..... | Nov. 4, 1811 | July 6, 1812 | 44th..... | 1st..... | Dec. 6, 1875 | Aug. 15, 1876 |
| | 2d..... | Nov. 2, 1812 | Mar. 3, 1813 | | 2d..... | Dec. 4, 1876 | Mar. 3, 1877 |
| 13th..... | 1st..... | May 24, 1813 | Aug. 2, 1813 | 45th..... | 1st..... | Oct. 15, 1877 | Dec. 3, 1877 |
| | 2d..... | Dec. 6, 1813 | Apr. 18, 1814 | | 2d..... | Dec. 3, 1877 | June 20, 1878 |
| | 3d..... | Sept. 19, 1814 | Mar. 3, 1815 | | 3d..... | Dec. 2, 1878 | Mar. 3, 1879 |
| 14th..... | 1st..... | Dec. 4, 1815 | Apr. 29, 1816 | 46th..... | 1st..... | Mar. 18, 1879 | July 1, 1879 |
| | 2d..... | Dec. 2, 1816 | Mar. 3, 1817 | | 2d..... | Dec. 1, 1879 | June 16, 1880 |
| 15th..... | 1st..... | Dec. 1, 1817 | Apr. 20, 1818 | | 3d..... | Dec. 6, 1880 | Mar. 3, 1881 |
| | 2d..... | Nov. 16, 1818 | Mar. 3, 1819 | 47th..... | 1st..... | Dec. 5, 1881 | Aug. 8, 1882 |
| 16th..... | 1st..... | Dec. 6, 1819 | May 15, 1820 | | 2d..... | Dec. 4, 1882 | Mar. 3, 1883 |
| | 2d..... | Nov. 18, 1820 | Mar. 3, 1821 | 48th..... | 1st..... | Dec. 3, 1883 | July 7, 1884 |
| 17th..... | 1st..... | Dec. 3, 1821 | May 8, 1822 | | 2d..... | Dec. 1, 1884 | Mar. 3, 1885 |
| | 2d..... | Dec. 2, 1822 | Mar. 3, 1823 | 49th..... | 1st..... | Dec. 7, 1885 | Aug. 5, 1886 |
| 18th..... | 1st..... | Dec. 1, 1823 | May 27, 1824 | | 2d..... | Dec. 6, 1886 | Mar. 3, 1887 |
| | 2d..... | Dec. 6, 1824 | Mar. 3, 1825 | 50th..... | 1st..... | Dec. 5, 1887 | Oct. 20, 1888 |
| 19th..... | 1st..... | Dec. 5, 1825 | May 22, 1826 | | 2d..... | Dec. 3, 1888 | Mar. 2, 1889 |
| | 2d..... | Dec. 4, 1826 | Mar. 3, 1827 | 51st..... | 1st..... | Dec. 2, 1889 | Oct. 1, 1890 |
| 20th..... | 1st..... | Dec. 3, 1827 | May 26, 1828 | | 2d..... | Dec. 1, 1890 | Mar. 3, 1891 |
| | 2d..... | Dec. 1, 1828 | Mar. 3, 1829 | 52d..... | 1st..... | Dec. 7, 1891 | Aug. 5, 1892 |
| 21st..... | 1st..... | Dec. 7, 1829 | May 31, 1830 | | 2d..... | Dec. 5, 1892 | Mar. 3, 1893 |
| | 2d..... | Dec. 6, 1830 | Mar. 3, 1831 | 53d..... | 1st..... | Aug. 7, 1893 | Nov. 3, 1893 |
| 22d..... | 1st..... | Dec. 5, 1831 | July 16, 1832 | | 2d..... | Dec. 4, 1893 | Aug. 28, 1894 |
| | 2d..... | Dec. 3, 1832 | Mar. 2, 1833 | | 3d..... | Dec. 3, 1894 | Mar. 2, 1895 |
| 23d..... | 1st..... | Dec. 2, 1833 | June 3, 1834 | 54th..... | 1st..... | Dec. 2, 1895 | June 11, 1896 |
| | 2d..... | Dec. 1, 1834 | Mar. 3, 1835 | | 2d..... | Dec. 7, 1896 | Mar. 3, 1897 |
| 24th..... | 1st..... | Dec. 7, 1835 | July 4, 1836 | 55th..... | 1st..... | Mar. 15, 1897 | July 24, 1897 |
| | 2d..... | Dec. 5, 1836 | Mar. 3, 1837 | | 2d..... | Dec. 6, 1897 | July 8, 1898 |
| 25th..... | 1st..... | Sept. 4, 1837 | Oct. 16, 1837 | | 3d..... | Dec. 5, 1898 | Mar. 3, 1899 |
| | 2d..... | Dec. 4, 1837 | July 9, 1838 | 56th..... | 1st..... | Dec. 4, 1899 | June 7, 1900 |
| | 3d..... | Dec. 3, 1838 | Mar. 3, 1839 | | 2d..... | Dec. 3, 1900 | Mar. 2, 1901 |
| 26th..... | 1st..... | Dec. 2, 1839 | July 31, 1840 | 57th..... | 1st..... | Dec. 2, 1901 | July 1, 1902 |
| | 2d..... | Dec. 7, 1840 | Mar. 3, 1841 | | 2d..... | Dec. 1, 1902 | Mar. 3, 1903 |
| 27th..... | 1st..... | May 31, 1841 | Sept. 13, 1841 | 58th..... | 1st..... | Nov. 9, 1903 | Dec. 7, 1903 |
| | 2d..... | Dec. 6, 1841 | Aug. 31, 1842 | | 2d..... | Dec. 7, 1903 | Apr. 28, 1904 |
| | 3d..... | Dec. 6, 1842 | Mar. 3, 1843 | | 3d..... | Dec. 5, 1904 | Mar. 3, 1905 |
| 28th..... | 1st..... | Dec. 4, 1843 | June 17, 1844 | 59th..... | 1st..... | Dec. 4, 1905 | June 30, 1906 |
| | 2d..... | Dec. 2, 1844 | Mar. 3, 1845 | | 2d..... | Dec. 3, 1906 | Mar. 2, 1907 |
| 29th..... | 1st..... | Dec. 1, 1845 | Aug. 10, 1846 | 60th..... | 1st..... | Dec. 2, 1907 | May 30, 1908 |
| | 2d..... | Dec. 7, 1846 | Mar. 3, 1847 | | 2d..... | Dec. 7, 1908 | Mar. 3, 1909 |
| 30th..... | 1st..... | Dec. 6, 1847 | Aug. 14, 1848 | 61st..... | 1st..... | Mar. 15, 1909 | Aug. 5, 1909 |
| | 2d..... | Dec. 4, 1848 | Mar. 3, 1849 | | 2d..... | Dec. 6, 1909 | June 25, 1910 |
| 31st..... | 1st..... | Dec. 3, 1849 | Sept. 30, 1850 | | 3d..... | Dec. 5, 1910 | Mar. 3, 1911 |
| | 2d..... | Dec. 2, 1850 | Mar. 3, 1851 | 62d..... | 1st..... | Apr. 4, 1911 | Aug. 22, 1911 |
| 32d..... | 1st..... | Dec. 1, 1851 | Aug. 31, 1852 | | 2d..... | Dec. 4, 1911 | Aug. 26, 1912 |
| | 2d..... | Dec. 6, 1852 | Mar. 3, 1853 | | 3d..... | Dec. 2, 1912 | Mar. 3, 1913 |
| 33d..... | 1st..... | Dec. 5, 1853 | Aug. 7, 1854 | 63d..... | 1st..... | Apr. 7, 1913 | Dec. 1, 1913 |
| | 2d..... | Dec. 4, 1854 | Mar. 3, 1855 | | | | |

FRONTISPIECE MAP.

DISTRICTS AND DIVISIONS, AND OFFICES, ETC.

The boundaries of these may change according to the exigencies of the work under the care of the Corps of Engineers. See below.

REFERENCES.

(Page 15.)

Sometimes the text, pages 1 to 1791, refers to H. D. 482, 55th Cong., 2d, and sometimes to H. D. 421, 57th Cong., 2d. These are practically the same, the one of later date embracing the facts up to that later date. (H. D. 1491, 63d, 3d is the latest edition, and so more embracive than the others named above.)

(Page 19.)

ORDER OF ARRANGEMENT OF WATERWAY GROUPS, AND UNITED STATES ENGINEER OFFICES.

The waterways of the United States, as listed in Volume I, are arranged in sequential geographical groups. Usually these groups correspond with the areas in the care of the local United States Engineer office in charge of works of defense and of improvements on waterways. Sometimes, for various reasons, the limits or area under the care of a United States Engineer office may be changed, so that waterway improvements in one or more of the groups named in Volume I may be under the care of an office other than named in Volume I. This fact may be particularly noticeable in the case of waterways which begin or end any list of waterways in Volume I.

Any request for information concerning a waterway, addressed to the United States Engineer Office deemed to be in charge of the waterway concerned, would, usually, be forwarded direct to the United States Engineer Office actually in charge.

A.—PORTLAND, ME., DISTRICT.

(Page 24.)

MAPS, PLATE 1.

ENGLISHMAN R.—This should be changed to
"Chandler R."

(Page 27.)

EAST MACHIAS RIVER, ME. (A-15)

It is tributary to Machias R., Me., No. 14.

(Page 28.)

PASSAGASAWAKEAG RIVER, ME. (A-139)

A tributary of Belfast H., Me. (A-138)

ROBIN HOOD COVE, ME. (A-213)

Tributary to Knubble Bay, Me. (A-212)

SAGADAHOC BAY, ME. (A-218)

Tributary to Stage Island Bay, Me. (A-217)

(Page 29.)

DRUMMORE, ME. (A-237)

This is Drummors Bay.

(Page 32.)

MOOSABEC BAR, ME. (A-22(a))

CONTRACTS.—1885. Moore & Wright, dr.,
38¢ c. y., s. m., 86, 534.

(Page 36.)

BASS HARBOR BAR, ME.

Change number to A-57(a).

BASS HARBOR BAR AND DEER ISLAND THOROUGHFARE, ME.

Change number to A-57(b).

(Page 39.)

PENOBSCOT RIVER, ME. (A-101)

PROJECTS.—Omit the reference to footnote 1
after estimate of \$130,000, in the last para-
graph, referring to act Mar. 2, 1907.

(Page 43.)

CAMDEN HARBOR, ME. (A-142)

PROJECTS.—First paragraph: The reference in
the third line is to mean low water.

(Page 44.)

ROCKPORT HARBOR, ME. (A-143)

PROJECTS.—Change reference to footnote 1, in
the second paragraph, instead of to 2.

(Page 50.)

KENNEBEC RIVER, ME. (A-219)

SURVEYS.—Add, in the last paragraph, ref-
erence to footnote 3, under Maps.

(Page 63.)

LAMPREY RIVER, ME. (A-288)

SURVEYS.—The footnote reference is to H. D.
1066, 61st, 3d.

(Page 64.)

EXETER RIVER, N. H. (A-289)

PROJECTS.—See below.

SURVEYS.—The proper reference under "Map"
is to footnote 1, or H. D. 1090, 61st, 3d.

(Page 65.)

ISLES OF SHOALS HARBOR, ME. AND N. H. (A-291)

SURVEYS.—Add the following reference under
"Map," namely, to footnote 3.

B.—BOSTON, MASS., DISTRICT.

ENGINEERS.

Col. F. V. Abbot was in charge of district from 1910.

See Newburyport H., page 71, for list of Corps of Engineers assistants.

(Page 69.)

POWOW RIVER, MASS. (B-5) (See below)
In Mass. only.

(Page 71.)

NEWBURYPORT HARBOR, MASS. (B-2)
OPERATIONS.—1904-5. 75' of core is correct instead of 71'.

(Page 72.)

1911-12. Project named 85% completed on 12, 69.

SURVEYS.—List of Congressional Docs., etc., to be found on 12, 68.

(Page 74.)

POWOW RIVER, MASS. (See above.) (B-5)
PHYSICAL CHARACTERISTICS.—Omit reference 02, 85.

(Page 75.)

IPSWICH RIVER, MASS. (B-60)
ESTIMATES.—Date should be 1873, not 1872. Add the following paragraph—"By Lt. Col. Thom, 1875, improving R.; by chan. 4' x 60', \$25,000; for chan. 9' x 60', \$300,000; 76, 199, 201, 202."

(Page 76.)

SURVEYS.—First paragraph.—Date should be 1873, not 1872.

ESSEX RIVER, MASS. (B-66)
OPERATIONS.—1909-1910. 30 point 187 c. y. bowlders is correct, not 30,187.

(Page 78.)

SANDY BAY, MASS. (B-77)
PROJECTS.—Reference in last paragraph should be to 10, 65.

ROCKPORT HARBOR, MASS. (B-79)
APPROPRIATIONS.—Item of 1902 is \$22,000, 02, 856.
SURVEYS.—Reference is to 00, 1177, 1178.

GLOUCESTER HARBOR, MASS. (B-83)
APPROPRIATIONS.—Item of 1823 is for \$6,000.

(Page 79.)

CONTRACTS.—1899. Reference is to 00, 1165.
PROJECTS.—Omit estimate of \$752,000 in item relating to Col. Mansfield, 1894.

(Page 80.)

BEVERLY HARBOR, MASS. (B-92)
ENGINEERS IN CHARGE.—Lt. Col. G. L. Gillespie, 1888. R., 90, 524. Lt. Col. S. M. Mansfield, 1889-90.

(Page 81.)

CRANE AND WATERS RIVERS, MASS. (B-96, 97)
ENGINEERS IN CHARGE.—Lt. Col. G. L. Gillespie, 1888-89, and Lt. Col. S. M. Mansfield.

SALEM HARBOR, MASS. (B-100)
ENGINEERS IN CHARGE.—Lt. Col. G. L. Gillespie, 1888. R., 90, 528.

(Page 82.)

PROJECTS.—Reference to Stanton project item is 04, 883-4. No est., by Col., for maintenance.

LYNN HARBOR, MASS. (B-108)
APPROPRIATIONS.—1912 item was for western or Saugus R. chan.

(Page 83.)

OPERATIONS.—1910-11-12. Omit "in w chan."

PROJECTS.—Omit "x 4,500' from sea to opposite Little Nahant," in Suter project.

(Page 84.)

WINTHROP HARBOR, MASS. (B-114)

Abstract should follow Boston H., Mass., abstract.

BOSTON HARBOR, MASS. (B-113)

TITLE.—Reference should be made also to B-117, and B-148.

COMMERCE.—Seven paragraph should read as follows: "Increase in value since 1867; 1902, about \$98,000,000, 03, 78; 1911, over \$122,000,000, 12, 89.

(Page 85.)

CONTRACTS.—1903. George H. Breyman is correct. 1907. Breyman is correct.

(Page 88.)

OPERATIONS.—1904-05. On third line the price should be "79.5¢."

PROJECTS.—In paragraph headed "Tributary Channels," the second from the last line should read—"chan. 25' x 150' from 35' chan., Boston H., for". Paragraph referring to Mansfield proj. of 1894 (page 89), the chan. was to run from Grand Junction R. R. Br. to B. & M. Omit "head to navigation" in the third line.

(Page 89.)

SURVEYS.—Paragraph relating to Allerton Pt., 1905; the footnote reference should be footnote No. 5 instead of No. 1.

EAST BOSTON CHANNEL, MASS. (B-117)

SURVEYS.—First line should begin with "Ex. se.," omitting "sse."

(Page 90.)

CHELSEA RIVER, MASS. (B-118)

SURVEYS.—Right reference in last paragraph is to 95, 648.

MYSTIC RIVER, MASS. (B-119)

CONTRACTS.—1912. "Bay State Dredging Co. (Ltd.)," is correct.

(Page 91.)

MYSTIC AND MALDEN RIVERS, MASS. (B-119 and 121)

APPROPRIATIONS.—07, 909 is an additional reference for item of 1905.

ENGINEERS IN CHARGE.—Lt. Col. G. L. Gillespie. See also report for 89, 594. Lt. Col. Stanton. See 05, 813, instead of 815.

(Page 92.)

DORCHESTER BAY AND NEPONSET RIVER, MASS. (B-132 and 134)

ENGINEERS.—Chief of Engineers. 07, 62 is correct.

(Page 93.)

WEYMOUTH RIVER, MASS. (B-138)

TITLE.—No. should be B-138 and B-143.

CONTRACTS.—1912. Bay State Dredging Co. (Ltd.), dr., about 10,000 c. y., in Back R., 30½ c. y., 12, 1399.

ENGINEERS IN CHARGE.—Lt. Col. G. L. Gillespie, 1888. R., 90, 521. Col. F. V. Abbot, 12, 1397.

(Page 95.)

WEIR RIVER, MASS. (B-146)

ENGINEERS IN CHARGE.—Lt. Col. S. M. Mansfield, 1888-89.

COHASSET HARBOR, MASS. (B-150)

ENGINEERS IN CHARGE.—Lt. Col. S. M. Mansfield, 1888-89.

(Page 96.)

SCITUATE HARBOR, MASS. (B-151)

PROJECTS.—The footnote is No. 1, and refers to second to last paragraph.

(Page 98.)

PLYMOUTH BEACH AND HARBOR, MASS. (B-168)

ENGINEERS (Chief of Engineers).—Reference of 85, 67 should include page 64.

ENGINEERS IN CHARGE.—Lt. Col. G. L. Gillespie, 89, 596.

(Page 99.)

OPERATIONS.—1901-2. 13,728 t. st. placed "in," not "completing."

SURVEYS.—Ex. of 1894, Lt. Col. Mansfield, was made under act Aug. 17, 1894.

(Page 101.)

PROVINCETOWN HARBOR, MASS. (B-208)

ENGINEERS (Assistants).—W. T. Martin, 69, 437 is correct.

(Page 103.)

STAGE HARBOR, MASS. (B-218)

ENGINEERS IN CHARGE.—Add Lt. Col. G. L. Gillespie.

C.—NEWPORT, R. I., DISTRICT.

(Page 107.)

SALT POND, MASS.

Should follow C-5 as C-5(a).

(Page 108.)

NANTUCKET AND VINEYARD SOUNDS, MASS. (C-2)

PHYSICAL CHARACTERISTICS.—Details, reference, first paragraph, 04, 959.

SURVEYS.—Reference is to 04, 952.

NANTUCKET SOUND, MASS. (C-3)

ENGINEERS (In charge).—Lt. Col. Sanford reference is 11, 118.

(Page 109.)

BASS RIVER, MASS. (C-7)

SURVEYS.—Reference, last paragraph, is 00, 1282.

HYANNIS HARBOR OF REFUGE, MASS. (C-9)

APPROPRIATIONS.—Reference after total is 12, 1407.

(Page 111.)

WOODS HOLE HARBOR, MASS. (C-18)

OPERATIONS.—1902-3. 42 c. y. bowlders removed is correct.

LITTLE HARBOR, WOODS HOLE, MASS. (C-19)

ENGINEERS (In charge).—Reference to Lt. Col. Sanford is 10, 93.

SURVEYS.—Insert, as a first paragraph, the following: Sur. au. act Aug. 7, 1894; made, 1895, by Lt. Harts, 95, 750.

(Page 114.)

MARTHAS VINEYARD, MASS. (C-30)

PLANS.—The Warren estimate was \$39,050, 82, 578.

SURVEYS (Maps).—95, 662 is correct.

(Page 115.)

NANTUCKET HARBOR, MASS. (C-31)

ENGINEERS (Chief).—The 1911 report is at page 93.

PROJECTS.—The 1880 report, second paragraph, is at page 434.

(Page 117.)

WAREHAM HARBOR, MASS. (C-43)

COMMERCE.—The 1872 report is at pages, 94, 953, 974.

CONTRACTS.—1886. The price, Pidgeon, dr., was 13.95¢, 87, 543.

ENGINEERS (In charge).—Maj. Warren's report for 1872 is at page 953.

OPERATIONS.—1875-77. The 1877 report is at page 195.

(Page 118.)

NEW BEDFORD, MASS. (C-53)

CONTRACTS.—1902. Page reference to Cole contract is 04, 912.

ENGINEERS (Chief).—The page of the 1911 report is 97.

(Page 119.)

WESTPORT HARBOR, MASS. (C-59)

OPERATIONS.—1887-88. Improvement completed by construction of a jetty at Horse Neck Pt., 88, 492.

SAKONNET RIVER, R. I. (C-63)

COMMERCE.—In 1907, 11,069 t., 08, 982.

(Page 120.)

SAKONNET POINT HARBOR, R. I. (C-64)

SURVEYS.—Report on the Lockwood and Goethals survey is in 01, 175, 1148.

(Page 121.)

COASTERS ISLAND HARBOR, R. I. (C-66)

TITLE.—Should be "Coasters Harbor Island."

NEWPORT HARBOR, R. I. (C-67)

CONTRACTS.—1875. Additional reference for Flannery contract is 76, 208.

(Page 123.)

TAUNTON RIVER, MASS. (C-69)
APPROPRIATIONS.—Page reference for the
1894 item of \$5,000 is 95, 675.

(Page 124.)

PROJECTS.—The reference to the Bixby
project, 1895, is 95, 675.

FALL RIVER HARBOR, MASS. (C-70)
ENGINEERS (Chief).—The reference for the
1899 report is 99, 91.

(Page 125.)

NARRAGANSETT BAY, R. I. (C-79)
ENGINEERS (In charge).—The 1901 reference
in both cases is 01, 1156.

(Page 126.)

**PROVIDENCE RIVER, HARBOR, BULK-
HEAD ROCK, AND NARRAGANSETT
BAY, R. I. (C-81)**

ENGINEERS (In charge).—The 1907 report of
Maj. Lockwood is 97, 908. Omit the figures
“908” after the 1896 reference.

CONTRACTS.—1870. Additional reference to
the Hill contract is 71, 727.

(Page 127.)

OPERATIONS.—1907-8. (Page 127.) The
reference is to 08, 983, 984.

(Page 128.)

PROVIDENCE RIVER, R. I. (C-81(a))
ENGINEERS (In charge).—The 1894 reference
is to 94, 592.

PAWTUCKET RIVER, R. I. (C-83)
CONTRACTS.—1902. The proper reference to
the Packard contract is 03, 800.

(Page 129.)

ENGINEERS (Assistants).—The page reference
to Russell and Dager should be 71, 735.

PHYSICAL CHARACTERISTICS. — Fifth
paragraph: Mean rise of tide about 5', 03, 95.

(Page 130.)

PAWTUCKET HARBOR, R. I. (C-84, 85, 86)
TITLE.—C-84, 85, 86 refer to the same work or
place.

PAWTUCKET COVE, R. I. (C-84)
ENGINEERS (In charge).—Col. Willard's re-
port is 06, 92.

(Page 131.)

POTOWOMUT RIVER, R. I. (C-92)
“Potonowut” is incorrect.

WICKFORD HARBOR, R. I. (C-93)
ENGINEERS (In charge).—Col. Willard's re-
port is 08, 97.

(Page 133.)

POINT JUDITH, R. I. (C-102)
APPROPRIATIONS.—The allotment of \$10,-
000, in 1907, was made in 1903. Reference is as
shown, 09, 1020.

(Page 134.)

BLOCK ISLAND, R. I. (C-103)
APPROPRIATIONS.—Reference to the total
is 12, 1429.

(Page 135.)

SURVEYS.—The reference to Maj. Lockwood's
report is 00, 1277.

(Page 137.)

**BLOCK ISLAND, R. I. HARBOR OF REF-
UGE. (C-104)**
Congressional documents are listed in 04, 84,
instead of 01, 84. They are referred to also at
01, 173.

**LITTLE NARRAGANSETT BAY, CONN.
AND R. I. (C-106)**

CONTRACTS.—The 1873 reference to the
Molthrop contract is 78, 244. The price, 1882,
of the Hartford Dredging Co. contract for dr.,
was 20.9 ¢ per c. y., 83, 498.

OPERATIONS.—1881-82. 33,683 c. y. were
dredged, instead of 33,686, 82, 563.

(Page 138.)

SURVEYS.—Map, 79, 314.

D.—NEW LONDON, CONN., DISTRICT.

(Page 141.)

PAWCATUCK RIVER, R. I. AND CONN. (D-1)

Flows into Little Narragansett Bay.

STONINGTON HARBOR, CONN. (D-2)

Flows into Fishers Island Sound.

WEQUETEQUOCK RIVER, CONN. (D-3)

Flows into Little Narragansett Bay.

QUIAMBOG COVE, CONN. (D-4)

Flows into Fishers Island Sound.

MYSTIC RIVER, CONN. (D-5)

Flows into Fishers Island Sound.

POQUONOCK RIVER, CONN. (D-6)

Flows into Fishers Island Sound.

HAY (WEST) HARBOR, FISHERS ISLAND, N. Y. (D-10)

Flows into Fishers Island Sound.

WESTBROOK HARBOR, CONN. (D-24)

Flows into Long Island Sound.

MILL RIVER, CONN. (D-77)

In Conn. only.

FIVEMILE RIVER, CONN. (D-84)

Flows into Fivemile R. Harbor.

DARIEN RIVER (GOODWIVES CR.), CONN. (D-87)

Flows into Darien Harbor.

(Page 142.)

PAWCATUCK RIVER, R. I. AND CONN. (D-1)

CONTRACTS:

- 1897. Omit "or t." in third line.
- 1895. Randerson contract was for boulder removal, not for rock removal.
- 1909. Omit "one about" from the second line.

ENGINEERS (Chief).—The report for 1886 is at 86, 80. The 1902 report is at 02, 123.

OPERATIONS:

- 1871-72. Omit "chan. (dimensions)."
- 1872-73. 5½' to Westerly.
- 1873-74. Depth of chan. to Westerly increased to 5½' x 75'.
- 1886-87. Reference is to 87, 565.
- 1887-1888. 8 c. y. bowlders removed.
- 1896-97. 266 c. y. rock and bowlders removed.
- 1909-10. "Contract" should be "contracts."

(Page 143.)

PROJECTS:

- In second paragraph, project is the project of 1885. Additional reference, 85, 622.
- The project for 10', 1895, from Stonington H., was by Maj. Lockwood; and it was to be 100' w., Avondale to Westerly. Additional reference, 96, 676.
- Additional reference for project for obstr. removal, under act Mar. 3, 1905, 05, 94.

STONINGTON HARBOR, CONN. (D-2)

CONTRACTS:

- 1875. Contract was with J. S. Crosby, 76, 223.
- 1879. Price, Ballou contract, 89.9—¢.
- 1881. Price of Ballou contract, \$1.14½.
- 1882. Price of Ballou contract, \$1.09½.
- 1886. Price of Bouker contract, \$1.02½.
- 1889. Price of Stoll contract \$1.07, not \$11.07 pert.

DOCUMENTS.—Report of Lt. Prescott was to Lt. Col. J. G. Anderson.

(Page 144.)

ENGINEERS (In charge).—The 1884 report of Lt. Col. Elliot is at 84, 630.

ESTIMATES.—BE., 1875. Additional estimate, \$231,000.

OPERATIONS:

- 1879-80. 34,801 t. granite delivered in break-water.
- 1881-82. 23,909 t. st. is correct.
- 1883-84. 4,986.5 t. riprap st. is correct.
- 1888-89. 3,664.5 t. riprap granite is correct.

PROJECTS.—First paragraph. Make last line read, "cost, \$36,753.83, 72, 918."

(Page 145.)

MYSTIC RIVER, CONN. (D-5)

ENGINEERS (Chief).—The 1891 report is 91, 63.

ENGINEERS (In charge).—Col. Houston was Lt. Col. prior to the 1891 report.

PROJECTS.—The project of 1888 was by Lt. Col. Houston.

SURVEYS.—The examination of 1888 was by Lt. Col. Houston. The reference is 89, 746.

NEW LONDON HARBOR, CONN. (D-7)

ENGINEERS (In charge).—The 1889 report was the first rendered by Col. Houston as colonel.

(Page 146.)

THAMES RIVER, CONN. (D-11)

APPROPRIATIONS.—The reference to the 1899 appropriation is 99, 1156.

(Page 147.)

CONTRACTS.—1867. The reference is 71, 751, not 551.

ENGINEERS (In charge):

The first report of Maj. Houston, as major, was the 1867 report.

The first report of Lt. Col. McFarland as Lt. Col. was for 1884.

Capt. Waldron's report for 1912 is found at 12, 1436.

ESTIMATES.—In the fourth line of the Barlow estimate the aggregate should be \$81,800.

OPERATIONS:

1866-67. The pages of the 1867 report are 45 and 448.

1871-72. 45,954 c. y. were dredged.

1872-73. The page of the 1873 report is 984.

1882-83. 53,197 c. y. were dredged.

1883-84. Omit the words "training wall completed," and insert "2,988 l. f. pile and riprap dike built at Mohegan."

1886-87. Insert the words "and in" after the semicolon, second line.

1888-89. 151,272 c. y. dr., not 222,392.

1907-08. 52,886 c. y. dr., not 74,340.

(Page 148.)

NIANTIC RIVER, CONN. (D-20)

ENGINEERS (Chief).—The page of the 1885 report is 96, not 963.

PLANS.—Make the last line read as follows—

"1. w. below the R. R. br., and dr. above br.; est., \$8,000, 85, 711."

(Page 149.)

CONNECTICUT RIVER, CONN., MASS. (D-23)

SUMMARY AT HEAD.—The period of Part a is 1829-1879.

Including miscellaneous, the total might be \$958,481.59.

CONNECTICUT RIVER. (D-23-a)

APPROPRIATIONS.—1878. References, additional, 78, 247, and act June 20.

(Page 150.)

CONNECTICUT RIVER, BELOW HARTFORD, CONN. (D-23-b)

APPROPRIATIONS.—The total, including miscellaneous, \$560,677.02.

CONTRACTS:

1881. In the first line, change "J. Beattie" to "E. H. Williams." In the third line, change "E. H. Williams" to "J. Beattie."

1882. E. H. Williams, riprap dike, \$1.10 t., of st., 83, 509. H. N. and A. J. Beardsley, dr., 13¢ c. y., 83, 509.

1883. Hartford Dredging Co., dr., 11½¢ c. y., 83, 509.

1884. Add contract of C. C. Goodrich, dr., 10¢ c. y., 84, 641.

1886. Add contracts of C. C. Goodrich, dr., 10¢ c. y., 86, 627. C. C. Goodrich, dr., 87, 592.

1887. Hartford Dredging Co., dr., 87, 593.

1888. C. C. Goodrich, dr., 10¢ c. y., 88, 533.

(Page 151.)

ENGINEERS (Chief).—The 1897 report is on page 86.

ENGINEERS (In charge):

The first report of Col. McFarland as Lt. Col. was 1884.

The first report of Col. Houston as Col. was 1889.

OPERATIONS:

1881-82. 32,870 c. y. dr., not 9,017.

1882-83. 47,269 c. y. dr., not 31,433.

1883-84. Change the whole line to read "91,400 c. y. dr., 14,255 t. st. placed, 84, 640, 641."

1885-86. 1542 t. st. placed, not 1,582.

1886-87. Second line—6,289 t. st. placed, not 6,829.

1889-90. 45,377 c. y. dr., not 63,411.

1898-1900. 180,538 c. y. dr., not 99,883.

1900-1901. 50,961 c. y. dr., not 64,284.

1910-11. 103,521 c. y. dr., not 168,355.

1911-12. 137,825 c. y. dr., not 155,147.

PROJECTS:

The Warren estimate, 1879, should be \$330,487.

The 1892 reference of the Houston project, 1889, is 92, 661.

(Page 152.)

CONNECTICUT RIVER, ABOVE HARTFORD, CONN. (D-23-c)

ENGINEERS (In charge):

First report of Col. McFarland as Lt. Col. was 1884.

First report of Col. Houston as Col. was 1889.

OPERATIONS.—Omit matter for 1881-82.

(Page 158.)

PROJECTS:

First paragraph.—Reference in the third line should be 71, 762, 763.

Fourth paragraph.—The estimate should be \$1,465,000, not \$1,564,000.

(Page 154.)

DUCK ISLAND HARBOR, CONN. (D-41)

CONTRACTS.—1896. The reference to the Quinn annulment is 98, 953.

CLINTON HARBOR, CONN. (D-44)

ENGINEERS (In charge):

First report of Col. McFarland as Lt. Col. was 1884.

First report of Col. Houston as Col. was 1889.

(Page 155.)

MADISON HARBOR, CONN. (D-47)

PLANS.—The locality in the second line should be "Madison," not "Milford."

(Page 156.)

BRANFORD HARBOR, CONN. (D-53)

SURVEYS.—The reference of the Leach survey is 01, 198.

NEW HAVEN HARBOR, AND WEST RIVER, CONN. (D-56)

SUMMARY.—The total, including miscellaneous items, might be \$37,194.35, 12, 1447.

NEW HAVEN HARBOR, CONN. (D-56-a)

APPROPRIATIONS.—The allotment was the \$3,000 item, 1907, not the \$10,000 item.

CONTRACTS:

1872. The 1872 reference is 72, 863 only.

1873. The price of the Beardsley contract is 19.73¢.

ENGINEERS (In charge):

Maj. Houston rendered a report in 1869, 69, 409.

(Page 157.)

First report of Col. McFarland as Lt. Col., 1884.

First report of Col. Houston as Col., 1889.

The 1903 report of Maj. Powell is at 03, 839.

ENGINEERS (Assistants).—Babcock's 1874 report is at 74, ii, 258.

PLANS.—The 1889 plan was submitted by Lt. Col. Houston.

PROJECTS:

Second paragraph.—The 1871 reference in the second line should be 71, 85, 769.

Last paragraph.—Change the last three lines to read as follows: "e. side of Quinnipiac R. between Ferry St. and Grand Ave., in which existing d. was 6' or more, 12, 152."

SURVEYS.—The right page of the 1871 reference is 71, 776.

(Page 159.)

NEW HAVEN, CONN. (D-57)

COMMERCE.—Fifth paragraph. Additional reference, 12, 157.

CONTRACTS.—1882. Price of Ballou contract, \$1.14¢.

ENGINEERS (In charge):

First report of Col. McFarland as Lt. Col., 1884.

First report of Col. Houston as Col., 1889.

OPERATIONS.—1880-81. 58,416 t. granite, etc., correct.

(Page 160.)

OPERATIONS:

1907-8. The west breakwater is referred to.

1908-9. West breakwater is referred to.

1909-10. West breakwater is referred to.

MILFORD HARBOR, CONN. (D-61)

APPROPRIATIONS.—Right total, including allotment of 1892, is \$72,750.

(Page 161.)

ENGINEERS (In charge):

First report of Col. McFarland as Lt. Col., 1884.

First report of Col. Houston as Col., 1889.

OPERATIONS.—1888-89. Besides dr., there were jetty repairs.

SURVEYS.—An additional reference for the harbor lines survey, 1894, is 95, 471.

(Page 162.)

HOUSATONIC RIVER, CONN. (D-64)

APPROPRIATIONS:

The correct reference for the 1888 item is 88, 553.

The 1909 item of \$5,000 was an allotment.

CONTRACTS:

1886. The Smith contract was for the removal of Drews Rock, not Davis Rock.

1889. Parrott contract annulled, 90, 633.

1890. Add, Hartford Dredging Co., hire of dr. plant, \$9 per hr., 90, 633.

1909. Add, E. S. Belden & Sons, placing st., in dike, \$1.43 per t., 09, 1041.

ENGINEERS (In charge):

First report of Col. McFarland as Lt. Col., 1884.

First report of Col. Houston as Col., 1889.

ESTIMATES.—The reference of the Edwards estimate is 71, 786. Omit page 711.

(Page 163.)

(Page 168.)

OPERATIONS:

- 1885-86. 17,812 c. y. dr., not 14,394.
- 1886-87. 34,076 c. y. dr., not 37,494. Add, 140 c. y. loose st. dr. at Washington B.
- 1891-92. Add, break'r repaired.
- 1893-94. Insert "dike" for "bank" in second line.
- 1896-97. 31,104 c. y. dr., instead of about 36,000.

PROJECTS.—Additional reference for the 1887 project, 88, 554.

(Page 164.)

BRIDGEPORT HARBOR, CONN. (D-66)

CONTRACTS:

- 1875. Prices of the Seward contract were 16¢, 15¢, 10¢; not 12½¢.
- 1878. Right reference is 79, 349.
- 1879. Another price for Beardsley dr. was 8¢.

ENGINEERS (In charge):

- First report of Maj. Houston as Maj., 68, 750.
- First report of Col. McFarland as Lt. Col., 84, 651.
- First report of Col. Houston as Col., 1889.

OPERATIONS.—1908-9. Omit the words "and basin" from the second to the last line.

PROJECTS:

- Fourth paragraph. Should begin as follows—
"By Maj. Barlow, dr. chan. to 12' with w. of 300'; est., \$62,200.80."
- In paragraph at bottom of column beginning "By Maj. Leach, 1898," add "one and" before "one-eighth" in second line from bottom of page.

(Page 166.)

PROJECTS:

- First line, first column. Should end with "and mainten. of the 3," not 4.
- Fourth paragraph from top. The second line should end with "to within 1,500' of head of dr."

SURVEYS.—Maps. Add, 89, 696.

BLACK ROCK HARBOR, CONN. (D-72)

ENGINEERS (In charge).—First report of Col. Houston as Col., 1889.

(Page 167.)

SOUTHPORT HARBOR, CONN. (D-76)

COMMERCE.—Thrd paragraph. Additional reference, 10, 1173.

ENGINEERS (In charge).—First report of Col. McFarland as Lt. Col., 1884.

WESTPORT HARBOR, AND SAUGATUCK RIVER, CONN. (D-79)

ENGINEERS (Chief).—Add, 79, 56.

(Page 169.)

NORWALK HARBOR, CONN. (D-80)

COMMERCE.—The 1912 reference is 12, 168, 1456.

CONTRACTS.—1904. J. P. Randerson, dr., 17½¢ c. y., 05, 894.

ENGINEERS (In charge):

- First report of Col. McFarland as Lt. Col., 1884.
- First report of Col. Houston as Col., 1889.

OPERATIONS:

- 1879-80. 40,671 c. y. dr., not 45,519.
- 1885-86. 19,360 c. y. dr., not 34,824.
- 1907-8. Add, 4.52 c. y. r. removed.
- 1908-9. 159.03 c. y. r. removed, not 159,034.

(Page 170.)

SURVEYS.—Maps. Add, 82, 622.

(Page 170.)

WILSON POINT HARBOR, CONN. (D-82)

OPERATIONS.—1899-91-92. 179,000 c. y. dr., not 54,026.

FOOTNOTE.—No. 4. Prior improvement of Wilson Point Harbor conducted as part of Norwalk Harbor.

(Page 171.)

FIVEMILE RIVER HARBOR, CONN. (D-85)

OPERATIONS.—1899. 13,000 c. y. dr., 99, 119.

(Page 171.)

STAMFORD HARBOR, CONN. (D-93)

APPROPRIATIONS.—Reference to the 1888 item is 88, 566.

(Page 172.)

ENGINEERS (In charge).—First report of Col. Houston as Col., 1889. His 1887 report is at page 618, not 61.

PHYSICAL CHARACTERISTICS.—Insert "ranges" for "range lights," second line.

(Page 172.)

(Page 173.)

**COSCOB HARBOR AND MIAMUS RIVER,
CONN. (D-95)**

COMMERCE.—Tonnage, 1903, 7,250, instead of 7,000.

GREENWICH HARBOR, CONN. (D-97)

SURVEYS.—In third paragraph add 08, 1025.

E.—NEW YORK, N. Y., DISTRICT NO. 1.

(Page 176.)

Page 178.

MAPS.

At top, "Rouses Pt." should be "Rouse Pt."

At quarter page from top, Ticonderoga "Cr." should be "R."

Whalons B. (E-94.) Proper spelling is "Whalons."

St. Albans. (E-120.) This refers to St. Albans H. and B.

(Page 194.)

(Page 177.)

WATERWAY LIST.

Pugsley Cr., N. Y. (E-20.) Is properly spelled "Pugsley."

Lake Meahayh, N. Y. (E-34.) Is properly spelled "Meahach."

Saugerties H. (E-63.) The name "Saugerties H." should precede "Esopus Cr.," and the latter should be in parentheses.

Little Monte, and Monte Bay. (E-83, and 84.) The proper spelling is "Monty."

HUDSON RIVER, N. J. AND N. Y. (E-28-a)

PROJECTS.—Fourth paragraph. Fifth line from bottom. The reference should be 68, 718, 719; 86, 667.

(Page 203.)

LAKE CHAMPLAIN, VT. (E-79)

ENGINEERS (In charge).—The first report of Maj. M. B. Adams is for 1887, and the page is 2412, not 97, 2412.

F.—NEW YORK, N. Y., DISTRICT NO. 2.

(Page 215.)

(Page 217.)

**GREAT SOUTH AND JAMAICA BAYS,
N. Y. (F-48 AND F-79)**

The tributaries referred to in the footnote.

FLUSHING BAY, N. Y. (F-5)

OPERATIONS.—1880-81. Channel is 65' x 6,000'.

G.—NEW YORK, N. Y., DISTRICT NO. 3.

(Page 247.)

KILL VAN KULL, N. J. (G-3)

TITLE.—Make it "Kill Van Kull, N. Y. and N. J."

ENGINEERS (In charge).—Omit page 154 from the Livermore reference.

SURVEYS.—Col. Livermore's report is dated Apr. 25, 1906.

NEWARK BAY, N. J. (G-4)

TITLE.—Make it "Newark Bay, N. Y. and N. J."

(Page 250.)

PASSAIC RIVER, N. J. (G-16-d)

COMMERCE.—Add reference 12, 256 to last paragraph.

(Page 251.)

OPERATIONS:

1907-8. 1,007,985 c. y. dr., not 1,017,985.

1908-9. 1,158,763 c. y. dr., not 1,158, 963.

(Page 252.)

LABITAN BAY, N. J. (G-23)

ENGINEERS (In charge).—The proper reference to Col. Roessler is 10, 188.

OPERATIONS.—1903-4. Change quantity on second line to read 43,855 c. y.

(Page 253.)

FOOTNOTE.—No. 1 is H. D. 184, 58th, 2d.

(Page 258.)

LABITAN RIVER, N. J. (G-36)

APPROPRIATIONS.—The reference to the 1902 allotment is to 03, 944.

CONTRACTS.—1882. Reference to the Leary contract is 83, 674.

(Page 259.)

ENGINEERS (Chief).—The 1910 reference is 10, 201.

ENGINEERS (In charge).—The reference to Col. Roessler is 10, 188.

PROJECTS.—The reference in the last paragraph is 93, 1116.

(Page 260.)

SOUTH RIVER, N. J. (G-39)

OPERATIONS.—1909-10. 13,479 c. y. is correct in first line.

(Page 261.)

CHEESEQUAKE CREEK, N. J. (G-40)

CONTRACTS:

1910. Omit the words "completed June 3, 1911."

1912. Omit this paragraph.

OPERATIONS.—1906-7. Length of chan. is 1,800', not 800'.

PHYSICAL CHARACTERISTICS. — Reference in the second paragraph is to 11, 230.

(Page 262.)

KEYPORT HARBOR, N. J. (G-43)

APPROPRIATIONS.—From 1902 to 1912, each item is an allotment.

(Page 265.)

SHREWSBURY RIVER, N. J. (G-48)

ENGINEERS (In charge):

Lt. Col. N. Michler, 1880-1882.

Col. W. T. Rossel, 1910-.

OPERATIONS.—1901-2. 12,590 c. y. sand dr.

H.—PHILADELPHIA, PA., DISTRICT.

(Page 271.)

DELAWARE RIVER. (H-3)

SUMMARY.—Part b. Title should be "Above and below Trenton."

(Page 272.)

DELAWARE RIVER. (H-3-a)

APPROPRIATIONS.—Add a seventh footnote, to read, "Includes also removal of piers in Delaware River, back of Reedy Island, act Aug. 2, 1882." This refers to appropriation of 1883 at foot of page for Ice Harbor.

(Page 273.)

DELAWARE RIVER, N. J., PA., DEL. (H-3-b)

TITLE.—Omit the words "Trenton to Mouth." The abstract refers to the whole river, above and below Trenton.

(Pages 274, 275, 276.)

ENGINEERS (Chief of).—Add, 84, 138 (Port Jervis ex.).

ENGINEERS (In charge).—Add to Weitzel reports, 84, 855 (Port Jervis ex.).

ENGINEERS (Assistants).—Add, E. A. Giesler, 84, 855 (Port Jervis ex.).

(Page 276.)

PHYSICAL CHARACTERISTICS.—Port Jervis to Trenton—130 miles by water. River bed of entire stretch of mountainous character. Description of sections, Port Jervis to Delaware Water Gap; to Easton; to Trenton. Floods frequent, and rises high. Details. 84, 855.

(Page 277.)

SURVEYS.—Trenton to Port Jervis. Ex. au. act Aug. 2, 1882; made under Lt. Col. G. Weitzel, by E. A. Giesler. R. (unfav.), dated Dec. 12, 1882. (See Physical Characteristics.) 84, 855. (Sen. Ex. 30, 48th, 1st.)

I.—WILMINGTON, DEL., DISTRICT.

(Page 299.)

WATERWAY LIST.

Little Egg Harbor, N. J. (I-9.)

Omit "Inlet." Flows into New Inlet, I-11, not into I-2.

Cedar Cr., Del. (I-71.) Flows into Mispillion R. (I-70), not into Delaware Bay.

(Page 303.)

ATLANTIC CITY HARBOR, N. J. (I-17)

SURVEYS.—Second paragraph should read as follows: "Au. act Aug. 5, 1886; made by BE., 1886, 87, 815.

(Page 315.)

WILMINGTON HARBOR, DEL. (I-58)

CONTRACTS.—1908. Emil F. Petterson is correct.

J.—BALTIMORE, MD., DISTRICT.

(Page 356.)

HESTER RIVER, MD. (J-413)

PROJECTS.—“Crampton” throughout should be “Crumpton.”

SURVEYS:

“Rirby’s to Spry’s Landing” should be
“Kirbys to Sprys Landing.”
“Crampton” should be “Crumpton.”

K.—WASHINGTON, D. C., DISTRICT.

(Page 373.)

WATERWAY LIST.

Picowaxton Cr., Md. (K-73.) Spelled with one
“c” only.

(Page 374.)

Neabsco Cr., Va. (K-103.) Not “Neabsico.”
Currioman B., Va. (K-117.) Flows into K-116,
or Nomini B.
Lockies Cr., Va. (K-229.) Spelled “Locklies.”

(Page 375.)

Sibleys Cr., Va. (K-275.) Not “Sipleys.”

(Page 395.)

NOMINI CREEK, VA. (K-118)

ENGINEERS (Chief of).—The 1895 report is at
95, 161.

L.—NORFOLK, VA., DISTRICT.

(Page 412.)

WATERWAYS LIST.

College Cr., Va. (L-113.) Same as L-116, or
Archers Hope R. See below.
Archers Hope R. (L-116.) Same as L-113. See
above.

(Page 413.)

Nawneys Cr., Va. (L-237.) Spelled as such on
U. S. C. S., not “Nanneys.”
Joyces Cr., N. C. (L-270-a.) Add to list with
number shown. Tributary to (264).

(Page 414.)

CAPE CHARLES CITY HARBOR, VA. (L-62)

ENGINEERS (Assistants).—Stierle’s report is
90, 972, 976.

(Page 419.)

JAMES RIVER, VA. (L-105)

CONTRACTS.—1887. The second contract was
with J. L. Johnson, not “Wilson.”

(Page 420.)

ENGINEERS (Chief).—The 1872 report is at
72, 69. Add, report for 09, 269.

(Page 421.)

OPERATIONS:

- 1890-91. The reference is 91, 1239-1240.
- 1910-11. The reference is 11, 1474-1477.
- 1911-12. The reference is 12, 1710-1714.

(Page 422.)

SURVEYS.—The 1870 reference is also on page 31, or 70, 31. Maps.—(See also 76, 292, and 298.)

(Page 425.)

APPOMATTOX RIVER, VA. (L-150)

CONTRACTS:

1884. Last contract was with A. F. Hall, not "Hull."

1886. Reference is 87, 979.

ENGINEERS (Chief).—Report for 1873 is 73, 75.

ENGINEERS (In charge).—Add to Craighill reports, 70, 68; 71, 606; 72, 692.

(Page 426.)

PHYSICAL CHARACTERISTICS:

In second to last paragraph reference is 12, 407.
In last paragraph reference is 12, 410.

PRIVATE WORK.—In paragraph relating to construction of dredge by Petersburg, the 1884 reference is 84, 915.

(Page 427.)

SURVEYS.—Second paragraph. Add, 70, 31.

(Page 428.)

NANSEMOND RIVER, VA. (L-165)

CONTRACTS.—1903. Add, 04, 1369.

(Page 429.)

ELIZABETH RIVER, VA. (L-173)

ENGINEERS (In charge).—Omit from Abert reports, 75, ii, 110.

ESTIMATES.—In Abert estimate of 1875 the reference is 75, 93; ii, 127.

(Page 430.)

NORFOLK HARBOR, VA. (L-173-b)

APPROPRIATIONS.—Item of \$187,500 (1886) has reference 86, 952, 957.

(Page 431.)

CONTRACTS.—1886. Last reference is 87, 968.

ENGINEERS (Assistants).—Add to Phillips reference, 72, 716.

OPERATIONS.—1880-90. There is some doubt about this quantity being dredged. (See 90, 1023, and 104, 105, 333.)

(Page 437.)

NORFOLK HARBOR TO ALBEMARLE SOUND. (L-173-i)

PROJECTS.—Last line of Hinman paragraph should read "est., \$65,122, 85, 159, ii, 1040."

(Page 438.)

DISMAL SWAMP CANAL, VA. (L-173-o)

PHYSICAL CHARACTERISTICS.—Reference, third paragraph is 96, 1090.

(Page 442.)

EDENTON BAY AND HARBOR, N. C. (L-296)

COMMERCE.—Reference in second paragraph is 06, 1139.

(Page 443.)

ESTIMATES.—Reference in first paragraph is 73, 856, 857.

OPERATIONS.—1884-85. Reference is 84, 1038.

PHYSICAL CHARACTERISTICS.—First line of first paragraph should be "Description of, 73, 857; 76, 358, 359."

(Page 444.)

BLACKWATER RIVER, VA. (L-312)

APPROPRIATIONS.—Reference to total is 12, 1727.

(Page 446.)

ROANOKE RIVER, N. C. AND VA. (L-352)

ENGINEERS (In charge).—Add to Craighill reports, 70, 69.

ESTIMATES.—Last reference of last paragraph should be 79, 625.

OPERATIONS.—1878-1888. 2,282 logs removed, not 2,272.

SURVEYS.—Add to Craighill reference, 70, 31, and omit pages 71 and 76.

(Page 448.)

DAN RIVER, N. C. AND VA. (L-378)
ENGINEERS (In charge).—The 1887 reference is 87, 953.

(Page 449.)

PROJECTS.—The 1886 reference in the last line is 86, 146.

M.—WILMINGTON, N. C., DISTRICT.

(Page 458.)

SHALLOWBAG BAY, N. C. (M-21)
APPROPRIATIONS.—The reference of the 1910 appropriation is 10, 1401.

NEWBERN TO BEAUFORT, N. C. (M-257-f)
ENGINEERS (Chief).—The 1882 reference in the third line should be 92, 161.

(Page 478.)

(Page 468.)

CONTENTNIA CREEK, N. C. (M-172)
OPERATIONS.—1881-82. The 1882 reference is 82, 1092.

OPERATIONS.—1887-88. The reference is 88, 872.

(Page 482.)

(Page 470.)

TRENT RIVER, N. C. (M-180)
OPERATIONS.—1908-9. The 1909 reference is 09, 1280.

NEW RIVER TO SWANSBORO, N. C. (M-286)
ENGINEERS (Assistant).—W. H. Chadbourn, jr., not H. W.

(Page 483.)

(Page 471.)

CORE SOUND, N. C. (M-226)
COMMERCE.—The 1893 reference should be 95, 1374.

NEW RIVER, N. C. (M-290)
OPERATIONS.—1895-1906. Cedar Bush Cove is correct.
PROJECTS.—The 1882 reference in the first paragraph is 82, 1117.

(Page 485.)

(Page 473.)

BEAUFORT HARBOR, N. C. (M-257-a)
PROJECTS.—The reference to the 1907 authorization (fifth paragraph) is 09, 301.

CAPE FEAR RIVER, N. C. (M-305-a)
CONTRACTS:
1883. The 1884 reference to the Summerell contract is 84, 939.
1884. The references to the Moore contract should be 85, 1089, and 86, 1012.
ENGINEERS (Boards).—In the third paragraph the 1873 reference should be 73, 809, 810.

(Page 491.)

(Page 476.)

BEAUFORT HARBOR, N. C. (M-257-e)
ENGINEERS (Chief).—The 1892 reference is 92, 162.

(Page 477.)

PHYSICAL CHARACTERISTICS.—The 1902 reference in the third paragraph is 02, 232.

NORTHEAST CAPE FEAR RIVER, N. C. (M-306)
PHYSICAL CHARACTERISTICS.—The 1912 reference in the last paragraph should be 12, 452.

N.—CHARLESTON, S. C., DISTRICT.

(Page 505.)

GREAT PEDEE RIVER, N. C. AND S. C. (N-19)

CONTRACTS.—1904. Merrill-Stevens is correct.

(Page 518.)

CHARLESTON HARBOR, AND ALLIGATOR CREEK, S. C. (INLAND WATERWAYS). (N-202-b)

PROJECTS.—Fourth paragraph from bottom of "Projects" on page 521 belongs on page 518, in "Projects" of (N-202-b)

SURVEYS.—Third paragraph from bottom of page 521 (Surveys) belongs on page 518, under "Surveys" of (N-202-b)

(Page 520.)

CHARLESTON HARBOR, S. C. (N-203)

OPERATIONS.—1885-86. Last reference is 86, 176.

PROJECTS AND SURVEYS.—See above (N-202-b)

(Page 524.)

ASHLEY RIVER, S. C. (N-214)

ESTIMATES.—"By Lt. Col. Gillmore" is correct.

(Page 528.)

SALKEHATCHIE RIVER, S. C. (N-255)

PHYSICAL CHARACTERISTICS. — "Salkehatchie" is correct.

O.—SAVANNAH, GA., DISTRICT.

(Page 533.)

WATERWAY LIST.

The list from O-77 to O-82 might be arranged preferably as follows:

O-77 South Chan., Ga. (2)

O-78 St. Augustine Cr., Ga. (77)

O-79 Wilmington R., Ga. (78)

O-80 Habersham Cr., Ga. (79)

O-81 Richardson Cr., Ga. (79)

O-82 Turners Cr., Ga. (79)

Wassaw Sound, Ga. (O-86.) Not "Warsaw."
Wassaw Cr., Ga. (O-104.) Not "Warsaw."

(Page 534.)

Pico Cut, Ga. (O-231.) Not "Cr."

(Page 536.)

Todds Cr., Ga. (O-500.) Not "Toods."

(Page 538.)

SAVANNAH RIVER AND HARBOR, GA. (O-2-a)

PLANS.—Last line of last paragraph. Change name to "Trotters Shoal."

(Page 540.)

SAVANNAH HARBOR, GA. (O-2-b)

ENGINEERS (Assistants).—Capt. B. D. Greene is correct. E. A. Gieseler is correct.

(Page 556.)

OCMULGEE RIVER, GA. (O-326)

ENGINEERS (Assistants).—J. L. Van Ornum is correct.

(Page 560.)

BRUNSWICK HARBOR, GA. (O-443)

ENGINEERS (Assistants).—S. L. Framont is correct.

(Page 563.)

**NUMBERLAND SOUND, FLA. AND GA.
(O-501)**

OPERATIONS.—1884-85. "South Jetty," instead of "Smith Jetty."

(Page 565.)

**ATLANTIC OCEAN-WATERWAY ACROSS
FLA. (O-510-b)**

(See also P-1-a, on page 572.)

The data on pages 565 and 566 relating to waterways between the Gulf of Mexico and to water-

way between St. Marys, Ga., and St. Johns, Fla., might, perhaps, be better assembled with the matter for the succeeding or P-District.

(Page 566.)

**ST. MARYS RIVER TO GULF OF MEXICO,
FLA. (O-510-c)**

ENGINEERS (Assistants).—S. L. Fremont is correct.

P.—JACKSONVILLE, FLA., DISTRICT.

(Page 572.)

**ATLANTIC OCEAN TO GULF OF MEXICO.
(P-1-a)**

See also page 565, or (O-510-b).

The waterway across to the Gulf of Mexico might be placed properly with the works of the Jacksonville District.

(Page 574.)

LOUISIANA AND TEXAS WATERS (HYACINTHS). (P-1-d)

OPERATIONS.—1902-3. "SS. Ramos fitted," not filled.

(Page 576.)

ST. JOHNS RIVER, FLA. (P-10-a)

Right number is as shown above.

(Page 577.)

ENGINEERS (In charge).—"Lt. A. M. D'Armit" is correct.

ENGINEERS (Assistants).—"Lt. A. M. D'Armit" is correct.

(Page 581.)

ST. JOHNS RIVER, FLA. (P-10-f)

CONTRACTS.—1886. J. A. Bryan is correct.

OPERATIONS.—1880-81. 1,950 is correct.

(Page 583.)

WEEKIVA RIVER, FLA. (P-60)

Correct spelling is as shown above.

(Page 585.)

CAPE CANAVERAL HARBOR, FLA. (P-110)

Correct title and number is as shown above.

(Page 589.)

KEY WEST HARBOR, FLA. (P-200)

OPERATIONS.—1911-12. 240,441 c. y. dr. on or from outer shoal is preferable.

(Page 596.)

TAMPA BAY, FLA. (P-288-a)

CONTRACTS.—1887. R. Moore is correct.

(Page 598.)

HILLSBORO BAY, FLA. (P-288-c)

APPROPRIATIONS.—Reference in total should be to (P-288-a).

(Page 603.)

**PITHLACHASCOOTIE RIVER, FLA.
(P-329)**

Correct spelling is as shown above.

(Page 606.)

CEDAR KEYS HARBOR, FLA. (P-349)

ENGINEERS (In charge).—Capt. A. N. Darnell is correct.

Q.—MONTGOMERY, ALA., DISTRICT.

(Page 610.)

MAP.

- Chattooga R. (At head of map.)
 Correct spelling as above.
 Choctawhatchee Bay. (Near bottom.)
 Correct spelling as shown above.
 Chattahoochee R. (Near center of map.)
 Correct spelling as shown above.

(Page 611.)

AUCILLA AND WACISSA RIVERS, FLA. (Q-5)

- COMMERCE.—Reference is to 82, 1302.
 ENGINEERS (Assistants).—Reference to Robinson report is 82, 1303.

(Page 612.)

- PLANS.—Second line, second paragraph.
 Change \$500 to \$300.

WAUKULLA RIVER, FLA. (Q-11)

- ENGINEERS (In charge).—Add, Capt. H. O. Ferguson, 08, 369.
 PHYSICAL CHARACTERISTICS.—Reference is to 87, 1260.
 SURVEYS.—Substitute "Ferguson" for "Cavanaugh" in last line.

OCKLOCKONEE RIVER, GA. AND FLA. (Q-13)

- PHYSICAL CHARACTERISTICS. — Substitute "Rafts" for "rocks" in second line.

(Page 613.)

CROOKED RIVER, FLA. (Q-14)

- ENGINEERS (Chief of).—The 1882 reference is 82, 186.

ST. GEORGES SOUND, FLA. (Q-15)

- ENGINEERS (In charge).—Reference is 06, 333.

(Page 615.)

APALACHICOLA BAY, FLA. (Q-20)

- OPERATIONS.—1884-85. Reference is to 85, 1259, 1261.

(Page 616.)

APALACHICOLA RIVER, FLA. (Q-21)

- ENGINEERS (Chief).—1878 reference is 78, 80.
 The 1880 reference is 80, 135, 141.
 ENGINEERS (In charge).—The Damrell report for 1882, right reference is 82, 1264, 1304.

(Page 617.)

- OPERATIONS.—1889-90. 364 logs and snags is right.

PROJECTS:

- Second paragraph. Omit "Proj. accomplished in 1880 by expend. of \$37,244, 80, 1076."

- Third paragraph. "Wewahitchka" is correct.

(Page 619.)

CHATTAHOOCHEE AND FLINT RIVERS, ALA., FLA., AND GA. (Q-23-a)

- APPROPRIATIONS.—Omit 1879 reference from first 1878 item.
 ENGINEERS (Assistant).—The Robinson reference is 79, 820.
 OPERATIONS.—1878-79. The reference is 79, 101, 815.

(Page 620.)

CHATTAHOOCHEE RIVER, ALA. AND GA. (Q-23-b)

- ENGINEERS (Chief).—The 1881 reference is 81, 181.
 OPERATIONS:
 1879-80. Add "and overhanging trees" after "51 snags."

(Page 621.)

- 1890-91. 414 c. y. marl, not 166 c. y.
 1897-98. Reference is 98, 1388, 1389.
 1910-11. Reference is 11, 1676.
 1911-12. Reference is to 12, 583, 1893.

- PLANS.—First paragraph. Reference is to 80, 1707, 1721.

- PROJECTS.—Second paragraph. Reference is to 99, 1662.

(Page 622.)

FLINT RIVER, GA. (Q-23-c)

OPERATIONS:

1882-83. 4,204 trees and snags is correct.

1911-12. Reference is 12, 582, 1891.

(Page 625.)

CHOCTAWHATCHEE RIVER, FLA. AND ALA. (Q-32)

APPROPRIATIONS.—Item of 1844 has reference "act June 15."

COMMERCE.—The last paragraph should read as follows: "With the exception of movement of logs, there is no C. above the mouth of Holmes R. The value of the general C. below that point valued at about \$2,000,000 per annum."

ENGINEERS (In charge).—Col. Fitch's 1912 report is 12, 1898.

(Page 626.)

OPERATIONS.—1904-5. Last line should read "below mouth of Holmes R., 05, 1335."

(Page 627.)

LAGRANGE BAYOU, FLA. (Q-33-b)

APPROPRIATIONS:

Reference to the 1882 item is 83, 1001.

Item of 1886 is an allotment.

ENGINEERS (In charge).—The 1886 report of Capt. Hoxie is at 86, 1178.

OPERATIONS.—1890-91. 185 snags removed is correct; omit "from the banks."

PROJECTS.—First paragraph. Insert comma after 4½, and word "depth" after "existing."

HOLMES RIVER, FLA. (Q-33-c)

APPROPRIATIONS:

1909 item is an allotment.

1910 item has reference 10, 1544.

1911 item has reference 11, 1683.

ENGINEERS (In charge):

Craighill reference, 07, 347.

Jervy reference, 07, 347.

Ferguson reference, 1910, 10, 1543.

(Page 628.)

PENSACOLA HARBOR, FLA. (Q-38)

CONTRACTS.—1900. Price is R. Moore contract, 16¢, not 15¢.

ENGINEERS (Chief of).—The 1887 reference is 87, 164, 171.

(Page 629.)

ENGINEERS (In charge).—Capt. Hoxie's report for 1885 is at 85, 1313.

OPERATIONS:

1882-83. McRee is correct.

1883-84. "st. protection" should be "shore protection."

1884-85. Fifth line. Substitute "end" for "and inner 15'."

PROJECTS:

Second paragraph. McRee is correct.

Third paragraph. \$31,446 is correct, in last line.

Second to last paragraph. Make reference 02, 288, 1288.

(Page 630.)

BLACKWATER RIVER, FLA. AND ALA. (Q-41)

PROJECTS:

Raymond project dimensions. "9' x 100'" is correct.

Last paragraph. Reference is 10, 449, 450.

(Page 631.)

CONECUH RIVER, ALA. (Q-43-b)

PLANS.—Correct amount in third line is "\$241,685."

ESCAMBIA AND CONEUCU RIVERS, FLA. AND ALA. (Q-43-c)

APPROPRIATIONS.—Item of 1910 is an appropriation, not an allotment.

ENGINEERS (In charge).—Capt. Price's report for 1891 is at 91, 1735.

(Page 632.)

ESCAMBIA AND CONEUCU RIVERS, FLA. AND ALA. (Q-43-c)

OPERATIONS:

1906-7. Derrick boat 75% completed.

1908-9. 3,266, instead of 1,866, obstructions removed. Reference is to 09, 1399, 1400.

1910-11. Insert "logs" for "stumps."

PATSALIGA RIVER, ALA. (Q-44)

PHYSICAL CHARACTERISTICS.—Reference in second line is to 79, 850, 851.

(Page 633.)

ALABAMA RIVER, ALA. (Q-49)

ENGINEERS (Chief of).—The 1879 report is at 79, 103.

OPERATIONS:

1879-80. Reference is to 80, 1083.

1889-90. 4,218 trees and stumps is correct.

1891-92. 25 c. y. bowlders is correct.

1892-93. 230 c. y. bowlders is correct.

(Page 634.)

- 1896-97. Reference is 97, 1635, 1636, 1637.
 1897-98. 2,000 obstructions is correct.
 1909-10. 28,395 c. y. is correct.

(Page 635.)

COOSA RIVER, ALA. AND GA. (Q-52)

NOTE AT HEAD.—Reference is 12, 599, 600.

(Page 636.)

COOSA RIVER, ALA. AND GA. (Q-52-a)**APPROPRIATIONS:**

All appropriations under "Coosa R., Ala. and Ga.," since 1888 should be listed under heading "Coosa River between Rome, Ga., and East Tennessee, Virginia & Georgia Railroad Bridge."

Omit reference to pages 1430, 1678, and 1422 from items of 1892, 1894, and 1896, respectively, "Coosa River, Ala. and Ga."

In table "Coosa R. between Wetumpka and East Tenn., Va. & Ga. R. R. br.," omit page 1427 from item of 1892, and page 1417 from item of 1896.

In table "Coosa R., Ala. and Ga., operation and care of canals," reference to item of 1909 is to page 1406.

Footnote (6) refers to between Rome, Ga., and Dam No. 4, Ala.

(Page 637.)

ESTIMATES.—Long estimate, 1872. Reference is to 72, 541-543.

OPERATIONS:

1880-81. Second line. 12,654 is correct.

1888-89. Third line. 2,105 c. y. stone is correct.

1894-95. Second to last line. 17,251, not 8,190, is correct.

PHYSICAL CHARACTERISTICS.—The 1871 reference is 71, 563-570.

(Page 638.)

PROJECTS:

Third paragraph. Reference is 78, 764-766.

Fourth paragraph. The 1889 reference is to 89, 1390, 1391, 1393.

Paragraph beginning "Act Sept. 19." Estimate is \$6,038,219, and reference is to 91, 1744, 1747-1752.

COOSA RIVER, BETWEEN ROME, GA., AND EAST TENNESSEE, VIRGINIA & GEORGIA RAILROAD BRIDGE (Q-52-c)

APPROPRIATIONS.—Reference is to (Q-52-a)

(Page 639.)

COOSA RIVER, GA., WETUMPKA TO EAST TENNESSEE, VIRGINIA & GEORGIA RAILROAD BRIDGE. (Q-52-d)

PROJECTS.—First paragraph. Reference is to 02, 1276, 1277.

(Page 640.)

COOSA RIVER, ALA. AND GA. (OPERATION AND CARE OF CANALS.) (Q-52-e)

OPERATIONS.—1905-6. Omit words "upper and lower."

FOOTNOTE NO. 3.—Act Mar. 3, 1909, is referred to.

ETOWAH RIVER, GA. (Q-53)

ENGINEERS (In charge).—Reference, Col. Fitch, is 12, 605.

(Page 641.)

SURVEYS:

First paragraph. Reference is to 72, 480, not 481.

Third paragraph. Add reference, 77, 603.

OOSTENAULA AND COOSAWATTEE RIVERS, GA. (Q-54-a)

ENGINEERS (Chief).—The 1874 reference is 74, 70.

PROJECTS.—Last paragraph. Reference is to 03, 305, 306.

(Page 642.)

CAHABA RIVER, ALA. (Q-60)

OPERATIONS.—1891-92. 1,558 l. f. willow j. constructed.

R.—MOBILE, ALA., DISTRICT.

(Page 647.)

MOBILE BAR, ALA. (R-3)

See also Mobile Harbor.

(Page 650.)

MOBILE RIVER AND HARBOR, ALA.

(R-21)

PROJECTS.—First paragraph. Chan. dimensions are 10' x 200'.

(Page 661.)

BLACK WARRIOR, WARRIOR, AND TOM-BIGBEE RIVERS, ALA. (R-23-m)

APPROPRIATIONS.—1900. Reference is to 00, 2175.

(Page 666.)

PASCAGOULA RIVER AND HORN ISLAND HARBOR, MISS. (R-63-c)

CONTRACTS.—1899. A. G. Delmas is correct.

(Page 668.)

CHICKASAHAY RIVER, MISS. (R-66)

COMMERCE.—Last paragraph. Add reference 11, 1722.

(Page 670.)

BILOXI BAY AND HARBOR, MISS. (R-83)

ENGINEERS (Chief).—The 1882 report is 82, 186.

(Page 672.)

GULFPORT TO SHIP ISLAND HARBOR, MISS. (R-87)

OPERATIONS.—1907-1912. Quantities are in round numbers.

(Page 673.)

JORDAN RIVER, MISS. (R-92-a)

PHYSICAL CHARACTERISTICS.—Second line. "Empties into the ne. extremity" is correct, not "nw."

(Page 674.)

PEARL RIVER, MISS. (R-98-a)

OPERATIONS.—1910-11. Third line. Omit "1.2" before "m. l. w."

(Page 675.)

PEARL RIVER, MISS. (R-98-c)

ENGINEERS (In charge):

The 1893 report is 93, 1774, 1792.

The second 1892 reports refers to the 1893 reports.

OPERATIONS.—1885-86. At the end of the first line, make "any" into "and," and at the end of the second line, make "clad" into "clay."

(Page 676.)

PEARL RIVER, MISS. (R-98-d)

OPERATIONS.—1884-85. 10,812 smags, etc., is correct.

S.—NEW ORLEANS, LA., DISTRICT.

(Page 680.)

(Page 685.)

MAP.

Jeanerette and New Iberia. Transpose these titles on the map, page 680, just above Vermilion Bay.

(Page 681.)

WATERWAYS LIST.

Bayou Liberty. (S-11.)
Has only one tributary connection, S-10.

(Page 682.)

Bayou Maxent. (S-147.)
Change name to "Bayou Chaperon."
Lake Borgne Canal. (S-149.)
Last tributary connection is 244, and not 314.
Bayou Centilly. (S-188.)
Change name to "Bayou Gentilly."

(Page 683.)

Adams B. (S-328.)
Change name to "Bay Adams."

(Page 684.)

Cay B. (S-337.)
Change name to "Cat."
Bayou Chevreuil and Bayou Tigre. (S-384.)
Bayou Tigre is a tributary of Bayou Chevreuil.
Lake Boeuf Canal, La. (S-392.)
Change name to "Lake Boeuf Drainage Canal, La."

Bay des Illettes. (S-407.)
Change name to "Illettes."

Harvey Canal. (Under S-422.)
Is the same as 398, and not 419. Flows as a connection of 419.

Bayou Lourse. (Under S-422.)
Is the same as 410, and not 419. Is a connection of 419.

Bayou Leau. (S-429.)
Change name to "L'Eau."

Dresser Canal. (Under S-430.)
Is the same as 425, and is a connection of 429.

Bayou Cane. (S-448.)
Change name to "Bayou Cane, or Whiskey Bayou, La."

Bay Challand. (S-453.)
Change name to "Bay Challaud."

Bayou L'Ourse. (S-467.)
Change name to "Bayou L'Ourse."

Bayou Mellow. (S-506.)
Change name to "Bayou Milhomme."

Bayou de Claise. (S-541.)
Change name to "Bayou des Glaise."

(Page 686.)

Bayou Currant. (S-578.)
Change name to "Bayou Current."
Bayou Bellsire. (S-646.)
Change name to "Bayou Bellaire."

(Page 687.)

Bayou Yokely. (S-689.)
Change name to "Bayou Yokely, La., or Choupique."

Bayou Cypremort. (S-697.)
Tributary connection is 696.

Jeanerette Canal. (S-702.)
Change to "Weeks Canal."

Weeks Canal. (S-704.)
Change to "Jeanerette Canal."

Mallard B. (S-752.)
Tributary connection is 751.

Bayou Nezpiqué. (S-769.)
Spelled with accent over final "e."

(Page 688.)

North American. (S-784.)
Correct name is "North American Land & Timber Co."

Mud Lake. (S-863.)
Correct No. is 862.

(Page 689.)

CASTAING BAYOU. (S-17)
Ex. of 1911 unfavorable. See H. D. 251, 63d, 1st.

(Page 690.)

CHEFUNCTE RIVER. (S-20)

ASSISTANTS.—Mr. Ripley's initials are "H. C."

(Page 692.)

PONCHATOU LA RIVER. (S-53)

Ex. of 1911 unfavorable. See H. D. 1117, 62d, 3d.

(Page 694.)

CARONDELET CANAL. (S-135)

The passage was by way of "Bayou St. John."

(Page 697.)

PLAQUEMINE BAYOU. (S-298)

OPERATIONS.—1911-12. The second line of the paragraph refers to 1,300 feet dr. by U. S.

(Page 700.)

LAFOURCHE BAYOU. (S-419)

PRIVATE WORK.—The date on second line of paragraph should be June 13, 1902.

(Page 702.)

ATCHAFALAYA BAY. (S-490-a)

SURVEYS.—Report by BERH., Sept. 8, 1908. The sixth line of paragraph should read "will reimburse the original expend."

(Page 704.)

COURTABLEAU BAYOU. (S-585)

SURVEYS.—Ex. and sur. of 1909. R. unfavorable. See H. D. 1056, 62d, 3d.

(Page 712.)

QUEUE DE TORTUE, LA. (S-756)

SURVEY.—Footnote reference marked (1) should be (2), to H. D. 609, 61st, 2d.

T.—DALLAS, TEX., DISTRICT.

(Page 717.)

WATERWAY LIST.

Sabine Pass, La. and Tex. (T-2)
Connected with Port Arthur Ship Canal.
Sabine and Neches Canal, Tex. (T-7)
Connected with Port Arthur Ship Canal.
Port Arthur Ship Canal, Tex. (T-8)
Connected with Sabine and Neches Canal, Tex.

SABINE LAKE, LA. AND TEX. (T-3)

SUMMARY.—Period begins with 1892.

The footnote to T-2 refers only to some of the tributaries of Sabine Pass, and principally on the east shore. The following list should be substituted for the list at the bottom of page 717:

- T 2 (a) Sabine Pass, La. and Tex. (1)
(b) Sabine Lake, La. and Tex. (a)
(c) Pat Glennon Bayou, La. (b)
(d) Johnsons Bayou, La. (b)
(e) Deep Bayou, La. (d)
(f) Shallow Bayou, La. (d)
(g) Three Bayous, La. (b)
(h) Sabine River, La. and Tex. (a)
(i) Black Bayou, La. (h)
(j) Intracoastal Canal, La. (h)
(k) Vinton Canal, La. (h)
(l) Conways Bayou, La. (h)
(m) Choates Creek, La. (h)
(n) Caney Creek, La. (h)

- (o) Brush Creek, La. (h)
(p) Bridge Creek, La. (h)
(q) Trout Creek, La. (h)
(r) Bayou l'Anasco, La. (h)
(s) Cypress Creek, La. (r)
(t) Bayou Zourie, La. (r)
(u) Bayou Castor, La. (r)
(v) Bayou Liberty, La. (u)
(w) Prairie Creek, La. (r)
(x) Pocoson Creek, La. (r)
(y) Williams Creek, La. (h)
(z) Damrell Creek, La. (h)
(aa) Tenmile Creek, La. (h)
(bb) Pearl Creek, La. (h)
(cc) Taureau Bayou, La. (h)
(dd) Sells Bayou, La. (cc)
(ee) Walker Bayou, La. (cc)
(ff) Bayou Sally, La. (cc)
(gg) Black Haw Creek, La. (h)
(hh) Funks Bayou, La. (h)
(ii) Bayou Lennan, La. (h)
(jj) Bayou San Miguel, La. (h)
(kk) Bayou San Patricio, La. (h)
(ll) Bear Creek, La. (h)
(mm) Cow Creek, La. (h)
(nn) Bayou Clement, La. (h)
(oo) Grand Cane Bayou, La. (h)
(pp) Horse Shoe Bayou, Tex. (h)
(qq) Harris Creek, Tex. (h)
(rr) Delaware Creek, Tex. (h)
(ss) Mill Creek, Tex. (h)
(tt) Little White Oak Creek, Tex. (h)
(uu) Glade Creek, Tex. (h)
(vv) Caney Creek, Tex. (h)
(ww) Rabbit Creek, Tex. (h)
(xx) Winns Creek, Tex. (h)
(yy) Gracies Creek, Tex. (h)
(zz) Morris Creek, Tex. (h)
(aaa) Tenaha Creek, Tex. (h)
(bbb) Martinez Creek, Tex. (h)

(ccc) Patroon Creek, Tex. (h)
 (ddd) Pologaino Bayou, Tex. (h)
 (eee) Housing Bayou, Tex. (h)
 (fff) Sugar Creek, Tex. (h)
 (ggg) Sandy Creek, Tex. (h)
 (hhh) Mill Creek, Tex. (h)
 (iii) Little Cow Creek, Tex. (h)
 (jjj) Whitman Creek, Tex. (h)
 (kkk) Davis Creek, Tex. (h)
 (lll) Wilsons Mill Creek, Tex. (h)
 (mmm) Cow Creek, Tex. (h)
 (nnn) Bayou Deception, Tex. (h)
 (ooo) Nichols Creek, Tex. (h)
 (ppp) Cypress Creek, Tex. (h)
 (qqq) Hoosier Creek, Tex. (ppp)
 (rrr) Ballows Bayou, Tex. (h)
 (sss) Watts Bayou, Tex. (h)
 (ttt) Cypress Bayou, Tex. (h)
 (uuu) Adams Bayou, Tex. (h)
 (vvv) Cow Bayou, Tex. (h)
 (www) Sabine-Neches Canal, Tex. (b) (h)
 (xxx)
 (xxx) Neches River, Tex. (b)
 (yyy) Greys Bayou, Tex. (xxx)
 (zzz) Star Bayou, Tex. (xxx)
 (aaa) Beards Bayou, Tex. (xxx)
 (bbb) Beards Lake, Tex. (aaa)
 (ccc) Mill Creek, Tex. (xxx)
 (ddd) Wright Creek, Tex. (xxx)
 (eee) Angelina River, Tex. (xxx)
 (fff) Molasses Bayou, Tex. (xxx)
 (ggg) Brakes Bayou, Tex. (xxx)
 (hhh) Pine Island Bayou, Tex. (xxx)
 (iii) Village Creek, Tex. (xxx)
 (jjj) Sabine-Neches Canal, Tex. (xxx)
 (kkkk)
 (kkkk) Port Arthur Canal, Tex. (jjj) (a)
 (llll) Taylors Bayou, Tex. (kkkk)

(Page 718.)

SABINE LAKE. (T-3-a)

CONTRACTS.—1899. Clarke contract was for 67 days, at \$119.60 per day.

ENGINEERS (In charge).—The 1904 reference of Capt. Bromwell is 04, 1914, 1953.

PROJECTS.—Paragraph beginning "Act June 13, 1902." Add reference 04, 1914.

(Page 719.)

SABINE-NECHES CANAL, ETC. (INCLUDING SABINE RIVER TO ORANGE AND NECHES RIVER TO BEAUMONT, TEX.). (T-3-b)

PRIVATE WORK.—Reference in first paragraph is to 11, 1817.

JOHNSONS BAYOU, LA. (T-4)

ENGINEERS (In charge).—Col. Adams's report is at 04, 1912.

PROJECTS.—Footnote reference is H. D. 299, 54th, 2d.

SABINE RIVER, LA. AND TEX. (T-5)

APPROPRIATIONS.—Add. 1895, \$4,000 (95, 1779—diverted from Sabine Pass).

COMMERCE.—Second paragraph. 407,372 t. is correct.

CONTRACTS.—1880. Add reference 81, 1322, to Hyatt item.

(Page 720.)

OPERATIONS:

1890-91. Reference is 91, 1836.

1895-96. Add, Chan. dr. 50' w. by 8' deep, from deep water in Sabine R. to deep water in Sabine Lake, 96, 1514.

SURVEYS.—Second to last paragraph. Substitute Maj. McIndoe for Capt. Wooten.

(Page 721.)

NECHES RIVER, TEX. (T-6)

CONTRACTS.—1881. Add reference 82, 1425.

ENGINEERS (In charge).—Substitute Maj. J. F. McIndoe, 08, 483, for Capt. W. P. Wooten, 08, 474.

OPERATIONS.—1880. Dr. to provide a chan. 5' x 40', through bar at mouth of r., Feb.-June, 1880, 80, 1201.

PROJECTS.—Last paragraph. 8' is correct, not 6'.

SURVEYS.—Last paragraph. Substitute Maj. McIndoe for Capt. Wooten.

PORT ARTHUR CANAL, TEX. (OPERATING AND CARE). (T-8)

COMMERCE.—Change paragraph to read as follows: "In 1911, 1,880,017 t., mostly petroleum, and its refined products; lumber, sulphur, cotton, and cottonseed products, 12, 2039, 2040.

(Page 722.)

OPERATIONS:

1911-12. 189,135 c. y. dr. from turning basin. Reference 12, 2037 is correct.

SABINE PASS HARBOR, TEX. (T-9)**COMMERCE:**

Fourth paragraph. Operations by 2 railroads in progress, 1896-97.

Fifth paragraph. The 1899 reference is 99, 1861.

(Page 723.)

ENGINEERS (In charge).—Capt. Heuer's report for 1883 is 83, 1047.

OPERATIONS.—1900-1901. Insert after "Sabine" the following: "and 61,538 c. y."

(Page 724.)

PROJECTS.—First paragraph. Reference for 1881 is 81, 197.

SURVEYS.—Second paragraph. Typographical error. "Of Blue (Blo) Buck Point Pass" is correct.

(Page 725.)

TRINITY RIVER, TEX. (T-10-a)

OPERATIONS:

1879-80. The 1880 reference is **80**, 1238.

1891-92. The 1892 reference is **92**, 1541.

(Page 726.)

TRINITY RIVER, TEX. (T-10-b)

APPROPRIATIONS.—1902 reference is **02**, 337, 1379.

FOOTNOTE.—No. 4 should read "Sur., mouth to Dallas."

(Page 729.)

JEFFERSON, TEX., AND SHREVEPORT, LA. (T-18-a)

TITLE.—Should include reference to Caddo Lake, Red River, and Cypress Bayou. Jefferson is at one end of Caddo Lake, on Cypress Bayou, and Shreveport is on Red R., or at the other end of Caddo Lake. (See map, page 716.)

SURVEYS.—Third paragraph. Substitute for "concurring" the following: "recom. no further work than that contemplated by."

(Page 730.)

CYPRESS BAYOU, LA. AND TEX.

TITLE.—Insert reference to Red River, and to Jefferson, Tex., and Shreveport, La.

ENGINEERS (In charge).—Substitute "Capt. C. L. Potter, **04**, 398" for "Capt. J. F. McIndoe, **04**, 399."

SURVEYS:

Insert as a third paragraph. "Suggestions for imp. called for by joint resolution Feb. 6, 1890; **R.** by Capt. Willard, **90**, 1914."

Second to last paragraph. Substitute for "concurs" the following: "recom. no further work than that contemplated by."

U.—GALVESTON, TEX., DISTRICT.

(Page 747.)

(Page 751.)

GALVESTON, TEX. (U-30)

TITLE NOTE.—A portion of the work referred to has been constructed since writing that note.

SURVEYS.—Paragraph beginning with "Rectangular conditions," change latter word to "coordinates."

X.—VICKSBURG, MISS., DISTRICT.

(Page 787.)

(Page 791.)

YAZOO RIVER, MISS. (X-4)

ENGINEERS (Assistants).—Add, after Starr's report, "H. M. Marshall. **R.**, **92**, 1631."

TALLAHATCHIE RIVER, FROM MOUTH OF COLDWATER RIVER TO BATESVILLE, MISS. (X-10-d)

ENGINEERS (In charge).—Add, Capt. Chas. L. Potter, 1902-03. **R.**, **04**, 2088.

SURVEYS.—Add, Pre. ex., Tallahatchie R., mouth of Coldwater R. to Batesville, au. act June 13, 1902; R. by Capt. Potter (unfav.), 04, 398, 2088.

(Page 798.)

RED RIVER, LA. AND ARK. (X-28-c)

ENGINEERS (Assistants).—Add, to reports of Marshall, 90, 1838.

(Page 799.)

RED RIVER, ITS TRIBUTARIES AND OUTLETS, LA., ARK., AND IND T., FULTON TO HEAD OF ATCHAFALAYA. (X-28-d)

CONTRACTS.—1908. O. E. Gammill, constr. Chalk Level Levee, 124,126 c. y., at 10.89¢ c. y. Hall Nattin, constr. Spirit Lake Levee, 50,700 c. y., at 17.74¢ c. y. 09, 1551.

Y.—LITTLE ROCK, ARK., DISTRICT.

(Page 819.)

ARKANSAS RIVER, ARK., OKLA., AND KANS. (Y-2-b)

APPROPRIATIONS.—Item of 1907 (Pine Bluff, Ark.) has reference 11, 1883, instead of 12, 1883.

(Page 821.)

ARKANSAS RIVER. (Y-2-e)

OPERATIONS.—1890-91 and 1891-92. Change "Morris Rocks" to "Moores Rocks."

(Page 822.)

ARKANSAS RIVER. (Y-2-f)

ENGINEERS (Boards).—First paragraph. Convened at Little Rock, Ark.

PRIVATE WORK.—First paragraph. St. Louis Southwestern is correct.

(Page 823.)

ARKANSAS RIVER — REMOVING OBSTRUCTIONS. (Y-2-g)

OPERATIONS.—1879-80. 341 miles of river, not 34, is correct.

(Page 826.)

PETIT JEAN RIVER, ARK. (Y-21)

ENGINEERS (Assistants).—M. A. Orlopp is correct.

(Page 832.)

CLARENDON, AND LOWER WHITE RIVER, ARK. (Y-23-h)

ENGINEERS (Chief of).—Typographical error. Should be Chief of Engineers.

(Page 833.)

CACHE RIVER, ARK. (Y-25)

SURVEYS.—The footnote to the third paragraph should be No. 2.

(Page 834.)

BLACK RIVER, ARK. AND MO. (Y-28)

COMMERCE.—Last paragraph. "C. 1900, 129,698 t.; value, \$966,961, 00, 422."

(Page 835.)

CURRENT RIVER, ARK. AND MO. (Y-29)

COMMERCE.—Statistics paragraph has reference 12, 797.

CONTRACTS.—Last reference is 95, 2031.

ENGINEERS (In charge).—Maj. Smith's term began with 1911.

(Page 837.)

ST. FRANCIS RIVER, ARK. AND MO. (Y-47-a)

ENGINEERS (Assistants).—J. B. Rohrer is correct.

OPERATIONS.—1888-89. Second line. "Kennett" is correct.

(Page 839.)

LITTLE RIVER, ARK. AND MO. (FROM HORNSVILLE TO ITS JUNCTION WITH THE ST. FRANCIS.) (Y-52)

TITLE.—Hornersville, not Homersville.

PROJECTS.—See above.

AA.—CHATTANOOGA AND NASHVILLE, TENN., DISTRICT.

(Page 844.)

MAPS.

Clark Cr. Near top. Should be "Clark R."

(Page 847.)

Left-hand side, near middle.—Change "Abram Cove Cr." to "Abrams Cr."

Below Abram Cove Cr.—Change "Tullulah Cr." to "Cheoah R."

Tuckasegee R.—Unnamed tributary shown is "Oconalufy R."

(Page 850.)

LOCKS AND DAMS.

Some of those named are to be constructed later, and projects for them may be changed.

(Page 853.)

FORKED DEER RIVER, TENN. (AA-6-a)

APPROPRIATIONS.—Item of 1896 (second) has reference 96, 1902, 1903.

(Page 860.)

TENNESSEE RIVER, BELOW CHATTANOOGA. (AA-18-b)

PHYSICAL CHARACTERISTICS.—Fifth paragraph from bottom. "Chattanooga and Kellers" is correct.

(Page 862.)

TENNESSEE RIVER, CHATTANOOGA TO RIVERTON. (AA-18-d)

APPROPRIATIONS.

First table refers to open channel work, and to Muscle Shoals Canal. Items of 1903, 1904, and 1909, are allotments.

Table of Hales Bar items. Item of 1909 is an allotment.

(Page 865.)

TENNESSEE RIVER, ABOVE CHATTANOOGA. (AA-18-e)

APPROPRIATIONS.—Items of 1907 and 1909. These are allotments.

(Page 867.)

TENNESSEE RIVER, TENN. — MUSCLE SHOALS CANAL. OPERATING AND CARE. (AA-18-g)

FOOTNOTE.—No. 1. Add, act of Mar. 3, 1909.

(Page 868.)

OPERATIONS.—1900-1901. Browns Island, not Brown Island, is correct.

(Page 870.)

HIWASSEE RIVER, TENN. (AA-67)

APPROPRIATIONS.—Items 1902, 1905, 1907, 1909, and 1910, are allotments.

(Page 885.)

CUMBERLAND RIVER, TENN. AND KY.; LOCKS AND DAMS; OPERATING AND CARE. (AA-239-e)

APPROPRIATIONS.—Footnote No. 4. Add, act Mar. 3, 1909.

(Page 886.)

CANEY FORK RIVER, TENN. (AA-263)

OPERATIONS.—1887-88. "568 l. f. spur" is correct.

BB.—LOUISVILLE, KY., DISTRICT.

(Page 898.)

WABASH RIVER, ILL. AND IND. (BB-23-a)

APPROPRIATIONS.—Change total to \$762,000.

WABASH RIVER, ILL. AND IND. (BB-23)**SUMMARY:**

Change total of Part a to \$762,000.

Change grand total to \$902,858.02.

CC.—CINCINNATI, OHIO, DISTRICT, NO. 1.

(Page 911.)

TRAP, THE.

The reference 950 should be 954.

OHIO RIVER.—GENERAL FACTS.

(CC-1-d)

COMMERCE.—Add reference 12, 886.

(Page 921.)

CONTRACTS:

Fourth line. Routh, not Roth, is correct.

Dr. and R. excavation. Meyers & Kerr, not Keer, is correct.

Removing rocks, snags, and logs. W. F. Richardson is correct.

(Page 922.)

1891. V. P. Collins, towboat hire, \$43.44 per day, 91, 2342, is correct.

(Page 912.)

APPROPRIATIONS—SUMMARY.

(CC-1-e)

TABLE 2.—Total, 695,722.27.

TABLE 13.—Period should be 1874-1912.

The total also includes funds derived from tolls, rents, etc.

Grand total, \$41,696.492.66.

(Page 924.)

ENGINEERS (In charge).—Maj. Oakes, 10, 711, is correct.

ENGINEERS (Assistants).—G. S. Kinsey is correct. W. M. Hall is correct.

LEGISLATION.—Last paragraph. 04, 711 is correct reference.

OBSTRUCTIONS.—Fourth paragraph. Reference is 12, 2286.

(Page 913.)

TABLE 1.—Reference at bottom of page should refer also to page 2280.

(Page 954.)

OHIO RIVER. CONSTRUCTION OF MOVABLE DAMS NOS. 2 TO 6. (CC-97-b)**CONTRACTS:**

1899. Add reference 99, 2356.

1901. The price, second line, Evansville Cont. Co., should be \$118,967.50.

OPERATIONS.—1900-1901. Reference is 01, 2662-2665.

(Page 914.)

TABLE 2.—Change the 1898 and 1899 items to \$21,412.08 and \$48,762.97, respectively. The total to \$695,722.27, in accordance with the foregoing.

EE.—WHEELING, W. VA., DISTRICT.

(Page 984.)

WATERWAY LIST.

Middle Island Cr., W. Va. (EE-188)

Spelling and title as shown, not "Middle Cr."

(Page 985.)

GUYANDOT RIVER, W. VA. (EE-11)

APPROPRIATIONS.—1899 item has reference
99, 2499.

(Page 986.)

KANAWHA RIVER, W. VA. (EE-62-a)

COMMERCE.—Diagram of tonnage and value
of, and app., right reference is 11, 2164.

(Page 987.)

ENGINEERS (Assistants).—A. M. Scott.
Omit 77, 684, 709. Lt. T. Turtle.—Add 77,
684.

(Page 988.)

LEGISLATION.—Omit paragraph beginning
"Act of Congress (1875)."

OPERATIONS:

1886-87. The 1887 reference is 87, 1911.

(Page 989.)

1907-8. Guide crib at Lock No. 11 is correct.

PLANS.—Fifth paragraph. Mr. Fisk, not Fish,
is correct.

(Page 990.)

SECRETARY OF WAR.—Reference is 80,
684.

(Page 992.)

JAMES RIVER AND KANAWHA CANAL, VA. AND W. VA. (EE-62-d)

ENGINEERS (Boards).—Last paragraph. Maj.
Weitzel reference should be 74, ii, 121, 124.

ENGINEERS (Assistants):

W. R. Hutton. Omit reference 75, ii, 633.

Add N. H. Hutton. R., 75, ii, 633.

E. Lorraine. Right reference is 71, 626, etc.

ESTIMATES:

Fourth paragraph. Omit reference 74, ii, 654.

Fifth line. Reference to "Tunnel" is 71, 627,
649; and Greenbrier and New Rs. has same
reference.

(Page 993.)

OHIO RIVER, CONNECTING WITH JAMES RIVER SURVEY. (EE-62-e)

ENGINEERS (Assistants).—N. H. Hutton, not
"W. R.," is correct.

(Page 997.)

LITTLE KANAWHA RIVER, W. VA. (EE-157-a)

APPROPRIATIONS.—The 1909 reference is
09, 1797.

(Page 998.)

ENGINEERS (Assistants).—The 1892 reference
of B. F. Thomas is 92, 2115, 2118.

(Page 999.)

OPERATIONS.—1898-99. The reference is 99,
2475.

FF.—PITTSBURGH, PA., DISTRICT.

(Page 1003.)

WATERWAY LIST.

NOTE AT HEAD.—Substitute "opposite Steubenville, Ohio," for "vicinity of Wheeling, W. Va."

MONONGAHELA RIVER, PA. AND W. VA. (FF-6)**SUMMARY:**

Part b. Add footnote No. 2, "Does not include \$4,000 allotted Sept. 25, 1889, Ex., Sur., and Contingencies."

Part e. Add footnote No. 3, "H. D. 421, 57th Cong., 2d, p. 351."

Part h. Change total, to conform with later office records, to \$3,727,347.41.

Grand total. Change, in accordance with the above, to \$11,773,201.

(Page 1004.)

MONONGAHELA RIVER, PA. AND W. VA. (FF-6-b)

ENGINEERS (Assistants).—The 1876 report of S. Petitdidier is at 76, ii, 54.

(Page 1005.)

PROJECTS.—Bottom of first paragraph, "locks to be 50' x 200'" is correct.

(Page 1006.)

MONONGAHELA RIVER, PA.; LOCK AND DAM NO. 7; PURCHASE. (FF-6-c)

Add reference 98, 2188.

(Page 1009.)

MONONGAHELA RIVER, PA. AND W. VA.; LOCKS AND DAMS ON; OPERATING AND CARE. (FF-6-h)**APPROPRIATIONS:**

Change the 1900 item to \$141,558.90; the 1902 item to \$191,810.12 (does not include \$106.11 received from damages); the 1908 item to \$253,518.93 (does not include \$182.43 paid

for account of Isthmian Canal Commission); the 1909 item to \$241,174.91 (includes \$9,-208.10, ex., rebuilding Lock and Dam No. 1); the 1910 item to \$364,663.38 (includes \$173,364.81, ex., rebuilding Lock and Dam No. 1); the 1911 item to have this footnote or explanation: "Includes \$161,647.83, ex., rebuilding Lock and Dam No. 1"; the 1912 item to have this note: "Includes \$57,999.10, ex., rebuilding Lock and Dam No. 1."

Change total, in accordance with the foregoing, to make it \$3,723,516.35.

(Page 1010.)

OPERATIONS.—1911-12. Reference is 12, 2299-2304.

(Page 1014.)

PITTSBURGH HARBOR, PA. (FF-19)

1911-12. 169,000 dr. is correct, not 123,447.

(Page 1015.)

ALLEGHENY RIVER, PA. (FF-20-b)

COMMERCE.—Last paragraph. 76, ii, 147-148 is correct.

(Page 1016.)

PLANS.—Second line at head of page. Takes footnote No. 3, as follows: "Movable dam; est., \$269,564."

(Page 1018.)

PROJECTS.—Fifth paragraph. Capt. Sibert's est., \$178,732.

(Page 1019.)

ALLEGHENY RIVER, PA.; LOCKS AND DAMS ON; OPERATING AND CARE. (FF-20-e)**APPROPRIATIONS:**

1903 item. The allotment for Herrs Island Dam was \$9,610; expended, \$5,233.62. The 1904 item is an expenditure.

GG.—KANSAS CITY, MO., DISTRICT.

(Pages 1025 to 1037.)

WATERWAYS LIST.

Substitute the following list:

Missouri River and tributaries.

Explanation: The number in parentheses is that of the receiving stream.

MO. AND IOWA.

- 1 Mississippi R., Mo.
- 2 Missouri R., Mo. (1)
- 3 Taylors Branch, Mo. (2)
- 4 Little Duckett Cr., Mo. (2)
- 5 Big Duckett Cr., Mo. (2)
- 6 Femme Osage Cr., Mo. (2)
- 7 Little Femme Osage Cr., Mo. (6)
- 8 Callaway Branch, Mo. (6)
- 9 Bigelow Cr., Mo. (2)
- 10 Sehrt Cr., Mo. (9)
- 11 Tuque Cr., Mo. (2)
- 12 Charrette Cr., Mo. (2)
- 13 Dry Fork, Mo. (12)
- 14 Smith Cr., Mo. (2)
- 15 Lost Cr., Mo. (2)
- 16 Little Lost Cr., Mo. (15)
- 17 Massas Cr., Mo. (2)
- 18 Loutre R., Mo. (2)
- 19 Bear Cr., Mo. (18)
- 20 Clear Cr., Mo. (18)
- 21 Smiths Branch, Mo. (18)
- 22 Bachelor Cr., Mo. (18)
- 23 Whetstone Cr., Mo. (18)
- 24 Prairie Fork, Mo. (18)
- 25 Martins Branch, Mo. (24)
- 26 Dry Fork of Loutre R., Mo. (18)
- 27 Modoc Cr., Mo. (2)
- 28 Quick Cr., Mo. (27)
- 29 Little Tavern Cr., Mo. (2)
- 30 Big Tavern Cr., Mo. (2)
- 31 Logan Cr., Mo. (2)
- 32 Auxvasse Cr., Mo. (2)
- 33 Harrison Branch, Mo. (32)
- 34 Crow Cr., Mo. (32)
- 35 Richland Cr., Mo. (34)
- 36 Stinson Cr., Mo. (34)
- 37 Ewings Cr., Mo. (2)
- 38 Middle R., Mo. (2)
- 39 Craghead Cr., Mo. (38)
- 40 Little Auxvasse Cr., Mo. (38)
- 41 Rivaux Cr., Mo. (2)
- 42 Cedar Cr., Mo. (2)
- 43 Millers Cr., Mo. (42)
- 44 Fowler Cr., Mo. (42)
- 45 Bonne Femme Cr., Mo. (2)
- 46 Little Bonne Femme Cr., Mo. (2)
- 47 Roche Perche Cr., Mo. (2)
- 48 Hinkson Cr., Mo. (47)
- 49 Grindstone Cr., Mo. (48)
- 50 Bear Cr., Mo. (47)
- 51 Silver Cr., Mo. (47)
- 52 Long Branch, Mo. (51)
- 53 Lick Cr., Mo. (47)
- 54 Stocktons Branch, Mo. (47)
- 55 Callahan Cr., Mo. (47)
- 56 Terrapin Cr., Mo. (2)
- 57 Sinking Cr., Mo. (2)
- 58 Moniteau Cr., Mo. (2)
- 59 McGill Branch, Mo. (58)
- 60 Prairie Fork, Mo. (58)
- 61 Hungry Mother Cr., Mo. (58)
- 62 Salt Cr., Mo. (2)
- 63 Bonne Femme Cr., Mo. (2)
- 64 Salt Fork, Mo. (63)
- 65 Adams Branch, Mo. (63)
- 66 Sulphur Cr., Mo. (63)
- 67 Richland Cr., Mo. (2)
- 68 Hurricane Cr., Mo. (2)
- 69 Greggs Cr., Mo. (2)
- 70 Charlton R., Mo. and Iowa (2)
- 71 East Fork, Mo. (70)
- 72 Doxles Cr., Mo. (71)
- 73 Batts Cr., Mo. (72)
- 74 Silver Cr., Mo. (71)
- 75 Sweet Springs Cr., Mo. (71)
- 76 Sugar Cr., Mo. (71)
- 77 Dark Cr., Mo. (71)
- 78 Middle Fork, Mo. (71)
- 79 Muncas Cr., Mo. (78)
- 80 Puzzle Cr., Mo. (70)
- 81 Long Branch, Mo. (70)
- 82 Brush Cr., Mo. (70)
- 83 Palmer Cr., Mo. (2)
- 84 Lake Cr., Mo. (83)
- 85 Grand R., Mo. and Iowa (2)
- 86 Brush Cr., Mo. (85)
- 87 Salt Cr., Mo. (85)
- 88 Yellow Cr., Mo. (85)
- 89 Little Yellow Cr., Mo. (88)
- 90 Elk Cr., Mo. (88)
- 91 Locust Cr., Mo. and Iowa (85)
- 92 East Fork, Mo. and Iowa (91)
- 93 West Fork, Mo. (91)
- 94 Parsons Cr., Mo. (85)
- 95 Medicine Cr., Mo. (85)
- 96 Thomsons Fork, Mo. and Iowa (85)
- 97 Honey Cr., Mo. (96)
- 98 Muddy Cr., Mo. (96)
- 99 Weldon R., Mo. and Iowa (96)
- 100 Quicksand Cr., Mo. (96)
- 101 Sugar Cr., Mo. (96)

- 102 Big Cr., Mo. and Iowa (85)
 103 East Fork of Big Cr., Mo. (102)
 104 West Fork of Big Cr., Mo. (102)
 105 Sampson Cr., Mo. (85)
 106 East Fork, Grand R., Mo. and Iowa (85)
 107 Middle Fork, Grand R., Mo. and Iowa (85)
 108 West Fork, Grand R., Mo. and Iowa (85)
 109 Grindstone Cr., Mo. (85)
 110 Honey Cr., Mo. (85)
 111 Shozi Cr., Mo. (85)
 112 Blg Cr., Mo. (85)
 113 Shootman Cr., Mo. (112)
 114 Wakenda Cr., Mo. (2)
 115 Little Wakenda Cr., Mo. (114)
 116 Turkey Cr., Mo. (114)
 117 Burr Oak Cr., Mo. (116)
 118 East Fork, Mo. (114)
 119 West Fork, Mo. (114)
 120 Moss Cr., Mo. (114)
 121 Crooked R., Mo. (2)
 122 East Fork, Mo. (121)
 123 Middle Fork, Mo. (122)
 124 Rocky Fork, Mo. (121)
 125 West Fork, Mo. (121)
 126 Willow Cr., Mo. (2)
 127 Cravens Cr., Mo. (2)
 128 Fishing R., Mo. (2)
 129 Keeney Branch, Mo. (128)
 130 East Fork, Mo. (128)
 131 Williams Cr., Mo. (128)
 132 Clear Cr., Mo. (128)
 133 Carroll Cr., Mo. (132)
 134 Muddy Cr., Mo. (132)
 135 Rush Cr., Mo. (2)
 136 Town Branch, Mo. (2)
 137 Shoal Cr., Mo. (2)
 138 Little Shoal Cr., Mo. (137)
 139 Buckeye Cr., Mo. (2)
 140 Rock Cr., Mo. (2)
 141 Line Cr., Mo. (2)
 142 Platte R., Mo. and Iowa (2)
 143 Rush Cr., Mo. (142)
 144 Brush Cr., Mo. (142)
 145 Prairie Cr., Mo. (142)
 146 Little Platte R., Mo. (142)
 147 Todds Cr., Mo. (146)
 148 First Cr., Mo. (146)
 149 Wilkerson Branch, Mo. (146)
 150 Roberts Branch, Mo. (146)
 151 Dicks Branch, Mo. (142)
 152 Castle Cr., Mo. (142)
 153 Mauldins Cr., Mo. (152)
 154 Third Fork, Mo. and Iowa (142)
 155 Honey Cr., Mo. and Iowa (142)
 156 North Branch, Mo. and Iowa (142)
 157 One Hundred and Two R., Mo. and Iowa (142)
 158 White Coal Cr., Mo. (157)
 159 Jowler Cr., Mo. (142)
 160 Bee Cr., Mo. (2)
 161 Jordan Branch, Mo. (160)
 162 Pedee Cr., Mo. (2)
 163 Bear Cr., Mo. (2)
 164 Mission Cr., Mo. (2)
 165 Sugar Cr., Mo. (2)
 166 Mud Lake (outlet), Mo. (2)
 167 Lake Contrary (outlet), Mo. (2)
 168 Liniment Cr., Mo. (2)
 169 Dillon Cr., Mo. (2)
 170 Nodaway R., Mo. and Iowa (2)
 171 East Nodaway R., Iowa (170)
 172 Middle Nodaway R., Iowa (170)
 173 West Nodaway R., Iowa (170)
 174 Mile Cr., Iowa (170)
 175 Little Tarkio Cr., Mo. (2)
 176 Square Cr., Mo. (175)
 177 Big Tarkio Cr., Mo. (2)
 178 East Fork, Mo. and Iowa (177)
 179 Middle Fork, Mo. and Iowa (177)
 180 West Fork, Mo. and Iowa (177)
 181 Nishnabotna R., Mo. and Iowa (2)
 182 Rock Cr., Mo. (181)
- IOWA, S. DAK., AND MINN.**
- 183 East Nishnabotna R., Iowa (181)
 184 Turkey Cr., Iowa (183)
 185 Crooked Cr., Iowa (183)
 186 Indian Cr., Iowa (183)
 187 West Nishnabotna R., Iowa (181)
 188 Walnut R., Iowa (187)
 189 Silver Cr., Iowa (187)
 190 Keg Cr., Iowa (2)
 191 Mosquito Cr., Iowa (2)
 192 Indian Cr., Iowa (2)
 193 Iowa Lake (outlet), Iowa (2)
 194 Pigeon Cr., Iowa (2)
 195 Boyer R., Iowa (2)
 196 Willow R., Iowa (195)
 197 Lone Tree Lake (outlet), Iowa (2)
 198 Soldier R., Iowa (2)
 199 East Soldier Cr., Iowa (198)
 200 Little Sioux R., Iowa (2)
 201 Maple R., Iowa (200)
 202 Mill Cr., Iowa (200)
 203 West Fork, Iowa (200)
 204 Big Whiskey Cr., Iowa (203)
 205 Sand Hill Lake (outlet), Iowa (2)
 206 Floyd R., Iowa (2)
 207 Deep Cr., Iowa (206)
 208 West Branch, Iowa (206)
 209 Perry Cr., Iowa (2)
 210 Big Sioux R., Iowa and S. Dak. (2)
 211 Broken Kettle Cr., Iowa (210)
 212 Indian Cr., Iowa (210)
 213 Ford Cr., Iowa (210)
 214 Rock R., Iowa and Minn. (210)
 215 Little Rock R., Iowa and Minn. (214)
 216 Champepelon Cr., Minn. (214)
 217 Tom Cr., Iowa (214)
 218 Mud Cr., Iowa (214)
- S. DAK. AND N. DAK.**
- 219 Bachelor Cr., S. Dak. (210)
 220 Silver Cr., S. Dak. (210)
 221 Beaver Cr., S. Dak. (210)
 222 Brule Cr., S. Dak. (210)
 223 Vermillion R., S. Dak. (2)
 224 Long Cr., S. Dak. (223)
 225 East Fork, S. Dak. (223)
 226 Little Vermillion R., S. Dak. (225)
 227 West Fork, S. Dak. (223)
 228 Turkey Ridge Cr., S. Dak. (223)

229 Clay Cr., S. Dak. (233)
230 James, or Dakota, R., S. Dak. and N. Dak. (2)
231 Wolf Cr., S. Dak. (230)
232 Rock Cr., S. Dak. (230)
233 Redstone Cr., S. Dak. (230)
234 Marsh Cr., S. Dak. (230)
235 Pearl Cr., S. Dak. (230)
236 Foster Cr., S. Dak. (230)
237 Mud Cr., S. Dak. (230)
238 Pipestem Cr., N. Dak. (230)
239 Beaver Cr., N. Dak. (230)
240 Cottonwood Cr., N. Dak. (230)
241 Elm R., S. Dak. and N. Dak. (230)
242 Maple R., S. Dak. and N. Dak. (241)
243 Moccasin Cr., S. Dak. (230)
244 Snake R., S. Dak. (230)
245 North Fork, S. Dak. (244)
246 South Fork, S. Dak. (244)
247 Turtle R., S. Dak. (230)
248 Cain Cr., S. Dak. (230)
249 Silver Cr., S. Dak. (230)
250 Sand Hill Cr., S. Dak. (249)
251 Firesteel Cr., S. Dak. (230)
252 West Firesteel Cr., S. Dak. (251)
253 Enemy Cr., S. Dak. (230)
254 Twelvemile Cr., S. Dak. (230)
255 Dry Cr., S. Dak. (230)
256 Lone Tree Cr., S. Dak. (230)
257 Beaver Cr., S. Dak. (230)
258 Silver Cr., S. Dak. (2)
259 Emmanuel Cr., S. Dak. (2)
260 Hoyts Cr., S. Dak. (2)
261 Plum Cr., S. Dak. (2)
262 Choteau Cr., S. Dak. (2)
263 Mosquito Cr., S. Dak. (2)
264 Ansons Cr., S. Dak. (2)
265 Spring Cr., S. Dak. (2)
266 Campbell Cr., S. Dak. (2)
267 Gulbert Cr., S. Dak. (2)
268 Cedar Cr., S. Dak. (2)
269 Platte Cr., S. Dak. (2)
270 Fivemile Cr., S. Dak. (2)
271 Snake Cr., S. Dak. (2)
272 Le Compte Cr., S. Dak. (2)
273 Elm Cr., S. Dak. (2)
274 Petersons Cr., S. Dak. (2)
275 American Cr., S. Dak. (2)
276 Crow Cr., S. Dak. (2)
277 Smith Cr., S. Dak. (276)
278 Boxelder Cr., S. Dak. (276)
279 Elm, or Wolf, Cr., S. Dak. (2)
280 Campbell Cr., S. Dak. (2)
281 Soldier Cr., S. Dak. (2)
282 Reynolds Cr., S. Dak. (2)
283 Chapelle Cr., S. Dak. (2)
284 Medicine Cr., S. Dak. (2)
285 Hackberry Cr., S. Dak. (2)
286 Okobojo Cr., S. Dak. (2)
287 Bloody Run Cr., S. Dak. (2)
288 Little Cheyenne R., S. Dak. (2)
289 Pole Cr., S. Dak. (2)
290 Stage Cr., S. Dak. (2)
291 Steamboat Cr., S. Dak. (2)
292 Otter Cr., S. Dak. (2)
293 Swan Cr., S. Dak. (2)
294 Blue Blanket Cr., S. Dak. (2)
295 Olson Cr., S. Dak. (2)
296 Hermaphrodite Cr., S. Dak. (2)

N. DAK.

297 Cat Tail Cr., N. Dak. (2)
298 Little Beaver Cr., N. Dak. (2)
299 Beaver Cr., N. Dak. (2)
300 Horse Head Cr., N. Dak. (2)
301 Long Lake Cr., N. Dak. (2)
302 Apple Cr., N. Dak. (2)
303 East Branch, N. Dak. (302)
304 West Branch, N. Dak. (302)
305 Burnt Cr., N. Dak. (2)
306 Painted Woods Cr., N. Dak. (2)
307 Turtle Cr., N. Dak. (306)
308 Spring Cr., N. Dak. (2)
309 Wolf Cr., N. Dak. (2)
310 Snake Cr., N. Dak. (2)
311 Douglas Cr., N. Dak. (2)
312 Rising Water or Pride Cr., N. Dak. (2)
313 Shell Cr., N. Dak. (2)
314 Little Knife R., N. Dak. (2)
315 White Earth R., N. Dak. (2)
316 Beaver Cr., N. Dak. (2)
317 Tobacco Garden Cr., N. Dak. (2)
318 Little Muddy R., N. Dak. (2)
319 Sandy Cr., N. Dak. (318)

MONT. AND N. DAK. AND CANADA.

320 Little Muddy Cr., Mont. and N. Dak. (2)
321 Red Bank Cr., Mont. and N. Dak. (320)
322 Big Muddy R., Mont. and Canada (2)
323 East Fork, Mont. (322)
324 Poplar R., Mont. (2)
325 Quaking Asp Cr., Mont. (324)
326 East Branch, Mont. and Canada (324)
327 West Branch, Mont. and Canada (324)
328 Tulle Cr., Mont. (2)
329 Wolf Cr., Mont. (2)
330 Little Porcupine Cr., Mont. (2)
331 Milk R., Mont. and Canada (2)
332 Porcupine Cr., Mont. (331)
333 Rocky Cr., Mont. and Canada (331)
334 Frenchmans Cr., Mont. and Canada (331)
335 White Cr., Mont. (331)
336 Cottonwood Cr., Mont. and Canada (331)
337 Woody Island Cr., Mont. (331)
338 Assinniboine Cr., Mont. (331)
339 West Fork, Mont. (338)
340 Twelvemile Cr., Mont. (331)
341 Mud Cr., Mont. (340)
342 Black Cr., Mont. (331)
343 Thirtymile Cr., Mont. (331)
344 Noon Cr., Mont. (331)
345 North Fork, Mont. (331)
346 Battle Cr., Mont. and Canada (345)
347 West Fork, Mont. and Canada (331)
348 Red Rock Cr., Mont. (347)
349 Coulee Cr., Mont. (348)
350 Many Berries Cr., Mont. and Canada (331)
351 North Branch, Canada and Mont. (331)
352 South Branch, Canada and Mont. (331)
MONT.
353 Big Sandy Cr., Mont. (331)
354 Sage Cr., Mont. (353)
355 Snake Cr., Mont. (331)

356 Peoples Cr., Mont. (331)
 357 White Horse Cr., Mont. (331)
 358 Beaver Cr., Mont. (331)
 359 Larb Cr., Mont. (331)
 360 Antelope Cr., Mont. (331)
 361 Willow Cr., Mont. (331)
 362 Skunk Cr., Mont. (2)
 363 Champaign Cr., Mont. (2)
 364 Wolf Cr., Mont. (2)
 365 Gibson Cr., Mont. (2)
 366 Timber Cr., Mont. (2)
 367 Killed Woman Cr., Mont. (2)
 368 Fourchett Cr., Mont. (2)
 369 Beauchamp Cr., Mont. (2)
 370 Kanuck Cr., Mont. (2)
 371 Little Rocky Cr., Mont. (2)
 372 Warm Spring Cr., Mont. (2)
 373 Calf Cr., Mont. (2)
 374 Cow Cr., Mont. (2)
 375 Birch Cr., Mont. (2)
 376 Sage Cr., Mont. (2)
 377 Eagle Cr., Mont. (2)
 378 Little Sandy Cr., Mont. (2)
 379 Twenty-fourmile Cr., Mont. (2)
 380 Marias R., Mont. (2)
 381 O'Briens Coulee, Mont. (380)
 382 Cottonwood Cr., Mont. (380)
 383 Willow Cr., Mont. (380)
 384 North Fork, Mont. (383)
 385 West Fork, Mont. (383)
 386 Cut Bank Cr., Mont. (380)
 387 Two Medicine Cr., Mont. (380)
 388 Birch Cr., Mont. (380)
 389 Schultz Cr., Mont. (380)
 390 Piser Cr., Mont. (380)
 391 Antelope Cr., Mont. (390)
 392 Teton R., Mont. (2)
 393 Muddy Cr., Mont. (392)
 394 Gravel Bottom Cr., Mont. (392)
 395 Sun R., Mont. (2)
 396 Big Muddy Cr., Mont. (395)
 397 North Fork, Mont. (395)
 398 Willow Cr., Mont. (395)
 399 South Fork, Mont. (395)
 400 Little Muddy Cr., Mont. (2)
 401 Trout Cr., Mont. (2)
 402 Dearborn R., Mont. (2)
 403 Dog Cr., Mont. (2)
 404 Rock Cr., Mont. (2)
 405 Little Prickly Pear Cr., Mont. (2)
 406 Wolf Cr., Mont. (405)
 407 Beaver Cr., Mont. (2)
 408 Warm Spring Cr., Mont. (2)
 409 Crow Cr., Mont. (2)
 410 Jefferson R., Mont. (2)
 411 Boulder R., Mont. (410)
 412 Big Hole R., Mont. (410)
 413 North Fork, Mont. (412)
 414 South Fork, Mont. (412)
 415 Wise R., Mont. (412)
 416 Beaver Head R., Mont. (410)
 417 Rattlesnake Cr., Mont. (416)
 418 Grasshopper Cr., Mont. (416)
 419 Horse Prairie Cr., Mont. (416)
 420 Red Rock Cr., Mont. (416)
 421 Blacktail Deer Cr., Mont. (416)
 422 Ruby R., Mont. (416)
 423 Willow Cr., Mont. (410)

MONT. AND WYO.

424 Madison R., Mont. and Wyo. (2)
 425 West Fork, Mont. (424)
 426 East Fork, Mont. and Wyo. (424)
 427 Firehole R., Wyo. (424)
 428 Gardner R., Wyo. (424)
 429 Gallatin R., Mont. (2)
 430 West Gallatin R., Mont. and Wyo. (429)
 431 East Gallatin R., Mont. (429)
 432 Sixteenmile Cr., Mont. (2)
 433 Sixmile Cr., Mont. (2)
 434 Greyson Cr., Mont. (2)
 435 Deep Cr., Mont. (2)
 436 Duck Cr., Mont. (2)
 437 Confederate Cr., Mont. (2)
 438 White Gulch Cr., Mont. (2)
 439 Snipe Cr., Mont. (2)
 440 Cottonwood Cr., Mont. (2)
 441 Wegner Cr., Mont. (2)
 442 Sheep Cr., Mont. (2)
 443 Bird Cr., Mont. (2)
 444 Deep R., Mont. (2)
 445 Encampment Cr., Mont. (444)
 446 Hound Cr., Mont. (444)
 447 Sand Coulee Cr., Mont. (2)
 448 Box Elder Cr., Mont. (2)
 449 Belt Cr., Mont. (2)
 450 Otter Cr., Mont. (449)
 451 Highwood Cr., Mont. (2)
 452 Spring Cr., Mont. (2)
 453 Shonkin Cr., Mont. (2)
 454 Shallow Cr., Mont. (2)
 455 Crow Cr., Mont. (2)
 456 Arrow R., Mont. (2)
 457 Pine Cr., Mont. (456)
 458 Judith R., Mont. (2)
 459 Wolf Cr., Mont. (458)
 460 Skull Cr., Mont. (458)
 461 Wiltons Cr., Mont. (458)
 462 Beaver Cr., Mont. (458)
 463 Big Trout Cr., Mont. (458)
 464 Warm Spring Cr., Mont. (458)
 465 Salt Cr., Mont. (458)
 466 Dog Cr., Mont. (2)
 467 Armells Cr., Mont. (2)
 468 Musselshell R., Mont. (2)
 469 Crooked Cr., Mont. (468)
 470 Dovetail Cr., Mont. (468)
 471 Cat Cr., Mont. (468)
 472 Blood Cr., Mont. (468)
 473 Wood Cr., Mont. (468)
 474 Big Box Elder Cr., Mont. (468)
 475 Fords Cr., Mont. (474)
 476 McDonald Cr., Mont. (474)
 477 Yellow Water Cr., Mont. (474)
 478 Elk Cr., Mont. (477)
 479 Lawrence Cr., Mont. (477)
 480 Willow Cr., Mont. (468)
 481 South Willow Cr., Mont. (468)
 482 Cameron Cr., Mont. (468)
 483 Pole Cr., Mont. (482)
 484 Womans Pocket Cr., Mont. (468)
 485 Elk Cr., Mont. (468)
 486 Hapleys Cr., Mont. (468)
 487 North Fork, Mont. (468)
 488 American Fork, Mont. (468)
 489 Fish Cr., Mont. (468)

490 Big Coulee Cr., Mont. (468)
491 Dean Cr., Mont. (468)
492 Goulden Cr., Mont. (468)
493 Half Breed Cr., Mont. (468)
494 Fattig Cr., Mont. (468)
495 Sage Hen Cr., Mont. (468)
496 Lodge Pole Cr., Mont. (468)
497 Squaw Cr., Mont. (2)
498 Rattlesnake Cr., Mont. (2)
499 Quarrel Cr., Mont. (2)
500 Seven Blackfeet Cr., Mont. (2)
501 Stick Lodge Cr., Mont. (2)
502 Paradise Cr., Mont. (2)
503 Flirt Cr., Mont. (2)
504 Little Dry Fork, Mont. (2)
505 Catamount Cr., Mont. (2)
506 Big Dry Cr., Mont. (2)
507 Big Timber Cr., Mont. (506)
508 Cached Cr., Mont. (506)
509 Crow Rock Cr., Mont. (506)
510 Bridge Cr., Mont. (506)
511 East Branch, Mont. (506)
512 Brow Cr., Mont. (511)
513 Ada Cr., Mont. (506)
514 Carter Cr., Mont. (506)
515 Elk R., Mont. (2)
516 Sand Cr., Mont. (2)
517 Elk Prairie Cr., Mont. (2)
518 Antelope Cr., Mont. (2)
519 Red Water Cr., Mont. (2)
520 Charles Cr., Mont. (2)
521 Hardserabble Cr., Mont. (2)

N. DAK., MONT., AND WYO.

522 Yellowstone R., N. Dak., Mont., and Wyo. (2)
523 Fourmile Cr., N. Dak. and Mont. (522)
524 Third Hay Cr., N. Dak. and Mont. (522)
525 Second Hay Cr., N. Dak. and Mont. (522)

MONT.

526 Hay Cr., Mont. (522)
527 Lone Tree Cr., Mont. (522)
528 Fox Cr., Mont. (522)
529 Craln Cr., Mont. (522)
530 Sears Cr., Mont. (522)
531 Dunlap Cr., Mont. (522)
532 White Clay Cr., Mont. (522)
533 Burns Cr., Mont. (522)
534 Thirteenmile Cr., Mont. (522)
535 Morgan Cr., Mont. (522)
536 Lower Sevenmile Cr., Mont. (522)
537 Deer Cr., Mont. (522)
538 Upper Sevenmile Cr., Mont. (522)
539 Clear Cr., Mont. (522)
540 Red Route Cr., Mont. (522)
541 Mayradlers Cr., Mont. (522)
542 Cedar Cr., Mont. (541)
543 Cherry Cr., Mont. (541)
544 Custer Cr., Mont. (522)
545 Muster Cr., Mont. (522)
546 Sunday Cr., Mont. (522)
547 Sand Cr., Mont. (522)
548 Horse Cr., Mont. (522)
549 Little Porcupine Cr., Mont. (522)
550 Short Cr., Mont. (522)

551 Great Porcupine Cr., Mont. (522)
552 Starved to Death Cr., Mont. (522)
553 Froze to Death Cr., Mont. (522)
554 Van Horn or Pease Cr., Mont. (522)
555 Alkal Cr., Mont. (522)
556 Buffalo Cr., Mont. (522)
557 Pompeys Pillar Cr., Mont. (522)
558 Razor Cr., Mont. (522)
559 Crooked Cr., Mont. (522)
560 Butter Cr., Mont. (522)
561 Canon Cr., Mont. (522)
562 Valley Cr., Mont. (522)
563 Keyser Cr., Mont. (522)
564 Sweet Grass Cr., Mont. (522)
565 Big Timber Cr., Mont. (522)
566 Lamar R., Wyo. (522)

MONT. AND WYO.

567 Buffalo Cr., Wyo. and Mont. (566)
568 Hell Roaring Cr., Wyo. and Mont. (522)
569 Mill Cr., Mont. (522)
570 Boulder Cr., Mont. (522)
571 Upper Deer Cr., Mont. (522)
572 Lower Deer Cr., Mont. (522)
573 Bridge Cr., Mont. (522)
574 Stillwater R., Mont. (522)
575 Big Rosebud R., Mont. (574)
576 Clarks Fork, Mont. and Wyo. (522)
577 Red Lodge Cr., Mont. (576)
578 Pryor Cr., Mont. (522)
579 West Fork, Mont. (578)
580 East Fork, Mont. (578)
581 Big Horn R., Mont. and Wyo. (522)
582 Beauvais Fork, Mont. (581)
583 Shoshone R., Wyo. (581)
584 North Fork, Wyo. (583)
585 South Fork, Wyo. (583)
586 Cottonwood Cr., Wyo. (583)
587 Grey Bull R., Wyo. (581)
588 Gooseberry Cr., Wyo. (581)
589 Mee-ye-ro Cr., Wyo. (581)
590 Owl Cr., Wyo. (581)
591 Muddy Cr., Wyo. (581)
592 Wind R., Wyo. (581)
593 Little Wind R., Wyo. (581)
594 Popo Agie R., Wyo. (581)
595 Beaver Cr., Wyo. (581)
596 Poison Cr., Wyo. (581)
597 Kirby Cr., Wyo. (581)
598 No Water Cr., Wyo. (581)
599 No Wood Cr., Wyo. (581)
600 Shell Cr., Wyo. (581)
601 Salt Cr., Wyo. (581)
602 Crystal Spring Cr., Wyo. (581)
603 Trout Cr., Wyo. (581)
604 No Mouth Cr., Wyo. (581)
605 Soap Cr., Mont. (581)
606 Rotten Grass Cr., Mont. (581)
607 Little Big Horn or Greasy Grass R., Mont. (581)
608 Tullocks Fork, Mont. (581)
609 Sarpy Cr., Mont. (522)
610 Armells Cr., Mont. (522)
611 West Fork, Mont. (610)
612 East Fork, Mont. (610)
613 Rosebud R., Mont. (522)
614 Sweeney Cr., Mont. (522)

615 Graveyard Cr., Mont. (522)
 616 Tongue R., Mont. and Wyo. (522)
 617 Hanging Woman Cr., Mont. and Wyo. (616)
 618 O'Dell Cr., Mont. (616)
 619 Otter Cr., Mont. (616)
 620 Beaver Cr., Mont. (616)
 621 Pumpkin Cr., Mont. (616)
 622 Squaw Cr., Mont. (616)
 623 Cottonwood Cr., Mont. (522)
 624 Powder R., Mont. and Wyo. (522)
 625 Mizpah R., Mont. (624)
 626 Cache Cr., Mont. (624)
 627 Bloom Cr., Mont. (624)
 628 Spring Cr., Mont. (624)
 629 Clear Cr., Wyo. (624)
 630 Crazy Woman Fork, Wyo. (624)
 631 Ninemile Cr., Wyo. (624)
 632 North Fork, Wyo. (624)
 633 South Fork, Wyo. (624)
 634 Buffalo Cr., Wyo. (633)
 635 Salt Cr., Wyo. (624)
 636 Pumpkin Cr., Wyo. (624)
 637 Wild Horse Cr., Wyo. (624)
 638 Buffalo Cr., Mont. and Wyo. (624)
 639 Bay Horse Cr., Mont. and Wyo. (624)
 640 Little Powder R., Mont. and Wyo. (624)
 641 Crow Cr., Mont. (624)
 642 Sheep Cr., Mont. (624)
 643 O'Fallons Cr., Mont. (522)
 644 East Fork, Mont. (643)
 645 Cabin Cr., Mont. (522)
 646 Cedar Cr., Mont. (522)
 647 Glendive Cr., Mont. (522)
 648 Box Elder Cr., Mont. (522)

MONT., N. DAK., S. DAK., AND WYO.

649 Smith Cr., Mont. and N. Dak. (522)
 650 Shadwell Cr., Mont. and N. Dak. (522)
 651 Charbonneau Cr., N. Dak. (522)
 652 Pebble Cr., N. Dak. (2)
 653 Squaw Cr., N. Dak. (2)
 654 Tobacco Cr., N. Dak. (2)
 655 Tobacco Garden Cr., N. Dak. (2)
 656 Clark Cr., N. Dak. (2)
 657 Indian Cr., N. Dak. (2)
 658 Little Missouri R., N. Dak., S. Dak., Mont., and Wyo. (2)
 659 Beaver Cr., N. Dak. and Mont. (658)
 660 Big Box Elder Cr., N. Dak., S. Dak., and Mont. (658)
 661 Tie Cr., Mont. (658)
 662 Cottonwood Cr., Mont. (658)
 663 Willow Cr., Mont. (658)
 664 Thompsons Cr., Mont. and Wyo. (658)
 665 North Fork, Wyo. (658)
 666 Deep Cr., N. Dak. (658)
 667 Whitetail Cr., N. Dak. (658)
 668 Blacktail Cr., N. Dak. (667)
 669 Belcegel Cr., N. Dak. (658)
 670 Little Beaver or Pretty Cr., N. Dak. (2)
 671 Emmanuel Cr., N. Dak. (2)
 672 Knife R., N. Dak. (2)
 673 Spring Cr., N. Dak. (672)
 674 Crooked Cr., N. Dak. (672)
 675 Mandan Lake (outlet), N. Dak. (2)

676 Square Butte Cr., N. Dak. (2)
 677 Heart R., N. Dak. (2)
 678 Sweet Briar Cr., N. Dak. (677)
 679 Curlew Cr., N. Dak. (677)
 680 Antelope Cr., N. Dak. (677)
 681 Little Heart R., N. Dak. (2)
 682 Cannon Ball R., N. Dak. (2)
 683 Dogtooth Cr., N. Dak. (682)
 684 Louse Cr., N. Dak. (683)
 685 North Fork, N. Dak. (682)
 686 Thirtymile Cr., N. Dak. (685)
 687 South Fork, N. Dak. (682)
 688 Willow Cr., N. Dak. (2)
 689 Pointer Cr., N. Dak. (2)
 690 La Barge Cr., N. Dak. (2)
 691 Long Soldier Cr., N. Dak. (2)
 692 Fourmile Cr., N. Dak. (2)
 693 Black Hawk Cr., N. Dak. (2)

S. DAK. AND WYO.

694 Blackfoot Cr., S. Dak. (2)
 695 Eagle Feather Cr., S. Dak. (2)
 696 Kunkpapa Cr., S. Dak. (2)
 697 Cathead Cr., S. Dak. (2)
 698 Rampart Cr., S. Dak. (2)
 699 Grand R., S. Dak. (2)
 700 North Fork, S. Dak. (699)
 701 South Fork, S. Dak. (699)
 702 Highbank Cr., S. Dak. (699)
 703 Bellsman Cr., S. Dak. (2)
 704 Green Timber Cr., S. Dak. (2)
 705 Le Compte Cr., S. Dak. (2)
 706 Owl or Moreau R., S. Dak. (2)
 707 Little Moreau Cr., S. Dak. (706)
 708 Red Earth Cr., S. Dak. (706)
 709 Thunder Cr., S. Dak. (706)
 710 Rabbit Cr., S. Dak. (706)
 711 Antelope Cr., S. Dak. (710)
 712 North Fork, S. Dak. (706)
 713 South Fork S. Dak. (706)
 714 Sand Ledge Cr., S. Dak. (706)
 715 Flint Rock Cr., S. Dak. (706)
 716 Four Bears Cr., S. Dak. (2)
 717 Buffaloskin Cr., S. Dak. (2)
 718 White Brant Cr., S. Dak. (2)
 719 Stove or Cherry Cr., S. Dak. (2)
 720 Pascal Cr., S. Dak. (2)
 721 No Heart Cr., S. Dak. (2)
 722 McKenzie Cr., S. Dak. (2)
 723 Fox Cr., S. Dak. (2)
 724 Cheyenne R., S. Dak. (2)
 725 Cherry Cr., S. Dak. (724)
 726 Sulphur Cr., S. Dak. (725)
 727 Owl Feather Cr., S. Dak. (725)
 728 Big Timber Cr., S. Dak. (724)

S. DAK. AND WYO.

729 Belle Fourche R., S. Dak. and Wyo. (724)
 730 Elm or Eightmile Cr. S. Dak. (729)
 731 East Elm Cr., S. Dak. (730)
 732 Willow Cr., S. Dak. (729)
 733 Indian Cr., S. Dak. (729)
 734 Dead Horse Cr., S. Dak. (733)
 735 Owl Cr., S. Dak. and Wyo. (729)
 736 Crow Cr., S. Dak. and Wyo. (729)
 737 Red Water Cr., S. Dak. and Wyo. (729)

738 Spearfish Cr., S. Dak. (737)
739 White Wood Cr., S. Dak. (729)
740 Bear Butte Cr., S. Dak. (729)
741 Warren Cr., S. Dak. (729)
742 South Fork, S. Dak. and Wyo. (724)
743 Elk Cr., S. Dak. (742)
744 Box Elder Cr., S. Dak. (742)
745 Rapid Cr., S. Dak. (742)
746 Spring Cr., S. Dak. (742)
747 Battle Cr., S. Dak. (742)
748 Beaver Cr., S. Dak. and Wyo. (742)
749 Black Thunder Cr., Wyo. (742)
750 Antelope Cr., Wyo. (742)
751 Dry Fork, Wyo. (742)
752 Lance Cr., S. Dak. and Wyo. (742)
753 Sage Cr., S. Dak. and Wyo. (742)
754 Cottonwood Cr., S. Dak. and Wyo.
(742)

S. DAK., NEBR., AND WYO.

755 Hat Cr., S. Dak., Nebr., and Wyo. (742)
756 Horse Head Cr., S. Dak. (742)
757 Squaw Cr., S. Dak. (724)
758 Ash Cr., S. Dak. (724)
759 Beaver Cr., S. Dak. (724)
760 Snake Cr., S. Dak. (724)
761 Mission Cr., S. Dak. (2)
762 Chantier Cr., S. Dak. (2)
763 Bad R., S. Dak. (2)
764 Willow Cr., S. Dak. (763)
765 Lance Cr., S. Dak. (763)
766 Plum Cr., S. Dak. (763)
767 Mitchell Cr., S. Dak. (763)
768 Medicine Cr., S. Dak. (763)
769 Grindstone Cr., S. Dak. (763)
770 North Fork, S. Dak. (763)
771 Cottonwood Cr., S. Dak. (763)
772 White Water Cr., S. Dak. (763)
773 White Willow Cr., S. Dak. (763)
774 Indian Cr., S. Dak. (763)
775 Brave Bill Cr., S. Dak. (763)
776 Fort George Cr., S. Dak. (2)
777 Loiselle Cr., S. Dak. (2)
778 Cedar Cr., S. Dak. (2)
779 Dry Cr., S. Dak. (2)
780 Medicine Cr., S. Dak. (2)
781 Fish Cr., S. Dak. (2)
782 Camel Cr., S. Dak. (2)
783 Badger Cr., S. Dak. (2)
784 Laurel or Zephyr Cr., S. Dak. (2)
785 American Crow Cr., S. Dak. (2)
786 White R., S. Dak. and Nebr. (2)
787 Bull Cr., S. Dak. (786)
788 Big Cottonwood Cr., Nebr. (786)
789 White Clay Cr., S. Dak. and Nebr. (786)
790 Wounded Knee Cr., S. Dak. (786)
791 Porcupine Cr., S. Dak. (786)
792 Yellow Medicine Cr., S. Dak. (786)
793 Pumpkin Cr., S. Dak. (786)
794 Corn Cr., S. Dak. (786)
795 Bear in the Lodge Cr., S. Dak. (786)
796 Eagle Nest Cr., S. Dak. (786)
797 Pass Cr., S. Dak. (786)
798 Black Pipe Cr., S. Dak. (786)
799 Bad Land Cr., S. Dak. (786)
800 South Fork, S. Dak. (786)
801 Pine Cr., S. Dak. (800)

802 Cutmeat Cr., S. Dak. (800)
803 Rosebud Cr., S. Dak. (800)
804 Oak Cr., S. Dak. (786)
805 Two Tall Cr., S. Dak. (786)
806 Dog Ear Cr., S. Dak. (786)
807 Bull Cr., S. Dak. (2)
808 Whetstone Cr., S. Dak. (2)
809 Scalp Cr., S. Dak. (2)
810 Garden Cr., S. Dak. (2)
811 Ponca Cr., Nebr. and S. Dak. (2)
812 Niobrara R., Nebr. and Wyo. (2)
813 Keya Paha R., Nebr. and S. Dak. (812)
814 Antelope Cr., S. Dak. (813)
815 Burton Cr., S. Dak. (813)
816 Minnechadua R., Nebr. and S. Dak.
(812)

NEBR.

817 Bear Cr., Nebr. (812)
818 Antelope Cr., Nebr. (812)
819 Rush Cr., Nebr. (812)
820 Pepper Cr., Nebr. (812)
821 Weasel Cr., Nebr. (812)
822 Box Butte Cr., Nebr. (812)
823 Pine Cr., Nebr. (812)
824 Deer Cr., Nebr. (812)
825 Snake R., Nebr. (812)
826 Eureka Cr., Nebr. (825)
827 Gordons Cr., Nebr. (812)
828 Plum Cr., Nebr. (812)
829 Evergreen Cr., Nebr. (828)
830 Long Pine Cr., Nebr. (812)
831 Eagle Cr., Nebr. (812)
832 Verdigris R., Nebr. (812)
833 Bazile Cr., Nebr. (2)
834 Bozzie Cr., Nebr. (833)
835 Beaver Cr., Nebr. (2)
836 Bow Cr., Nebr. (2)
837 West Bow Cr., Nebr. (836)
838 Aowa Cr., Nebr. (2)
839 Omaha Cr., Nebr. (2)
840 Elk Cr., Nebr. (839)
841 Spring Cr., Nebr. (2)
842 Blackbird Cr., Nebr. (2)
843 Fish Cr., Nebr. (2)
844 Ponca Cr., Nebr. (2)
845 Mill Cr., Nebr. (2)
846 Florence Lake (outlet), Nebr. (2)
847 Otos Cr., Nebr. (2)
848 Papillion R., Nebr. (2)
849 Little Papillion Cr., Nebr. (848)
850 Platte R., Nebr. (2)
851 Elkhorn R., Nebr. (850)
852 Logan Cr., Nebr. (851)
853 Plum Cr., Nebr. (851)
854 North Fork, Nebr. (851)
855 Willow Cr., Nebr. (851)
856 South Fork, Nebr. (851)
857 Cache Cr., Nebr. (851)
858 Cedar Cr., Nebr. (851)
859 Taylor Cr., Nebr. (851)
860 Maple Cr., Nebr. (851)
861 Rawhide Cr., Nebr. (851)
862 Shell Cr., Nebr. (850)
863 Lasker Cr., Nebr. (862)
864 Loup R., Nebr. (850)
865 Beaver Cr., Nebr. (864)
866 Cedar Cr., Nebr. (864)

867 North Loup R., Nebr. (864)
 868 Calamus R., Nebr., (867)
 869 Middle Loup R., Nebr. (864)
 870 Dismal R., Nebr. (869)
 871 South Loup R., Nebr. (864)
 872 Mud Cr., Nebr. (871)
 873 Prairie Cr., Nebr. (850)
 874 Wood R., Nebr. (850)
 875 Buffalo Cr., Nebr. (850)
 876 White Horse Cr., Nebr. (850)

NEBR., WYO., AND COLO.

877 North Platte R., Nebr., Wyo., and Colo. (850)
 878 Birdwood Cr., Nebr. (877)
 879 White Tail Cr., Nebr. (877)
 880 Lonergan Cr., Nebr. (877)
 881 White Clay Cr., Nebr. (877)
 882 Otter Cr., Nebr. (877)
 883 Blue R., Nebr. (877)
 884 Willow Cr., Nebr. (877)
 885 Spoonhill Cr., Nebr. and Wyo. (877)
 886 Rawhide Cr., Wyo. (877)
 887 Broom Cr., Wyo. (877)
 888 Willow Cr., Wyo. (877)
 889 Muddy Cr., Wyo. (888)
 890 Casper Cr., Wyo. (877)
 891 Poison Spider Cr., Wyo. (877)
 892 Sweetwater R., Wyo. (877)
 893 Sage Hen Cr., Wyo. (892)
 894 Rock Cr., Wyo. (892)
 895 Willow Cr., Wyo. (892)
 896 Sulphur Cr., Wyo. (892)
 897 Muddy Cr., Wyo. (892)
 898 Sand Cr., Wyo. (877)
 899 Dewese Cr., Wyo. (877)
 900 Big Sage Cr., Wyo. (877)
 901 Little Sage Cr., Wyo. (900)
 902 Jack Cr., Wyo. (877)
 903 Spring Cr., Wyo. (877)
 904 Cow Cr., Wyo. (877)
 905 Grand Encampment Cr., Wyo. and Colo. (877)
 906 Beaver Cr., Wyo. and Colo. (877)
 907 Big Cr., Wyo. (877)
 908 Roaring Fork, Colo. (877)
 909 Raspberry Cr., Colo. (908)
 910 Grizzly Cr., Colo. (877)
 911 Illinois Cr., Colo. (877)
 912 Michigan R., Colo. (911)
 913 Owl Cr., Colo. (912)
 914 East Fork or Canadian R., Colo. (877)
 915 Beaver Cr., Wyo. (877)
 916 South French Cr., Wyo. (877)
 917 French Cr., Wyo. (877)
 918 Brush Cr., Wyo. (877)
 919 Cedar Cr., Wyo. (877)
 920 Pass Cr., Wyo. (877)
 921 Medicine Bow R., Wyo. (877)
 922 Little Medicine Bow R., Wyo. (921)
 923 Sheep Cr., Wyo. (922)
 924 Muddy Cr., Wyo. (922)
 925 Sage Cr., Wyo. (877)
 926 Canon Cr., Wyo. (877)
 927 Camp Cr., Wyo. (877)
 928 Bates Cr., Wyo. (877)
 929 Muddy Cr., Wyo. (877)

930 Deer Cr., Wyo. (877)
 931 Box Elder Cr., Wyo. (877)
 932 La Prele Cr., Wyo. (877)
 933 Wagon Hound Cr., Wyo. (877)
 934 La Bonte Cr., Wyo. (877)
 935 Indian Cr., Wyo. (877)
 936 Elkhorn Cr., Wyo. (877)
 937 Horseshoe Cr., Wyo. (877)
 938 Laramie R., Wyo. and Colo. (877)
 939 North Laramie, Wyo. (938)
 940 Little Laramie R., Wyo. (938)
 941 Sybille Cr., Wyo. (938)
 942 Chugwater Cr., Wyo. (877)
 943 Horse Cr., Nebr. and Wyo. (877)
 944 Bear Cr., Wyo. (943)
 945 Pumpkin Seed Cr., Nebr. (877)
 946 Lawrence Cr., Nebr. (945)
 947 Smith Branch, Nebr. (877)
 948 Ash Cr., Nebr. (877)
 949 South Platte R., Nebr. and Colo. (850)
 950 Lodge Pole Cr., Colo., Nebr., and Wyo. (949)
 951 Moores Cr., Colo. and Wyo. (949)
 952 Lewis Cr., Colo. (949)
 953 Horsetail or Clear Cr., Colo. (949)
 954 Pawnee Cr., Colo. (949)
 955 Wild Cat Cr., Colo. (949)
 956 Crow Cr., Colo. and Wyo. (949)

COLO.

957 Cache La Poudre R., Colo. (949)
 958 Big Thompson Cr., Colo. (949)
 959 St. Vrain Cr., Colo. (949)
 960 Dry Cr., Colo. (949)
 961 Clear Cr., Colo. (949)
 962 Bear Cr., Colo. (949)
 963 Deer Cr., Colo. (949)
 964 North Fork, Colo. (949)
 965 Goose or Lost Park Cr., Colo. (949)
 966 Tarryall Cr., Colo. (949)
 967 Trout Cr., Colo. (949)
 968 Fourmile Cr., Colo. (949)
 969 South Fork, Colo. (949)
 970 Buffalo Slough, Colo. (949)
 971 Threemile Cr., Colo. (949)
 972 Douglas Cr., Colo. (949)
 973 Trout Cr., Colo. (949)
 974 Plum Cr., Colo. (949)
 975 Willow Cr., Colo. (949)
 976 Cherry Cr., Colo. (949)
 977 Coal Cr., Colo. (949)
 978 Terrapin or Box Elder Cr., Colo. (949)
 979 Kiowa Cr., Colo. (949)
 980 Bijou Cr., Colo. (949)
 981 Little Badger Cr., Colo. (949)
 982 Beaver Cr., Colo. (949)
 983 Badger Cr., Colo. (982)

NEBR.

984 Skull Cr., Nebr. (850)
 985 Otoe Cr., Nebr. (850)
 986 Wahoo Cr., Nebr. (850)
 987 Upper Clear Cr., Nebr. (986)
 988 Silver Cr., Nebr. (987)
 989 Sand Cr., Nebr. (986)
 990 Cottonwood Cr., Nebr. (986)
 991 Salt Cr., Nebr. (986)

992 Weeping Water Cr., Nebr. (2)
993 Squaw Cr., Nebr. (2)
994 Walnut Cr., Nebr. (2)
995 North Table Cr., Nebr. (2)
996 South Table Cr., Nebr. (2)
997 Fox Cr., Nebr. (996)
998 Fourmile Cr., Nebr. (2)
999 Buck Cr., Nebr. (2)
1000 Honey Cr., Nebr. (2)
1001 Little Nemaha R., Nebr. (2)
1002 North Fork, Nebr. (1001)
1003 Prairie Owl Cr., Nebr. (1001)
1004 Muddy Cr., Nebr. (1001)
1005 South Fork, Nebr. (1001)
1006 Whisky Cr., Nebr. (1001)
1007 Jones Cr., Nebr. (2)
1008 Winnebago Cr., Nebr. (2)

NEBR. AND KANS.

1009 Big Nemaha R., Nebr. and Kans. (2)
1010 Muddy Cr., Nebr. (1009)
1011 North Fork, Nebr. (1009)
1012 Long Branch, Nebr. (1011)
1013 South Fork, Nebr. and Kans. (1009)
1014 Camp Cr., Nebr. (1013)
1015 Noharts Cr., Nebr. and Kans. (1009)
1016 Roys Cr., Nebr. and Kans. (1009)

KANS.

1017 Squaw Cr., Kans. (2)
1018 Cedar Cr., Kans. (2)
1019 Wolf Cr., Kans. (2)
1020 Mosquito Cr., Kans. (2)
1021 Charleston Cr., Kans. (2)
1022 Peters Cr., Kans. (2)
1023 Brush Cr., Kans. (2)
1024 Independence Cr., Kans. (2)
1025 Rock Cr., Kans. (1024)
1026 Deer Cr., Kans. (1024)
1027 Whiskey Cr., Kans. (2)
1028 Walnut Cr., Kans. (2)
1029 Salt Cr., Kans. (2)
1030 Plum Cr., Kans. (1029)
1031 Onemile Cr., Kans. (2)
1032 Corral Cr., Kans. (2)
1033 Threemile Cr., Kans. (2)
1034 Fivemile Cr., Kans. (2)
1035 Sevenmile Cr., Kans. (2)
1036 Ninemile Cr., Kans. (2)
1037 Island Cr., Kans. (2)
1038 Honey Cr., Kans. (1037)
1039 Conner Cr., Kans. (2)
1040 Marshall Cr., Kans. (2)
1041 Jersey Cr., Kans. (2)
1042 Kansas R., Kans. (2)
1043 Muncie Cr., Kans. (1042)
1044 Mill Cr., Kans. (1042)
1045 Little Turkey Cr., Kans. (1042)
1046 Betts Cr., Kans. (1042)
1047 East Mission Cr., Kans. (1042)
1048 West Mission Cr., Kans. (1042)
1049 Spring Cr., Kans. (1042)
1050 Wolf Cr., Kans. (1042)
1051 Little Kaw Cr., Kans. (1042)
1052 Big Stranger Cr., Kans. (1042)
1053 Crooked Cr., Kans. (1052)

1054 Walnut Cr., Kans. (1052)
1055 Fall Cr., Kans. (1052)
1056 Jarbalo Cr., Kans. (1052)
1057 Tonganoxie Cr., Kans. (1052)
1058 Ninemile Cr., Kans. (1052)
1059 Crow Cr., Kans. (1058)
1060 Wild Horse Cr., Kans. (1058)
1061 Mud Cr., Kans. (1042)
1062 Buck Cr., Kans. (1042)
1063 Stone House Cr., Kans. (1042)
1064 Grasshopper Cr., Kans. (1042)
1065 Wild Horse Cr., Kans. (1064)
1066 Big Slough Cr., Kans. (1064)
1067 Little Slough Cr., Kans. (1064)
1068 Fish Pond Cr., Kans. (1067)
1069 Rock Cr., Kans. (1064)
1070 Brush Cr., Kans. (1064)
1071 Walnut Cr., Kans. (1064)
1072 Coal Cr., Kans. (1064)
1073 Cedar Cr., Kans. (1064)
1074 Craig Cr., Kans. (1073)
1075 Mud Cr., Kans. (1073)
1076 Lock Lane Cr., Kans. (1075)
1077 Wolfley Cr., Kans. (1075)
1078 Spring Cr., Kans. (1064)
1079 Mosquito Cr., Kans. (1078)
1080 Straight Cr., Kans. (1078)
1081 Elk Cr., Kans. (1064)
1082 Cedar Cr., Kans. (1064)
1083 Duck Cr., Kans. (1064)
1084 Rock Cr., Kans. (1064)
1085 Muddy Cr., Kans. (1042)
1086 Little Muddy Cr., Kans. (1042)
1087 Indian Cr., Kans. (1042)
1088 Big Soldier Cr., Kans. (1042)
1089 Halfday Cr., Kans. (1088)
1090 Little Soldier Cr., Kans. (1088)
1091 Walnut Cr., Kans. (1088)
1092 Cross Cr., Kans. (1042)
1093 Salt Cr., Kans. (1092)
1094 Sullivan Cr., Kans. (1092)
1095 Illinois Cr., Kans. (1092)
1096 Little Cross Cr., Kans. (1092)
1097 Meyano Cr., Kans. (1092)
1098 Vermillion R., Kans. (1042)
1099 Straight Cr., Kans. (1098)
1100 Red Vermillion Cr., Kans. (1098)
1101 Rock Cr., Kans. (1098)
1102 Brush Cr., Kans. (1101)

KANS., NEBR., AND COLO.

1103 Big Blue R., Kans. and Nebr. (1042)
1104 Cedar Cr., Kans. (1103)
1105 McIntyre Cr., Kans. (1103)
1106 Carnahan Cr., Kans. (1103)
1107 Bluff Cr., Kans. (1103)
1108 Fourmile Cr., Kans. (1107)
1109 Black Vermillion R., Kans. (1103)
1110 Clear Cr., Kans. (1109)
1111 South Fork, Kans. (1109)
1112 North Fork, Kans. (1109)
1113 Vermillion Cr., Kans. (1109)
1114 Mosquito Cr., Kans. (1103)
1115 Spring Cr., Kans. (1103)
1116 Elk Cr., Kans. (1103)
1117 Horseshoe Cr., Kans. (1103)
1118 Mountain Cr., Kans. (1103)

- 1119 Raemer Cr., Kans. (1103)
 1120 Little Blue R., Kans. and Nebr. (1103)
 1121 Sandy Cr., Nebr. (1120)
 1122 Big Sandy Cr., Nebr. (1120)
 1123 Elk Cr., Nebr. (1120)
 1124 Mill Cr., Kans. (1120)
 1125 Coon Cr., Kans. (1103)
 1126 Camp Cr., Kans. (1125)
 1127 Swede Cr., Kans. (1103)
 1128 Fancy Cr., Kans. (1103)
 1129 Otter Cr., Kans. (1128)
 1130 Crooked Cr., Kans. (1128)
 1131 Walnut Cr., Kans. (1128)
 1132 Mill Cr., Kans. (1103)
 1133 Wildcat Cr., Kans. (1042)
 1134 Sevenmile Cr., Kans. (1042)
 1135 Threemile Cr., Kans. (1042)
 1136 Onemile Cr., Kans. (1042)
 1137 Republican R., Kans., Nebr., and Colo. (1042)
 1138 Fourmile Cr., Kans. (1137)
 1139 Moll Cr., Kans. (1137)
 1140 Peat Cr., Kans. (1137)
 1141 Gar Cr., Kans. (1137)
 1142 Scribner Cr., Kans. (1137)
 1143 Salt Cr., Kans. (1137)
 1144 School Cr., Kans. (1137)
 1145 Otter Cr., Kans. (1137)
 1146 Blakely Cr., Kans. (1137)
 1147 Beaver Cr., Nebr. (1137)
 1148 Willow Cr., Nebr. (1137)
 1149 Farmers Cr., Nebr. (1137)
 1150 Thompsons Cr., Nebr. (1137)
 1151 Sassacus Cr., Nebr. (1150)
 1152 Lovely Cr., Nebr. (1137)
 1153 Center Cr., Nebr. (1137)
 1154 Turkey Cr., Nebr. (1137)
 1155 Rope Cr., Nebr. (1137)
 1156 Flag Cr., Nebr. (1137)
 1157 Elk Cr., Nebr. (1137)
 1158 Muddy Cr., Nebr. (1137)
 1159 Beaver Cr., Nebr., Kans., and Colo. (1137)
 1160 Sappa Cr., Nebr. and Kans. (1159)
 1161 Prairie Dog Cr., Nebr. and Kans. (1137)
 1162 Crystal Cr., Nebr. and Kans. (1137)
 1163 Rebecca Cr., Nebr. and Kans. (1137)
 1164 Lochiel Cr., Nebr. (1137)
 1165 Calumet Cr., Nebr. and Kans. (1137)
 1166 Reams Cr., Nebr. and Kans. (1137)
 1167 Lohff Cr., Nebr. and Kans. (1137)
 1168 White Rock Cr., Kans. (1137)
 1169 Beaver Cr., Kans. (1137)
 1170 Buffalo Cr., Kans. (1137)
 1171 Wolf Cr., Kans. (1137)
 1172 Millers Cr., Kans. (1137)
 1173 Five Creeks Cr., Kans. (1137)
 1174 Smoky Hill R., Kans. and Colo. (1042)
 1182 Plum Cr., Kans. (1177)
 1183 Brown Cr., Kans. (1177)
 1184 Dog Cr., Kans. (1183)
 1185 Livingstone Cr., Kans. (1177)
 1186 North Fork, Kans. (1177)
 1187 Beaver Cr., Kans. (1186)
 1188 Cedar Cr., Kans. (1186)
 1189 Deer Cr., Kans. (1186)
 1190 Big Cr., Kans. (1189)
 1191 Ash Cr., Kans. (1177)
 1192 Wolf Cr., Kans. (1177)
 1193 Bow Cr., Kans. (1177)
 1194 South Fork, Kans. (1177)
 1195 Slate Cr., Kans. (1177)
 1196 Sand Cr., Kans. (1177)
 1197 Brush Cr., Kans. (1177)
 1198 Skunk Cr., Kans. (1194)
 1199 Wild Horse Cr., Kans. (1194)
 1200 Lost Cr., Kans. (1194)
 1201 Box Elder Cr., Kans. (1194)
 1202 Elm Cr., Kans. (1194)
 1203 Medicine Cr., Kans. (1194)
 1204 Kill Cr., Kans. (1194)
 1205 Covert Cr., Kans. (1194)
 1206 Indian Cr., Kans. (1194)
 1207 Twin Cr., Kans. (1194)
 1208 Clay Cr., Kans. (1194)
 1209 Walnut Cr., Kans. (1177)
 1210 Leban Cr., Kans. (1177)
 1211 Fourth Cr., Kans. (1177)
 1212 Third Cr., Kans. (1177)
 1213 Salt Cr., Kans. (1177)
 1214 Rattlesnake Cr., Kans. (1213)
 1215 Saline R., Kans. (1174)
 1216 Spillman Cr., Kans. (1215)
 1217 Wolf Cr., Kans. (1215)
 1218 Paradise Cr., Kans. (1215)
 1219 Salt Cr., Kans. (1215)
 1220 Cedar Cr., Kans. (1215)
 1221 Hell Cr., Kans. (1215)
 1222 West Twin Cr., Kans. (1215)
 1223 East Twin Cr., Kans. (1215)
 1224 Bullfoot Cr., Kans. (1215)
 1225 Elkhorn Cr., Kans. (1215)
 1226 Mulberry Cr., Kans. (1215)
 1227 Clear Cr., Kans. (1174)
 1228 Spring Cr., Kans. (1174)
 1229 Oak Cr., Kans. (1174)
 1230 Buffalo Cr., Kans. (1174)
 1231 Cow Cr., Kans. (1174)
 1232 Fossil Cr., Kans. (1174)
 1233 Big Cr., Kans. (1174)
 1234 Downer Cr., Kans. (1174)
 1235 Hackberry Cr., Kans. (1174)
 1236 North Hackberry Cr., Kans. (1235)
 1237 South Hackberry Cr., Kans. (1235)
 1238 Indian Cr., Kans. (1174)
 1239 Plum Cr., Kans. (1174)

KANS.

- 1175 Chapmans Cr., Kans. (1174)
 1176 Abilene Cr., Kans. (1174)
 1177 Solomon R., Kans. (1174)
 1178 Sand Cr., Kans. (1177)
 1179 Lindsey Cr., Kans. (1177)
 1180 Pipe Cr., Kans. (1177)
 1181 Fisher Cr., Kans. (1177)

KANS. AND COLO.

- 1240 North Fork of Smoky Hill R., Kans. and Colo. (1174)
 1241 Turtle Cr., Kans. (1174)
 1242 Pond Cr., Kans. (1174)
 1243 Goose Cr., Kans. (1174)
 1244 Rose Cr., Kans. (1174)
 1245 Ladder Cr., Kans. and Colo. (1174)

KANS.

1246 Twin Butte Cr., Kans. (1245)
1247 Big Timber Cr., Kans. (1174)
1248 Shelter Cr., Kans. (1174)
1249 Langdons Cr., Kans. (1174)
1250 Sellers Cr., Kans. (1174)
1251 Wright Cr., Kans. (1174)
1252 Beaver Cr., Kans. (1174)
1253 Coal Cr., Kans. (1174)
1254 Blood Cr., Kans. (1174)
1255 Wolf Cr., Kans. (1174)
1256 Turkey Cr., Kans. (1174)
1257 Oxide Cr., Kans. (1174)
1258 Mud Cr., Kans. (1174)
1259 Ash Cr., Kans. (1174)
1260 Thompson Cr., Kans. (1174)
1261 Bluff Cr., Kans. (1174)
1262 Sharps Cr., Kans. (1174)
1263 Gypsum Cr., Kans. (1174)
1264 Stag Cr., Kans. (1263)
1265 Harvey Cr., Kans. (1263)
1266 Hobbs Cr., Kans. (1263)
1267 McAllister Cr., Kans. (1263)
1268 Holland Cr., Kans. (1174)
1269 Turkey Cr., Kans. (1174)
1270 Lyons Cr., Kans. (1174)
1271 Cary Cr., Kans. (1270)
1272 West Branch, Kans. (1270)
1273 Coal Cr., Kans. (1270)
1274 Line Cr., Kans. (1270)
1275 Clarks Cr., Kans. (1042)
1276 Davis Cr., Kans. (1275)
1277 Humboldt Cr., Kans. (1275)
1278 McDowell Cr., Kans. (1042)
1279 Deep Cr., Kans. (1042)
1280 Antelope Cr., Kans. (1042)
1281 Wells Cr., Kans. (1042)
1282 Turkey Cr., Kans. (1042)
1283 Mill Cr., Kans. (1042)
1284 Mulberry Cr., Kans. (1283)
1285 Hendricks Cr., Kans. (1283)
1286 West Branch, Kans. (1283)
1287 Middle Branch, Kans. (1283)
1288 East Branch, Kans. (1283)
1289 Kinsley Cr., Kans. (1283)
1290 Snokomo Cr., Kans. (1283)
1291 Post Cr., Kans. (1042)
1292 Vassar Cr., Kans. (1042)
1293 Mission Cr., Kans. (1042)
1294 Shonganunga Cr., Kans. (1042)
1295 Deer Cr., Kans. (1294)
1296 Tecumseh Cr., Kans. (1042)
1297 Martin Cr., Kans. (1042)
1298 Wakarusa Cr., Kans. (1042)
1299 Deer Cr., Kans. (1298)
1300 Rock Cr., Kans. (1298)
1301 Washington Cr., Kans. (1298)
1302 Cole Cr., Kans. (1298)
1303 Spring Cr., Kans. (1298)
1304 Captain Cr., Kans. (1298)
1305 Kill Cr., Kans. (1042)
1306 Cedar Cr., Kans. (1042)
1307 Mill Cr., Kans. (1042)
1308 Clear Cr., Kans. (1307)
1309 Little Cr., Kans. (1307)

MO. AND KANS.

1310 Turkey Cr., Mo. and Kans. (1042)
1311 Big Blue R., Mo. and Kans. (2)
1312 Brush Cr., Mo. and Kans. (1311)
1313 Indian Cr., Mo. and Kans. (1311)
1314 Tomahawk Cr., Kans. (1313)
1315 Coffee Cr., Kans. (1311)
1316 Wolf Cr., Kans. (1311)
1317 Round Grove Cr., Mo. (1311)
1318 Rock Cr., Mo. (2)
1319 Sugar Cr., Mo. (2)
1320 Mill Cr., Mo. (2)
1321 Little Blue R., Mo. (2)
1322 Sleepy Branch, Mo. (2)
1323 Sugar Cr., Mo. (2)
1324 Prairie Cr., Mo. (2)
1325 Sniabar Cr., Mo. (2)
1326 Owl Cr., Mo. (1325)
1327 Little Sniabar Cr., Mo. (2)
1328 Tabo Cr., Mo. (2)
1329 Brush Cr., Mo. (1328)
1330 Little Tabo Cr., Mo. (1328)
1331 Graves Cr., Mo. (2)
1332 Buck Cr., Mo. (2)
1333 Bear Cr., Mo. (2)
1334 Fish Cr., Mo. (2)
1335 Moon Cr., Mo. (2)
1336 Lamine R., Mo. (2)
1337 Blackwater R., Mo. (1336)
1338 Salt Fork of Blackwater R., Mo. (1337)
1339 Camp Cr., Mo. (1338)
1340 Rock Cr., Mo. (1338)
1341 Davis Cr., Mo. (1337)
1342 Post oak Cr., Mo. (1337)
1343 Clear Cr., Mo. (1337)
1344 Heaths Cr., Mo. (1336)
1345 Muddy Cr., Mo. (1336)
1346 Flat Cr., Mo. (1336)
1347 Richland Cr., Mo. (1336)
1348 Thomas Branch, Mo. (2)
1349 Petite Saline Cr., Mo. (2)
1350 Stevens Cr., Mo. (1349)
1351 Clarks Fork, Mo. (1349)
1352 Cave Cr., Mo. (1349)
1353 Wolf Cr., Mo. (1352)
1354 Big Splice Cr., Mo. (2)
1355 Little Splice Cr., Mo. (2)
1356 Factory Cr., Mo. (2)
1357 Moniteau Cr., Mo. (2)
1358 Little Moniteau Cr., Mo. (1357)
1359 String Cr., Mo. (1358)
1360 Rock Cr., Mo. (2)
1361 Meadow Cr., Mo. (2)
1362 Grays Cr., Mo. (2)
1363 Sones Cr., Mo. (2)
1364 Moreau R., Mo. (2)
1365 North Moreau Cr., Mo. (1364)
1366 Straight Fork, Mo. (1365)
1367 Burris Fork, Mo. (1365)
1368 South Moreau Cr., Mo. (1364)
1369 Rising Cr., Mo. (2)
1370 Osage R., Mo. and Kans. (2)
1371 Babruty Cr., Mo. (1370)
1372 Little Tavern Cr., Mo. (1370)
1373 Jim Henry Cr., Mo. (1370)

1374 Saline Cr., Mo. (1370)
 1375 Little Saline Cr., Mo. (1374)
 1376 Gum Cr., Mo. (1370)
 1377 Little Buffalo Cr., Mo. (1370)
 1378 Buffalo Cr., Mo. (1370)
 1379 Cole Camp Cr., Mo. (1370)
 1380 Grand R., Mo. (1370)
 1381 Tebo Cr., Mo. (1380)
 1382 Big Cr., Mo. (1380)
 1383 South Cr., Mo. (1380)
 1384 Mormon Cr., Mo. (1380)
 1385 Deepwater Cr., Mo. (1380)
 1386 Gallinipper Cr., Mo. (1370)
 1387 Little Monegaw Cr., Mo. (1370)
 1388 Big Monegaw Cr., Mo. (1370)
 1389 Miami Cr., Mo. (1370)
 1390 Mulberry Cr., Mo. (1370)
 1391 Sugar Cr., Kans. (1370)
 1392 Middle Cr., Kans. (1370)
 1393 Big Sugar Cr., Kans. (1370)
 1394 Little Sugar Cr., Mo. (1393)
 1395 Mine Cr., Mo. and Kans. (1370)
 1396 Little Osage R., Mo. and Kans. (1370)
 1397 Muddy Cr., Mo. (1396)
 1398 Hogles Cr., Mo. (1396)
 1399 Pryors Cr., Mo. (1396)
 1400 Marmaton R., Mo. and Kans. (1396)
 1401 South Fork of Marmaton R., Kans. (1400)
 1402 Dry Wood Cr., Mo. and Kans. (1400)
 1403 West Fork of Dry Wood Cr., Mo. and Kans. (1402)

MO.

1404 Peshaw Cr., Mo. (1370)
 1405 Sac R., Mo. (1370)
 1406 Horse Cr., Mo. (1405)
 1407 Turnback Cr., Mo. (1405)
 1408 Little Sac Cr., Mo. (1405)
 1409 Bear Cr., Mo. (1405)
 1410 Brush Cr., Mo. (1405)
 1411 Pomme de Terre R., Mo. (1370)
 1412 Little Pomme de Terre R., Mo. (1411)
 1413 Turkey Cr., Mo. (1370)
 1414 Deer Cr., Mo. (1370)
 1415 Rainey Cr., Mo. (1370)
 1416 Bolinger Cr., Mo. (1370)
 1417 Niangua R., Mo. (1370)
 1418 Little Niangua R., Mo. (1417)
 1419 Linn Cr., Mo. (1370)
 1420 Grand Auglaise Cr., Mo. (1370)
 1421 Dry Auglaise Cr., Mo. (1420)
 1422 Bear Cr., Mo. (1370)
 1423 Dog Cr., Mo. (1370)
 1424 Coon Cr., Mo. (1370)
 1425 Big Tavern Cr., Mo. (1370)
 1426 Little Tavern Cr., Mo. (1425)
 1427 Sugar Cr., Mo. (1370)
 1428 Proffs Cr., Mo. (1370)
 1429 Marles Cr., Mo. (1370)
 1430 Little Marles Cr., Mo. (1429)
 1431 Loose Cr., Mo. (2)
 1432 Cedar Cr., Mo. (1431)
 1433 Deer Cr., Mo. (2)
 1434 Greasy Cr., Mo. (2)
 1435 Balleys Cr., Mo. (2)

1436 Gasconade R., Mo. (2)
 1437 Contrary Cr., Mo. (1436)
 1438 Painters Cr., Mo. (1436)
 1439 Owens Cr., Mo. (1436)
 1440 Swan Cr., Mo. (1436)
 1441 Jones Cr., Mo. (1436)
 1442 Bear Cr., Mo. (1436)
 1443 Osage Fork, Mo. (1436)
 1444 Clarks Cr., Mo. (1436)
 1445 Whetstone Cr., Mo. (1436)
 1446 Beaver Cr., Mo. (1436)
 1447 Roubidoux Cr., Mo. (1436)
 1448 Piney Cr., Mo. (1436)
 1449 Little Piney Cr., Mo. (1436)
 1450 Spring Cr., Mo. (1436)
 1451 Buck Elk Cr., Mo. (1436)
 1452 Large Nixon Cr., Mo. (1436)
 1453 Pinoak Cr., Mo. (1436)
 1454 Second Cr., Mo. (1436)
 1455 First Cr., Mo. (1436)
 1456 Coles Cr., Mo. (2)
 1457 Frene Cr., Mo. (2)
 1458 Little Berger Cr., Mo. (2)
 1459 Big Berger Cr., Mo. (2)
 1460 Boeuf Cr., Mo. (2)
 1461 St. Johns Cr., Mo. (2)
 1462 Du Bois Cr., Mo. (2)
 1463 Dunn Springs Cr., Mo. (2)
 1464 Labadie Cr., Mo. (2)
 1465 Fiddle Cr., Mo. (2)
 1466 Little Tavern Cr., Mo. (2)
 1467 Big Tavern Cr., Mo. (2)
 1468 Wild Horse Cr., Mo. (2)
 1469 Bon Homme Cr., Mo. (2)
 1470 Creve Coeur Cr., Mo. (2)
 1471 Cold Water Cr., Mo. (2)

(Page 1037.)

MISSOURI RIVER. (GG-2-a)

Milk R. is also in Canada.

(Page 1038.)

MISSOURI RIVER. (GG-2-b)

Claysville to Isbell Stn. is correct.
 Dakota R. is correct.
 Isbell Station to Rhineland Landing is correct.

(Page 1039.)

Marias R. is correct. Add reference 1028.
 Moreau R., with references 1031, 1037, is correct.
 Murrays Bend is correct.
 Owl River (Moreau R.), with references 1031, and 1037, is correct.
 Rhineland Lndg. (see Isbell Stn.), and with reference 1054, is correct.
 Rule Reach is correct.
 St. Aubert is correct.
 Vermilion is spelled with one l, as shown herewith.

(Page 1040.)

MISSOURI RIVER. (GG-2-c)

APPROPRIATIONS.—Add reference **03**, 405.

COMMERCE.—First line. Change 391,000 to 391,029.

PHYSICAL CHARACTERISTICS.—Add references **12**, 831, 832.

PROJECTS:

Add reference **03**, 405.

(Page 1041.)

Add references, **12**, 844, 847, 848.

SURVEYS.—Add references **95**, 2214, 3958.

(Page 1042.)

**MISSOURI RIVER—APPROPRIATIONS.
(GG-2-d)**

FOOTNOTE 4.—Add reference **12**, 2219.

(Page 1043.)

**MISSOURI RIVER. (EXCEPT REMOVING
SNAGS). (GG-2-e)**

ENGINEERS (Assistants).—H. E. Stevens is correct.

(Page 1044.)

PROJECTS.—Paragraph beginning "Rectification of chan." Add reference **79**, 1078.

(Page 1045.)

**MISSOURI RIVER, GENERAL IMPROVE-
MENT. (GG-2-f)**

OPERATIONS:

1905-6. 2 pile dikes, 90' long, constructed Little Blue Reach, not 90 pile dikes. Mur- rays Bend is correct.

1909-10. Tenth line from bottom of page. 6,564 l. f. concrete piles cast for dike at Bon- ton Bend.

1910-11. Revet. by contract at Randolph Bend, not Howard, 30% completed.

(Page 1046.)

1911-12. Paragraph beginning "Kansas City to mouth." Revetment in progress at Wayne City Bend, and at Liberty Bend— not completed.

PRIVATE WORK:

Second paragraph. Atchison, Topeka & Santa Fe Ry. Co. is correct.

Paragraph beginning "Floyd River." 200', not 210', dike built.

(Page 1047.)

Paragraph beginning "St. Joseph." Add reference **05**, 1689.

PROJECTS:

Third paragraph. Add reference **05**, 1689.

Sixth paragraph from top. Schulz proj., 1908, Sioux City to Kansas City. Annual main- tenance of 6' depth, \$97,500.

(Page 1048.)

ENGINEERS (Assistants). — Add L. L. Wheeler. **R.**, **87**, 2983. Omit this reference from O. B. Wheeler's reports.

**MISSOURI RIVER, MOUTH TO SIOUX
CITY. (GG-2-h)**

CONTRACTS.—Add reference **95**, 3986.

(Page 1049.)

ENGINEERS (Chief of).—Atchison report for 1881 is at **81**, 226.

ENGINEERS (In charge):

Maj. Suter. Brownville. Work abandoned, **82**, 1702. Omit 1883 reference.

Mouth to Sioux City. The 1887. reference is **87**, 2914.

Paragraph beginning "Sur. Arrow Rock, Mo." Omit 1887 references.

ENGINEERS (Assistants):

C. S. Pease. **81**, 1637 is correct, not **80**, 1637.

T. C. Bradley. Reference is **81**, 1607.

(Page 1050.)

OPERATIONS:

1881-82. The 1882 reference on the second line is **82**, 1692.

The Ft. Leavenworth reference is **82**, 1691.

The Sioux City reference is to work 2 miles, not 12, above, not below, city.

(Page 1051.)

1889-90. The reference to Kaw Bend works is **90**, 3443.

1894-95. Revetment repairs at St. Joseph, not dike repairs.

1895-96. Revetment repairs at St. Joseph, not dikes.

(Page 1052.)

PHYSICAL CHARACTERISTICS:

Paragraph beginning with "Napoleon." Add **00**, 2852.

Paragraph beginning "Water-gauge." This reference is to locations, not readings.

Paragraph beginning "Floods and ice damag- ing works." See each annual report, near beginning. See also **96**, 1869.

Paragraph beginning "Gauge readings." "Gauges" is sufficient

(Page 1053.)

PROJECTS.—Paragraph beginning "Specifications for dikes." Add reference 96, 3851.

SURVEYS:

Paragraph beginning "Bankhead constr." The 1900 reference is 00, 4992.

Paragraph beginning "Divisions: First Reach." Line beginning "Omaha Division." The 1892 reference is to 92 (atlas), 158, 161.

Paragraph beginning "Miscellaneous places." Subparagraph beginning "Bakers, Fontanelle." "Senieurs" is correct. Subparagraph beginning "Claysville." Isbell is correct.

(Page 1054.)

MISSOURI RIVER (REMOVING SNAGS, KANSAS CITY TO MOUTH). (GG-2-1)

CONTRACTS.—1886. J. D. Lawnin, not Lavoisin, is correct.

ENGINEERS (In charge).—Maj. Miller. 85, 1663 is correct.

(Page 1055.)

MISSOURI RIVER, ABOVE SIOUX CITY IOWA. (GG-2-1)

CONTRACTS.—1897. The price for brush, McNamara, Miller & Keefe, and J. C. Hayes, is per cord.

ENGINEERS (Chief of).—The 1901 and 1902 reports are 01, 453; 02, 382.

ENGINEERS (In charge):

Missouri R. Commission. The 1887 reference is 87, 2913.

Maj. J. C. Allen. 89, 1787 is correct.

Capt. C. F. Powell. 91, 2231, 2242, 2244, and 2248 is correct.

LEGAL PROCEEDINGS.—96, 1867 is correct.

OPERATIONS:

1881-82. Above Vermilion is correct.

(Page 1056.)

1885-86. Add reference 86, 2167.

PHYSICAL CHARACTERISTICS.—Paragraph beginning "Discharge measurements, Great Falls." Great Falls to Sioux City is correct.

(Page 1057.)

PROJECTS.—Paragraph beginning "Sioux City." The 1897 reference is 97, 2183.

(Page 1058.)

SURVEYS:

Paragraph beginning "Misc." The 1895 reference is 95, 2219.

Paragraph beginning "Sur. of the Missouri R." This was an ex. and sur. Add reference 92, 1875.

MISSOURI RIVER, ABOVE SIOUX CITY. IOWA. (REMOVING OBSTRUCTIONS). (GG-2-k)

OPERATIONS:

1897-98. Add reference 98, 1865.

1898-99. Add reference 99, 2229.

(Page 1060.)

JAMES RIVER, N. DAK. AND S. DAK. (GG-301-a)

ENGINEERS (In charge).—Add Capt. Chas. F. Powell. R., 93, 2321.

(Page 1061.)

YELLOWSTONE RIVER, N. DAK., MONT. AND WYO. (GG-626)

SURVEYS.—First paragraph. The 1879 reference is 79, 128 in the first line.

(Page 1062.)

KANSAS RIVER, KANS. (GG-1178)

COMMERCE.—Omit "unimportant" from the first paragraph.

(Page 1063.)

OSAGE RIVER, MO. (GG-1457)

ESTIMATES.—The Simpson estimate, 1875, is \$3,000,000.

(Page 1066.)

GASCONADE RIVER, MO. (GG-1517)

SURVEYS.—Reference to the Quinn ex. is 08, 550.

HH.—MISSISSIPPI RIVER.

(Page 1070.)

ABSTRACT LIST.

Change abstract numbers HH-306, and HH-319, a to e, respectively, to read HH-319, and HH-332, a to e, respectively.

(Page 1071.)

Apple R. Omit page reference 1102.
Apple Cr. Add this name, and reference 1102.
Batsons Cut. Spell as shown herewith.
Beaver Dam Rock. Not "Beaver Dam."
Big Muddy R. Page 1116, not 1115, is correct.
Bissells Pt. to Calico Isld. is correct.
Bolivar. Correct spelling is shown herewith.

(Page 1072.)

Brooks Break. Page references are 1139, 1149.
Cairo to Keokuk. Page reference is 1143, not 1142.
Cairo to St. Louis. Add page reference 1185.
Caruthersville. Correct spelling is shown herewith.
Cashes Isld. Correct name shown herewith.
Cassville. Add page reference 1105.
Cincinnati. Omit, and add page reference to "Cincinnati Landing."
Curtis Pt. Add page reference 1193.
Dakota. Only page reference 1122 refers to the State of Dakota, the others referring to Dakota, Minn.

(Page 1073.)

Des Moines to Illinois R. Add page reference 1090.
Dubuque to Prairie du Chien. Page reference is 1126.
Fox Isld. Page reference is 1193, not 1195.
Fox R. Page references are 1105 and 1195.

(Page 1074.)

Glasscox. Not Glasscock.
Grand Cairo to Passes. Change to "Grand Prairie to Passes."
Grand Rapids to Bratnerd. Reference 1125 should be 1225.
Hannibal to Lagrange. Page 1196 is correct, not 1169.

(Page 1075.)

Illinois R. to Missouri R. Add reference 1090.
Island 65. 1193. Add.
Keokuk to Cairo. Reference 1143, not 1142, is correct.
La Grange to Hannibal. Page 1196, not 1169, is correct.
Lake Borgne. Omit page 1086.
La Salle. Page 1115 is correct, not 1151.

(Page 1076.)

Lockport, Ill., to St. Louis. Add page 1090.
Matthews Bend. Correct spelling shown herewith.
Minneapolis (St. Anthonys Falls). Page 1070, not 1069, is correct.
Minnehaha Cr. Page 1195, not 1194, is correct.
Mississippi, lower. Add pages 1116 and 1145.
Mississippi, upper. Add pages 1120 and 1122.
Missouri, lower. Omit page 1145.
Missouri R. to Ohio R. Add page 1171.

(Page 1077.)

Nininger Slough. Spelling as shown herewith.
Northeast Pass. Page 1097, not 1027.
North Pass. Page 1097, not 1027.
Octave Pass. Page 1097, not 1027.
Oder, The. Not "The Ode."
Ohio R. to Dickeys Isld. Page 1176 is correct.
Opossum Fork is correct.
Oquawka to Dallas City. Add page 1189.
Passes to Grand Prairie, not to "Grand Cairo."
Peruque Isld. is correct, not "Perugue."

(Page 1078.)

Platin, not Plantin, is correct.
Port Allen, not Port Allerton, is correct.
Pontchartrain. Omit page 1086.
Pontoosuc. Spelling is as shown herewith.
Puckett, not Puckert, Isld.
Red R. Omit pages 1186 and 1105.
Reds Landing. Page 1105. Add.
Reads Landing. Omit page 1105.
Reads Landing to Minnellska. Add page 1191.
Reelfoot Crossing. Omit page 1165.
Reelfoot Levee. Add page 1165.
Rhone, The. Add page 1132.
Rock R. Add page 1105.

Rum R. Add page 1122.
St. Cloud. Add page 1225.
St. Francis Levees. Add page 1087.
St. Francis R. to New Madrid. Page 1086 is correct.
St. Louis. Page 1069, not 1109, is correct.
St. Louis to Cairo, Ill. Add page 1185.

(Page 1079.)

St. Paul to Cassville. Page 1192 is correct.
St. Paul to Illinois R. Add page 1171.
Sandusky. Add page 1204.
Sandy Lake Dam. Page 1121, not 1120, is correct.
Smiths Isld. Page 1192, not 1182.
Steele Bayou, not Steale.
Sterling, not Stirling.
Stop Landing. Page 1165 is correct.
Teepeeota Pt. Page 1209, not 1206.
Tensas Basin. Add page 1147.
Tensas, upper. Add page 1147.

(Page 1080.)

Waupeton. Add pages 1208, 1209.
Whipple Co. Bar, is correct.
Whisky Chute is correct spelling.
Yellow R., The. Add page 1142.

(Page 1081.)

BOARDS:

Worrall, James. Not "Worrall."
Raynolds, Lt. Col. Not "Reynolds."
Weitzel, Maj. Not "Weitzell."

(Page 1082.)

Lt. Col. G. McC. Derby is correct.
Berh. Add pages 1260, 1261.

MISSISSIPPI RIVER COMMISSION:

Omit page 1141.
Comstock, Col. President, 1882-84 (add).
Gillespie, Col. G. L., is correct.
Gillmore, Col. President also from 1879-1882.
Rossell, Col. Member, 1906-1912.
West, Chas. H. Omit year 1916.

ENGINEERS IN CHARGE OF DISTRICTS:

Allen, Maj. C. From 1879-1896.
Farquhar, Maj. F. U., is correct.
Hodges, Lt. J. N. Page 1218, not 1208.

(Page 1083.)

Knight, Capt. J. G. D., is correct.
Mackenzie, Maj. A. Omit page 1211.
Macomb, Col. J. N. Add page 1211.
Shunk, Maj. Omit pages 1188, 1197.
Stickney, Maj. A. In charge from 1878-1881.
Townsend, Capt. In charge from 1892-1904.

ASSISTANTS:

Coppee, H. St. L. Add year 1881.
Davenport, R. Page 1224, not 1242.
Durham, C. W., is correct, not "C." only.
 Page 1186, not 1182.

(Page 1084.)

Gender, G. W., Not "Gender."
Gillespie, J. L. Add years 1880-1885.
Jenne, D. C. Not "Jeune."
Long, H. C. Not "N. C." Period from 1868-1871
Meigs, M. Page 1186, not 1182, is correct.
Richards, A. L. Period is from 1899-1905.
Shield, E. M. Not "Shields."
Skinner, J. D. Page 1124, not 1123.
Stephens, A. E. Right spelling is "Stevens."
Suter, Capt. C. R. Omit page 1161.
Terry, F. Not "J."
True, C. S. Page 1173, not 1172.

(Page 1085.)

Wiley, O. S. Not "O. L."

PHYSICAL CHARACTERISTICS. — Third paragraph, second column. Reference is 12, 3715.

(Page 1086.)

PROJECTS.—Third paragraph. "The lower part of the river, from Head of Passes to Cairo, and levees on right bank to Cape Girardeau, Mo.," is correct.

(Page 1090.)

APPROPRIATIONS:

Table 37. Total is \$9,730,000.01.
Table 38. Total is \$26,093.40.
Table 42. Period is 1870-1890.
Table 44. Total is \$405,812.03.
 Total, 42-44, is \$2,933,067.03.
 Grand total is \$148,992,955.71.

(Page 1093.)

Table 21. 1906 item. Reference is 06, 2487.

(Page 1095.)

Footnote 7. Part of an app. of \$160,000 is correct.

(Page 1096.)

Table 44. 1907 item. \$18,423.65 is correct.
 Total is \$405,812.03.

(Page 1097.)

No. 27. Port Allen, not Allerton.

(Page 1100.)

MAP (THIRD MISSISSIPPI RIVER DISTRICT).

Milliken, not Miliken, is correct.

(Page 1102.)

- No. 168. Ames Towhead, not Island.
- No. 172. Calico Island, Ill., is correct.
- No. 173. Platin Rock is correct.
- No. 183. Carolis Island is correct spelling.

(Page 1105.)

No. 304. Trempealeau is correct spelling.

(Page 1106.)

MAP (ST. LOUIS, MO., DISTRICT).

Lower corner. Birds Point, not Bird, is correct.

(Page 1108.)

MAP (ROCK ISLAND, ILL., DISTRICT).

Upper corner. Wacouta is on opposite side of river from that shown.

(Page 1109.)

MAP (ST. PAUL, MINN., DISTRICT).

Mark in Fort Snelling, opposite St. Paul, at mouth of Minnesota R., left bank.

(Page 1116.)

OPERATIONS:

- 1890-91. 3,389 snags pulled and 20,571 trees cut.
- 1892-93. 2,946 snags pulled, 8,214 trees cut, 16 drift piles removed.
- 1893-94. 3,057 snags pulled, 22,861 trees cut, 19 drift piles, and 5 wrecks removed.
- 1894-95. 3,307 snags pulled, 17,520 trees cut, 22 drift piles, and 3 wrecks removed.
- 1895-96. 2,979 snags pulled, 19,648 trees cut, 11 drift piles removed, etc.
- 1896-97. 3,072 snags pulled, 31,014 trees cut, 24 drift piles, and 2 wrecks removed.
- 1897-98. 4,253 snags pulled, 14,856 trees cut, 32 drift piles, and 3 wrecks removed.
- 1898-99. 3,300 snags pulled, 30,695 trees cut, boats repaired, and 34 drift piles removed.
- 1899-00. 4,479 snags pulled, 22,630 trees cut, boats repaired, and 19 drift piles removed.

- 1900-01. Piles removed were drift piles.
- 1901-02. Piles removed were drift piles.
- 1902-03. Piles removed were drift piles.

(Page 1117.)

MISSISSIPPI RIVER, LOWER. OBSTRUCTIONS. (HH-1-j)

OPERATIONS:

- 1910-11. Add reference 1898.
- NOTE TO OPERATIONS.—Reference 11, 1753 should be 10, 1753.

PRIVATE WORK.—Big Muddy R. is correct.

SURVEYS.—Reference 07, 1612 should be 08, 1612.

(Page 1118.)

MISSISSIPPI RIVER GAUGES. (HH-1-k)

PHYSICAL CHARACTERISTICS:

- Meter readings should be "meter ratings."
- Low-water readings. The 1912 reference is to page 3758.

(Page 1119.)

MISSISSIPPI RIVER. GAUGING NEAR ST. PAUL. (HH-1-l)

OPERATIONS.—1902-03. Gauges reestablished.

MISSISSIPPI RIVER. RESERVOIRS. (HH-1-m)

BOARDS.—Fourth paragraph begins with the second line of the third paragraph.

(Page 1120.)

ENGINEERS (In charge).—Capt. Chittenden. Omit page reference 2343.

(Page 1126.)

MISSISSIPPI RIVER. HEADWATERS, RESERVOIRS. OPERATION, ETC. (HH-1-n)

PHYSICAL CHARACTERISTICS. — Second paragraph, second column. Reference is 06, 1456.

(Page 1138.)

MISSISSIPPI RIVER—CAIRO TO MOUTH. (HH-15-a)

COMMERCE:

First paragraph. 79, 1019, not 1819.

(Page 1139.)

Receipts and shipments at principal ports.
Add the following references: **04**, S., 60;
05, S., 71; **06**, 2514; **07**, 2661; **08**, 2695; **09**,
2699; **10**, 2974; **11**, 3228; **12**, 3768.

CONTRACTS:

1888. Andrews Bros., Whisky Chute, 28 $\frac{1}{2}$ ¢
c. y.
1889. Arnold & McDonell. Alabama Dredg-
ing & Jetty Co., dr., 12¢ c. y. T. Sullivan,
levees, Skipwith.
1891. E. Evins, brush, \$1.17 $\frac{1}{2}$ ¢; poles, \$1.97 $\frac{1}{2}$ ¢.
T. A. Helgason, levees, 14.45¢ c. y.
1892-93. Prices ranged from 10¢ upward (in
first paragraph); add page 3858.

(Page 1140.)

1894-95. Second paragraph. Contracts were
for poles, rather than for piles.
1897-98. Price of towboat, last line of column,
\$27,750.
1898-99. Prices ranged from 8.74¢.

(Page 1141.)

ENGINEERS (Chief of).—New Orleans H., La.
1879 report is **79**, 106.

(Page 1142.)

MISSISSIPPI RIVER COMMISSION:

Reports for 1885, **85**, 2535, 2573.
Col. Rossell, member from 1906-1912.
R. S. Taylor, from 1881.

(Page 1143.)

ENGINEERS IN CHARGE.—Capt. Rossell.
Vicksburg H., **91**, 3663 is correct. Bend sur-
of 3d dist., **90**, 3288.

SECRETARY'S OFFICE, M. R. C.—Capt.
M. M. Patrick, 1898-1901.

(Page 1144.)

FIRST AND SECOND DISTRICTS:

Capt. S. S. Leach. Omit **85**, 2955. Add **85**,
2955; **90**, 3196, 3211.
Capt. S. W. Roessler. Omit **91**, 3586.

THIRD DISTRICT.—Capt. C. B. Sears. The
1886 report is **86**, 2162.

ASSISTANTS:

G. Burney. The 1881 report is **81**, 1382.

(Page 1145.)

T. G. Dabney is correct.
ASSISTANTS, SECRETARY'S OFFICE, M.
R. C.:
O. W. Ferguson. **85**, 2650 is correct.
W. Gerig. Report for 1905 is **05**, S., 128.

(Page 1146.)

B. B. Gordon. Osceola Bar, not Ocoola.

(Page 1147.)

A. Hider. Plant repairs, **99**, 3544 is correct.
Revetment work, **99**, 3544 is correct. Surs.,
etc., **99**, 3544 is correct.
G. C. Thomas. Discharge observations, **93**,
3674 is correct.
H. S. Douglas. Revetment work, **03**, S., 300.
W. Garvin. New Orleans H., **96**, 3717 is
correct.

(Page 1148.)

ASSISTANTS:

B. J. Oliverla. **91**, 3540 is correct.
A. F. Wooley, jr. **00**, 4919 is correct.
W. E. Knobloch is correct spelling.

(Page 1149.)

OPERATIONS:

1884. In second line, **85**, 2751, not 2752, is
correct.
1888-89. Line beginning "at Baleshed." Ref-
erence **89**, 2700 is correct. Line beginning
"Chute."—Sterling, not Stirling, is correct.
Third line from bottom. **89**, 2737 is correct.

(Page 1150.)

1890-91. Line beginning "of Helena," **91**,
3592 is preferred reference. Line beginning
"Constr. II.," **91**, 3671 is preferred ref-
erence.

1891-92. Line beginning "Lake Providence,"
Substitute "extended" for "extending."
Line beginning "and 783," total yardage,
435,550.

1892-93. Line beginning "Revet. at Green-
ville H.," 5,835 linear feet added.

(Page 1151.)

1894-95. Second district. Line beginning
"protected by." **95**, 3619 is reference pre-
ferred.

1895-96. Levees. Line beginning "and 36,615."
35,615 in the foregoing is correct.

(Page 1152.)

1900-01. First district. Reference **01**, S., 10
is preferred. Second district.—54,636 c. y.
dr. from Wolf R. Third district.—Reference
01, S., 13 is preferred. Fourth district.—
Add the following: "Dr. Red R., **01**, S., 356."

(Page 1153.)

- 1902-03. Third district. Line beginning "Providence revet." Add reference **03**, S., 14.
1903-04. Line beginning "wall, lower."—Reference preferred is **04**, S., 203. Levees.—5,564,169 c. y. built by U. S., and 8,607,388 c. y. by local board. Reference preferred is **04**, S., 141, 274.
1904-05. First district.—Reference **05**, S., 11 to be added. Levees.—Add reference **05**, S., 20.
1905-06. First paragraph.—Add references **06**, 2525, 2544. Third district, second line.—"Downstream," not "upstream."

(Page 1154.)

- 1907-08. Second district. Add reference **08**, 2719.
1908-09. Second district.—Add reference **09**, 2737. Levees.—Add reference **09**, 2659.
1909-10. First district. Add reference **10**, 2923.

(Page 1155.)

- 1911-12. Third district. Second line.—"downstream" instead of "upstream." Fourth district. Line beginning "I. f. revet."—Add after "paved" the words "at Plaquemine."
PHYSICAL CHARACTERISTICS:
Beds. First line. **82**, 2758 correct reference. Last line of paragraph.—Geology of **78**, 855 is correct.
Crevasse. Add reference **91**, 3463 to line No. 7, and **91**, 3465.
Delta. Reference **78**, 854, not **79**, 854, is correct.

(Page 1156.)

- Discharge. Arkansas City and Wilsons Pt. Add reference **90**, 3277.
Discharge observations. Add reference **91**, 3428, 3429.
Floods. Third line from top of second column. Add reference **85**, 2628.
Gauges. Highest and lowest readings. Add **07**, 2664; **10**, 3001; **11**, 3231.

(Page 1157.)

- Outlets. Add reference **81**, 2728.

(Page 1158.)

- Shoal. Add reference **88**, 2251.
Slopes (scour found). Reference is **93**, 3557.
Stages. Cairo to Head of Passes, **93**, 3662.
Stone. Add reference **07**, 2706.
Water surface. Add reference **95**, 3748.

PRIVATE WORK.—1891-92. Third line. About 213,484 c. y. used by local and State levee authorities, not merely 83,484 c. y. Add reference **92**, 2896.

(Page 1160.)

PROJECTS:

General—Dike experiments. **00**, 4557, not 3557, is correct. Plant, cost of. Third district.—Add reference **05**, S., 224. Fourth district.—Add reference **04**, S., 286, and **05**, S., 285.

(Page 1161.)

SURVEYS:

Precise levels. Add reference **92**, 2946.
Resurveys (bench marks). **95**, 3748 is correct.
Minor (third district). Add reference **12**, 3905. (First and second districts.) Add reference **08**, 2744.

(Page 1162.)

MAPS:

Crevasse sections. **93**, 3920, not 3970, is correct.
Paragraph beginning "Topographical instrument constr." Reference **96**, 3573 is correct.
Banks (caving). Reference **05**, S., 196 is correct.
Cross sections (scour and fill). Reference **01**, S., 232 is correct.

(Page 1163.)

Abattis dikes. Reference **05**, S., 196 is correct.
Districts (third). Reference **04**, S., 244 is correct. Add **01**, S., 310.
Floods (third district). Reference **94**, 2970 is correct, not 2870.
Hydrographs—
Carrollton and South Pass. **94**, 2858 is correct reference.
Cairo to Carrollton. **01**, S., 232.
Anderson Crossing. Add reference **05**, 150.
Arkansas City. Add reference **89**, 2596.
Cherokee Crossing. Reference **01**, S., 232 is correct.
Corona Crossing. Add reference **05**, S., 150.

(Page 1164.)

Fleeces Crossing. **01**, S., 232 is correct.
Foot of Island 30. **01**, S., 232 is correct.
Graves Bayou Crossing. **03**, S., 68 is correct.
Hopedfield Bend and Memphis H. **91**, 3594 is correct.
Hathaways Crossings. **02**, S., 90 and **03**, S., 68 are correct.

Hickman Crossing. **01**, S., 232 is correct.
 Island 21. **03**, S., 68 and **05**, S., 150 are correct.
 Island 20. **03**, S., 68 is correct.
 Joe Eckles Crossing. **01**, S., 232 and **05**, S., 150 are correct.
 Last Chance Crossing. **03**, S., 68 is correct.
 Lower Pt. Pleasant Crossing. **05**, S., 150 is correct.
 Luxora Crossing. **01**, S., 232 is correct.
 Memphis. **91**, 3594 is correct. Add **01**, S., 266.
 Montezuma Crossing. **05**, S., 150 is correct.
 New Orleans. **89**, 2740 and **95**, 3956 are correct.
 New Madrid. **99**, 3512 is correct.
 O'Donnells Crossing. **01**, S., 232 is correct.
 Old Town, Ark. **09**, 2754 is correct.
 Presidents Isld. Crossing. **05**, S., 150 is correct.
 Peters Crossing. **05**, S., 150 is correct.
 Peters Lower or Ashley Pt. Crossing. **03**, S., 68 is correct.
 Peters Upper Crossing. **03**, S., 68 is correct.
 Pt. Pleasant Crossing. **01**, S., 232 is correct.
 Polks Crossing. **05**, S., 150 is correct.
 Presidents Isld. Bar. **01**, S., 232 is correct.
 Random Shot or Pecan Pt. Crossing. **05**, S., 150 is correct.
 Reelfoot Crossing. **05**, S., 150 is correct.
 Tyler Crossing. **01**, S., 232 is correct.

Levees—
 Crevasses, closing. **97**, 3836 is correct.
 First and second districts. Add **01**, S., 266.

(Page 1165.)

Paragraph beginning "Pontchartrain." Second to last line. **09**, 2728, 2786, is correct.
 Second district. Omit last page reference, i. e., 248.
 Tensas (lower) and Homochitto levee districts. Omit **03**, 264 and **10**, 3026.
 Tensas (upper). Omit **05**, S., 196.

Revetments—
 Lake Providence. Annual report for 1890 should be **00**, 4830, etc.

Surveys. "New Bedford Bend" should be "New Madrid Bend." Right reference is **01**, S., 232.

Velocity observations. Change "Louisiana Bend" to "Lake Providence Bend."

(Page 1170.)

MEMPHIS, TENN. (HH-96)
ENGINEERS (In charge).—Capt. Roessler. **91**, 3586 is preferred.

(Page 1171.)

CAIRO TO FALLS OF ST. ANTHONY, ETC. (HH-127-a)
 Note under title.—Meramac is correct spelling, not "Maramec."

(Page 1173.)

ESTIMATES.—Eighth paragraph, second column. "Opposite Cairo, \$325,500" is correct.

(Page 1174.)

OPERATIONS.—Between Illinois and Ohio Rs. 1874-75. Reference **75**, 65, 479 is preferred.

PHYSICAL CHARACTERISTICS.—Description of river about Alton, **72**, 361.

(Page 1175.)

PROJECTS.—Line beginning "to 10' above l. w." Omit reference **75**, 447.

(Page 1177.)

SURVEYS.—Line beginning "Missouri to Ohio." Add reference **75**, 480.

OHIO RIVER TO ILLINOIS RIVER (MISSISSIPPI RIVER). (HH-127-b)

CONTRACTS:

1888. J. J. Hawk, wire, 3.2¢ lb., **88**, 1428.
 1891. H. S. Brown, extension dam, not "extensive."

ENGINEERS (In charge).—Miss. R. Com. Add reference **85**, 2538.

(Page 1178.)

ENGINEERS (Assistants):

A. F. Freis. Not "Fries."
 W. S. Mitchell. Add references **89**, 1682; **91**, 2095; **93**, 2166.
 J. O. Holman. Add reference **92**, 1720-22.
 C. D. Lamb. Omit reference **83**, 1232. Add references **91**, 2094-96; **92**, 1723; and **93**, 2165, 2167.
 S. S. Van Norman. Add **88**, 1434.

OPERATIONS:

1880-81. Omit reference to plate 17, page 1598.

(Page 1179.)

1884-85. Line beginning "R., **85**, 2856." **85**, 2939 preferred to **85**, 2940. Last line of paragraph. **85**, 2856 preferred to **85**, 2857.

(Page 1180.)

PROJECTS:

Paragraph beginning "Dam completed to." **75**, 477 is correct or preferred reference.
 Paragraph beginning "At Cape Girardeau." Reference **81**, 1533 is correct.

MAPS:

At Alton H. Add reference 92, 1714.
Add, From Carrolls Isld. to Foster Isld., 87,
1650.

(Page 1181.)

OHIO RIVER TO MISSOURI RIVER.
(HH-127-c)

CONTRACTS:

1899. Reference to R. C. Arnold is 99, 2068.
1910. Reference includes page 1921.

(Page 1182.)

ENGINEERS (Assistants).—J. O. Holman.
In second line, contraction works, not “pro-
tective,” is correct.

(Page 1183.)

OPERATIONS:

1897-98. Line beginning “year at.” Chester,
Ill., not Chesley Isld., is correct.
1898-99. Reference includes up to page 2063.
1899-00. The 1900 reference includes up to
page 2637.
1900-01. Line beginning “falo Isld.” Liberty,
Mo., not Ill., is correct.
1902-03. Line beginning “and raised to.”
24' to 28', not 26' to 30', is correct.
1904-05. Third line. Hurricane Field, not
Bend, is correct.

(Page 1184.)

1907-08. Second line. Substitute “Eliza
Towhead” for “Osborne Field.”

1910-11. Line beginning “Ft. Chartres.”
Add “restoration and extension of bank
protection at Liberty, Mo.” Line beginning
“way Board made.” Reference 11, 1904-10
preferred.

1911-12. Last line of column. Omit “Ill.”
Second line, second column. Add reference
12, 2114-19. Third line, second column.
Add reference 12, 2121. Last line of para-
graph. Reference 12, 2122-23, 2127, pre-
ferred.

PHYSICAL CHARACTERISTICS.—Fourth
paragraph from bottom of column. Omit ref-
erence 00, 2637.

(Page 1188.)

**ST. LOUIS HARBOR, MISSISSIPPI
RIVER. (HH-188)**

OPERATIONS:

1872-75. Add reference 74, 60.
1891-92. Reference 92, 1838 is correct.

(Page 1202.)

**DES MOINES RAPIDS, MISSISSIPPI
RIVER. (HH-222-a)**

CONTRACTS.—1888. W. J. Broatch is correct,
not Bwatch.

ENGINEERS (Assistants).—J. P. Frizell is
correct.

(Page 1212.)

**ROCK ISLAND RAPIDS, MISSISSIPPI
RIVER. (HH-245)**

ENGINEERS (Boards).—Recom., 1866, not
1886.

ENGINEERS (Assistants):

C. H. Beuck is correct.
C. W. Purham is correct.

(Page 1213.)

PROJECTS.—Last paragraph. Amount app.
to 1881, not 1866, is correct.

(Page 1220.)

**MINNEAPOLIS TO ST. PAUL, MINN
(HH-332-d)**

ENGINEERS (In charge).—Capt. Schulz refer-
ence is 08, 529.

(Page 1223.)

**FALLS OF ST. ANTHONY. (ABOVE.)
(HH-335-b)**

ENGINEERS (Assistants).—A. E. Stevens is
correct.

(Page 1225.)

**BRainerd TO GRAND RAPIDS, MINN.
(HH-344-a)**

COMMERCE.—Second paragraph. 12, 820 is
preferred reference.

II.—ST. LOUIS, MO., DISTRICT.

(Page 1228.)

(Page 1229.)

KIMMSWICK.

Erroneously spelled "Ximmswick" on map.

KASKASKIA RIVER, ILL. (II-4)
SURVEYS.—Estimate of 1838 was for 1
ment.

BIRDS POINT.

Erroneously spelled "Bird Point" on map.

JJ.—ROCK ISLAND, ILL., DISTRICT.

(Page 1233.)

MAPS.

Wacouta, Minn., should be indicated as on the
same side of the river as Red Wing, and below
the latter.

KK.—ST. PAUL, MINN., DISTRICT.

(Page 1246.)

(Page 1253.)

MAP.

Ft. Snelling. Insert opposite St. Paul.

**ST. CROIX LAKE AND RIVER,
AND WIS. (KK-47)**
SURVEYS.—Ex. of canal connectin
Superior and Mississippi R., via St. C
authorized by act Mar. 3, 1909.

(Page 1247.)

WATERWAY LIST.

St. Croix Lake and River, Wis. (KK-47.) Is
also in Minn.

(Page 1255.)

**MINNESOTA RIVER, MINN. (KK-
PROJECTS.**—Third paragraph from
The \$2,500 was app. 1902, not 1903, for
of dam near mouth.

(Page 1248.)

Minnesota R., Minn. (KK-137-166.) The water-
ways which follow this stream, after KK-166,
are in the JJ geographical district. See page
1234, beginning with Vermilion R., Minn., or
JJ-25.

(Page 1256.)

**BIG STONE LAKE, AND LAKE TRAV
MINN. AND S. DAK. (KK-153-4)**
Reference is to KK-170, under title, page

(Page 1257.)

RED RIVER OF THE NORTH, MINN. AND DAK. (KK-170-a)

OPERATIONS.—1902-03. 134 obstructions, not snags, removed.

(Page 1261.)

WARROAD HARBOR AND RIVER, MINN. (KK-211)

Footnote No. 2 should be H. D. 92, 56th, 2d

LL.—DULUTH, MINN., DISTRICT.

(Page 1264.)

MAP.

McCargoe's Cove is correct. (Isle Royal.)
Isle Royal is correct.
Siskiwit Bay is correct. (Isle Royal.)
Siskiwit, not Siskiwik, River, is correct (east of Port Wing).

(Page 1265.)

WATERWAY LIST.

Waus-wau-goning (LL-4) is correct.

WAUS-WAU-GONING BAY, MINN. (LL-5)

Spelling as shown herewith is correct.

(Page 1266.)

GRAND MARAIS HARBOR, MINN. (LL-9)

COMMERCE.—The 1898 reference in the second paragraph is 98, 2217.

PHYSICAL CHARACTERISTICS.—Harbor situated 106, not 110, m. ne. from Duluth.

PROJECTS:

Third paragraph. Cost of the Quinn project, \$165,475.

Fourth paragraph. The Farquhar project was modified, not "substituted."

(Page 1267.)

**GRAND MARAIS, MICH. (LL-9-b)
(SHOULD BE LL-58)**

Should follow Munising Harbor, Mich., of page 1293.

ENGINEERS (In charge).—Maj. Lockwood reference is 01, 513.

(Page 1268.)

SURVEYS.—The 1903 reference to minor surveys is 03, 1825.

(Page 1270.)

AGATE BAY HARBOR, MINN. (LL-14)

OPERATIONS.—1886-87. Preparations were for breakwater construction.

Insert the following—

TWO HARBORS, MINN. (LL-15)

The same as Agate Bay (LL-16).

(Page 1271.)

DULUTH-SUPERIOR HARBOR, MINN. AND WIS. (LL-18)

SUMMARY.—The total includes \$19,467.69 miscellaneous receipts.

(Page 1272.)

SURVEYS.—First paragraph. Omit the 1867 reference.

(Page 1273.)

DULUTH HARBOR, MINN. (LL-18-b)

PROJECTS:

Fifth paragraph. Add reference 81, 2027.

Seventh paragraph. Quinn estimate increased total project cost to \$332,540.

(Page 1275.)

SUPERIOR BAY AND ST. LOUIS BAY, WIS. (LL-18-d)

PROJECTS.—First paragraph. Add reference 82, 2104.

MINNESOTA POINT, SUPERIOR BAY, MINN. (LL-18-e)

OPERATIONS.—Add reference 91, 313.

PROJECTS.—Second paragraph. Add reference 91, 313.

(Page 1276.)

(Page 1282.)

ALLOUEZ BAY, WIS. (LL-18-f)

See also LL-23-b, on page 1281.

(Page 1278.)

DULUTH-SUPERIOR HARBOR, MINN. AND WIS. (LL-18-g)**OPERATIONS:**1904-05. The reference to lighting of piers, etc., is **05**, 1974.

1910-11. The last 1911 reference is to page 2260.

1911-12. North breakwater head—11,547, not 11,549, tons riprap placed.

(Page 1279.)

PRIVATE WORK.—Fourth paragraph. The 1910 reference is to page 2054, not 2055.**SURVEYS.**—Seventh paragraph. The 1907 reference is to **07**, 603.

(Page 1281.)

PORT WING HARBOR, WIS. (LL-26)**COMMERCE.**—Third paragraph. Add reference **08**, 1915.**COENUCOPIA HARBOR, WIS. (LL-28-b)**

This is the same as Siskiwit Bay.

(Page 1290.)

KEWEENAW WATERWAY, MICH.**(LL-41-a)****SURVEYS.**—Maps. The 1903 reference is 1816

(Page 1293.)

MARQUETTE HARBOR, MICH. (LL-54)**SURVEYS.**—Maps. Plans, 1904, and 1910 references. Omit reference **11**, 2293.**PRESQUE ISLE POINT, MARQUETTE BAY, MICH. (LL-54-b)**

Insert as LL-52, on page 1291.

ENGINEERS (In charge).—Gaillard reference for 1902 is **02**, 2039.**MM.—MILWAUKEE, WIS., DISTRICT.**

(Page 1318.)

STURGEON BAY CANAL, WIS. (PART b, MM-24)**LEGISLATION.**—The first word in the second line should be "land."**NN.—CHICAGO, ILL., DISTRICT.**

(Page 1349.)

(Page 1350.)

ILLINOIS RIVER, ILL. (NN-1)**SUMMARY:**

Part D total should be \$278,356.26.

Grand total should be \$2,740,006.26.

ILLINOIS RIVER, ILL. (NN-1-a)**ENGINEERS** (Assistants).—Brainard references for 1902 and 1903 are **02**, 2116, and **03**, 1917.

LEGAL PROCEEDINGS.—Third paragraph.
Reference to subject of closing Spring Lake,
10, 2166.

(Page 1351.)

OBSTRUCTIONS.—Last paragraph. 12, 1022
is correct.

OPERATIONS:

1875-76. 76, 83 is correct, not 84.
1903-04. 04, 2951 is correct.

(Page 1353.)

SURVEYS.—Last paragraph (above Maps).
12, 1022 is correct.

(Page 1354.)

**ILLINOIS RIVER, ILL., LOCKS AND
DAMS. (NN-1-d)**

APPROPRIATIONS:

1901 item is \$10,654.97; omit reference to 1912
report.

1904 item is \$10,477.04; omit reference to 1912
report.

(Page 1355.)

Total is \$278,356.26.

ENGINEERS (In charge).—Maj. Keller refer-
ence is 10, 2167.

PRIVATE WORK.—Lowering of dam at La
Grange not completed; work abandoned.

(Page 1356.)

CHICAGO HARBOR, ILL. (NN-14)

Footnote No. 3.—Add reference 95, 2695.

(Page 1358.)

OPERATIONS.—1911-12. Reference 12, 2537
is correct.

PHYSICAL CHARACTERISTICS.—Fourth
paragraph. Chan. shoaled to 19'.

(Page 1359.)

SURVEYS.—The 1912 reference to Cong. docu-
ments is 12, 1007.

(Page 1361.)

CHICAGO RIVER, ILL. (NN-15)

PRIVATE WORK.—Fourth paragraph from
bottom. 52,000 c. y. is correct, not c. f.

SURVEYS.—The 1912 reference to Cong. docs.
is 12, 1007

(Page 1363.)

CALUMET HARBOR, ILL. (NN-17)

OPERATIONS.—1906-07. All project work
completed, 07, 623. (Omit this from 1905-06.)

(Page 1364.)

SURVEYS.—1912 reference to Cong. docs. is
12, 1024.

CALUMET RIVER, ILL. AND IND. (NN-18)

ENGINEERS (Chief of).—1912 reference is 12,
1013, 1024.

(Page 1365.)

PHYSICAL CHARACTERISTICS. — Last
paragraph. Fourth line up. Little Calumet,
not Lake Calumet, is correct.

PROJECTS.—Third line from bottom of column.
Make 1902 reference 02, 2107, 2108.

(Page 1366.)

SURVEYS.—Last paragraph. Reference to
Cong. docs., etc., is 12, 1014; 13, 1127.

(Page 1369.)

MICHIGAN CITY HARBOR, IND. (NN-23)

CONTRACTS.—1911. 1912 reference is 12, 2553.

ENGINEERS (In charge).—Maj. Rees's report
takes reference 09, 1999.

ENGINEERS (Assistants).—Capt. Heap's 1870
report has page reference 107, not 17.

(Page 1370.)

OPERATIONS:

1900-01. Reference is to 01, 3074.

1902-03. Reference is to 03, 1932.

(Page 1371.)

PROJECTS.—Third paragraph from end (be-
ginning "Aug. 15, 1908"). Add reference 08,
2000.

(Page 1372.)

**LAKE MICHIGAN TO WABASH RIVER,
IND. AND OHIO. (NN-24)**

PLANS.—Last paragraph, third line from bot-
tom. 1,062 y. l. is correct, not 2,062

OO.—GRAND RAPIDS, MICH., DISTRICT.

(Page 1376.)

MAP.

The three "tails" to White Pigeon R. and to St. Joseph R., shown as in Ohio, should be cut off. The St. Joseph rises above the Ohio line, and White Pigeon R. rises near the corner of Indiana.

(Page 1377.)

WATERWAY LIST.

White Pigeon R. is in Mich. and Ind. Omit Ohio. (OO-6.)

(Page 1394.)

GRAND RIVER, MICH. (OO-25)

ENGINEERS (Assistants).—Add, Fred Morley. R., 92, 2378.

SURVEYS.—Fifth paragraph. Sur. below Grand Rapids. Add, H. D. Ex., 197, 52d, 1st.

(Page 1413.)

CHARLEVOIX HARBOR AND ENTRANCE TO PINE LAKE, MICH. (OO-58)

PROJECTS.—Last paragraph. Original project of 1868 extended by act Aug. 2, 1882, to include channel Round Lake to Pine Lake, 83, 292, 1806; proj. depth increased by act June 13, 1902, 03, 519.

(Page 1414.)

PETOSKEY HARBOR, MICH.

PROJECTS.—Insert as third paragraph. Act Aug. 18, 1894, adopted the larger (\$170,000) project in place of the smaller (\$70,000) project, 94, 353.

PP.—DETROIT, MICH., DISTRICT.

(Page 1452.)

(Page 1456.)

DETROIT RIVER, MICH. (PP-105)

COMMERCE.—Fourth paragraph. The 1911 tonnage was 66,951,000.

ROUGE RIVER, MICH. (PP-110)

PROJECTS.—Last paragraph. Project was modified by act Mar. 2, 1907, to increase depth from mouth to first bridge.

RR.—BUFFALO, N. Y., DISTRICT.

(Page 1494.)

(Page 1495.)

ERIE (PRESQUE ISLE) HARBOR, PA. (RR-5-a)**CONTRACTS:**

1890. Hingston & Woods is correct.

1905. Shelton contract was for extending south pier.

(Page 1508.)

**BLACK ROCK HARBOR AND CHANNEL,
N. Y. (RR-13-e)**

CONTRACTS.—1910. Arthur L. Vogel is correct.

ENGINEERS (In charge).—First report of Col. Warren as colonel, 1912.

ENGINEERS (Assistant).—J. C. Quintus is correct.

PROJECTS.—Eleventh line. "Barge," not "large," is correct.

(Page 1509.)

**TONAWANDA HARBOR AND NIAGARA
RIVER, N. Y. (RR-15-a)**

ENGINEERS (In charge):

Col. Adams reference for 1906 is 06, 1939.

Col. Fisk reference for 1909 is 09, 2160.

SS.—LOS ANGELES, CAL., DISTRICT.

(Page 1543.)

**COLORADO RIVER, ARIZ., CAL., AND
NEV. (SS-1)**

COMMERCE.—The printed figures in the second paragraph refer to railroad freight. Commerce "very little," and only about 500 tons out, 04, 3393, 3398.

(Page 1545.)

SAN DIEGO HARBOR, CAL. (SS-11)

CONTRACTS:

1896. Reference to Waterman contract, 97, 3338.

1903. Reference to Babcock contract, 03, 2173.

ESTIMATES.—Fifth paragraph. \$23,000 is est. in minority report by Maj. Mendell, and covered only jetties in place of riprap, and is only part of estimate for diversion.

(Page 1546.)

PHYSICAL CHARACTERISTICS. — Second paragraph. Sediment observations is correct, not "current."

NEWPORT HARBOR, CAL. (SS-13)

PLANS.—Est. included dredging, and total for all should be \$1,620,000.

(Page 1547.)

WILMINGTON HARBOR, CAL. (SS-20-a)

APPROPRIATIONS.—Reference to 1875 item is 75, 123.

CONTRACTS.—1882. Bid was \$2.40, and 50¢ c. y.

(Page 1548.)

ENGINEERS (Chief of).—Add reference 00, 4194.

ENGINEERS (In charge).—00, 4191, 4196, 4199, is correct.

OPERATIONS:

1873-74. 3,200', not 1,680', is correct.

1874-75. 2,400 c. y. stone, and 1,375 c. y. gravel (not 4,075 t. st.) deposited.

(Page 1550.)

Insert the following (S-22)

SANTA MONICA BAY, CAL. (SS-22)

This title should be inserted on this page, and a reference made to the earlier items of (SS-20-b).

REDONDO BEACH HARBOR, CAL. (SS-21)

PHYSICAL CHARACTERISTICS.—Add reference 93, 3247.

SURVEYS.—Add reference 93, 3247, 3248.

(Page 1551.)

**SANTA BARBARA CHANNEL AND HAR-
BOR, CAL. (SS-25)**

The references of the 1875 report are to estuary near Pt. Muger also.

(Page 1552.)

SAN LUIS OBISPO HARBOR, CAL. (SS-28)

PLANS.—Third paragraph. Not exactly a repetition, for it refers more to a smaller plan with an estimate of \$234,898.

TT.—SAN FRANCISCO, CAL., DISTRICT No. 1.

(Page 1557.)

SANTA CRUZ BAY, CAL. (TT-11)

This refers to Santa Cruz Harbor, Cal. (See map, p. 1554.)

SURVEYS.—By Lt. Col. J. Biddle, for break-water; est., \$1,470,000, and \$1,650,000; (unfav.). H. D. 1084, 61st, 3d.

(Page 1559.)

SAN FRANCISCO HARBOR, CAL. (PART D, TT-15)

Noonday Rock is situated about 25 miles west of entrance to Golden Gate, for which reason it might not be classed properly as a part of the works connected with San Francisco.

The wreck of the "Patrician" was one of the early projects. A number of other wrecks have since been removed in the harbor under the usual wreck-removal operations.

(Page 1570.)

HUMBOLDT HARBOR AND BAY, CAL. (TT-175)

Footnote (2) should be omitted as referring to appropriation of 1911.

Footnote (4) refers also to the balance being used for rebuilding jetties.

(Page 1572.)

CRESCENT CITY, CAL. (TT-206)

ENGINEERS (In charge).—Omit the Capt. Leeds reference.

UU.—SAN FRANCISCO, CAL., DISTRICT No. 3.

(Page 1579.)

SAN JOAQUIN RIVER, CAL. (UU-6)**OPERATIONS:**

1900-01. 247,222 c. y. dr.

1906-07. 350,191 c. y. dr.

PRIVATE WORK.—21,142 c. y. dr. from Stockton Chan. in 1882 by City of Stockton, 82, 2536. Dr. under Harris was to 16' x 600', 08, 2223.

(Page 1580.)

CALIFORNIA DÉBRIS COMMISSION. (UU-6)

Reference under heading should be to "UU-57" instead of to "UU-59."

The app. of \$800,000, opposite Part f, includes \$400,000 app. by California, Mar. 1, 1909, and deposited in U. S. Treasury July 1, 1911.

(Page 1581.)

CONTRACTS.—Under 1906, the address on the first line should be "1733."

(Page 1583.)

SAN JOAQUIN VALLEY, CAL. (UU-6)

SURVEYS.—The document referred to in the first line under "Maps" is H. D. 290, 43d, 1st.

(Page 1584.)

MOKELUMNE RIVER, CAL. (UU-45)

ENGINEERS (Chief of Engineers).—Report for 1899 is at page 556.

(Page 1585.)

GEORGIANA SLOUGH, CAL. (UU-52)

ENGINEERS (In charge).—Maj. Heuer's R. for 1895 is at page 3328.

(Page 1586.)

SACRAMENTO AND FEATHER RIVERS, CAL. (UU-55)

CONTRACTS.—1908. Should be "Golden Gate Dredging Co., furnishing dredge, \$125 a day, 09, 2201."

ENGINEERS (In charge).—Capt. T. H. Jackson's reports are as follows: **07**, 2154; **08**, 2232; **09**, 2200; **10**, 2369.

(Page 1588.)

PHYSICAL CHARACTERISTICS (Sacramento and Feather Rivers).—The correct page of the report of 1893 for "Description of" is 3271.

(Page 1587.)

OPERATIONS (Sacramento and Feather Rivers):

(Page 1589.)

1880-81. Second line should read "from Sacramento to Colusa."

1888-89. Reference is to **89**, 2486.

1911-12. 48,480 c. y. dr. (first line), and the reference on second line is to **12**, 2776-77.

ENGINEERS (Part b).—Chief of Engineers. Reference for 1901 is to page 608.

VV.—PORTLAND, OREG., DISTRICT NO. 1.

(Page 1593.)

WATERWAY LIST.

Malheur R., Oreg. (VV-88) is correct.

WW.—PORTLAND, OREG., DISTRICT NO. 2.

(Page 1614.)

(Page 1617.)

MAP.

Tualatin R. flows into Columbia R. above Willamette Falls.

The middle fork over "Youngs Riv." is Klaskanine Riv.

Alamicut (Deep) Riv. is just below Grays Riv.

Crooked Riv. is just above Grays Riv.

Skamokawa Riv. enters Columbia Riv., right bank, about "three-quarters of an inch" above Grays Riv.

(Page 1616.)

Dalles, The. Add page 1633.

Eutiat Rapids. Correct spelling is Entiat.

Hell Gate is not the New York Hell Gate.

Linnton, not Linton, is correct.

Methow Rapids. Add page 1639.

Mouth, Columbia R. Add pages 1626, 1627.

Riparia to mouth of Snake R. Add page 1634.

Ross Isld. refers to Ross Isld. Channel.

St. Helen refers to St. Helens.

Second Rapids, page 1637, follows Scappoose Bay.

Snag Isld. Add page 1623.

Tongue Pt. Omit "below."

(Page 1618.)

COLUMBIA RIVER. (WW-2-b)

Bradford's Isld. Add page 1631.

Cascades. Add pages 1631, 1634, 1636.

Celilo Falls. Add page 1633.

Columbia R., lower. Insert page 1620.

Columbia R., upper. Add page 1637.

Willamette Bars is correct.

Willamette Slough. Add page 1621.

COLUMBIA RIVER. (WW-2-c)

No. 40 is St. Helens, Oreg.

No. 56 is Dalles-Celilo Canal, Oreg.

(Page 1619.)

COLUMBIA RIVER. (WW-2-d)

The 1905 item in first table was an allotment.

(Page 1620.)

APPROPRIATIONS.—First table. The 1886 item takes reference **86**, 2011.

FOOTNOTE NO. 1.—Foster Cr., not Foster Co., is correct.

APPROPRIATIONS:

Table at head of second column. The 1867 item takes reference **67**, 51.

Second table, second column. The 1874 item takes reference **74**, 118. The 1876 item relates to Upper Columbia and Snake Rs.

(Page 1621.)

COLUMBIA RIVER, OREG. (WW-2-e)

ENGINEERS (Chief of).—Add **83**, 337; **84**, 341; **85**, 368; **86**, 365; **88**, 303; **89**, 361; **90**, 329; **91**, 419; **92**, 393. The 1903 report is **03**, 619.

ENGINEERS (In charge).—Add, Capt. C. F. Powell, 1883-86. **R.**, **83**, 2076; **84**, 2290; **85**, 2408; **86**, 2010. Maj. Handbury. Add **88**, 2177; **89**, 2565; **90**, 3064; **91**, 3372; **92**, 2839.

OPERATIONS.—1910-11. "Linnton" is correct.

(Page 1622.)

COLUMBIA AND LOWER WILLAMETTE RIVERS. (WW-2-f)

ENGINEERS (Chief of).—The reports for **79**, 183, 1863, refer to mouth of Columbia R.

ENGINEERS (In charge):

Maj. J. M. Wilson. Omit page 1791 of 1879.

Maj. G. L. Gillespie. Reports for **79**, 1853, 1864, refer to mouth of Columbia R.

ENGINEERS (Assistants):

Lt. P. M. Price. **81**, 2538 refers to mouth of Columbia R.

R. Warrack, not Warrick, is correct.

OPERATIONS:

1873-74. 13,680 c. y. dr., not 17,300. 17,200 c. y. dr. takes reference **75**, ii, 758.

1878-79. (Willamette and Columbia.) 13,815 c. y. dr., Willamette; and 14,210 c. y. dr. Columbia.

1880-81. (Willamette and Columbia.) Add reference **81**, 2531.

1882-83. (Last line of column.) 12,821 l. f. ofrevet. is correct.

(Page 1623.)

The correct reference in the first line is **83**, 2005, 2006.

1885-86. Add reference **86**, 1939.

1888-89. Add reference **89**, 2572.

1900-01. Add reference **01**, 3559.

1903-04. Third and fourth lines. "For a width of 200' to a depth of 6'" is correct. Add reference **04**, 3536, 3537.

1911-12. Add reference **12**, 2817.

PHYSICAL CHARACTERISTICS. — Lower Willamette. Fifth paragraph. Insert "(See Gauging, p. 1621 of this Index.)."

(Page 1624.)

PLANS.—Lower Columbia. In 1871 Maj. Robert requested authority to examine St. Helens Bar and mouth of Willamette.

PRIVATE WORK.—Third paragraph. The expenditure of \$10,000 was probably for sluicing St. Helens Bar, or "one of the bars."

PROJECTS.—Paragraph beginning "At 1885." Amount estimated for completion, \$467,000.

(Page 1625.)

COLUMBIA RIVER; MOUTH. (WW-2-g)

ENGINEERS (Chief of).—Add references **75**, 124; **76**, 115; **78**, 137; **79**, 182.

(Page 1626.)

ENGINEERS (In charge):

Add, Maj. N. Michler, 1875-76. **R.**, **75**, ii, 747; **76**, ii, 633.

Add, Maj. J. M. Wilson, 1876-79. **R.**, **76**, ii, 651; **77**, 1003; **78**, 1321; **79**, 1791, 1853.

OPERATIONS:

1908-09. Add reference **09**, 863.

1910-11. Add reference **11**, 1017.

PHYSICAL CHARACTERISTICS:

Fourth paragraph. **81**, 2542 refers to Columbia and lower Willamette Rs.

(Page 1627.)

Last paragraph. Improvement has given an increase of about 9' depth on bar, **12**, 1220.

PROJECTS.—Second paragraph. "in 1889 to \$525,000" is correct.

COLUMBIA RIVER BELOW TONGUE POINT. (WW-2-h)

ENGINEERS (Chief of).—The 1899 reference is **99**, 594; and the 1900 reference is **00**, 670.

(Page 1629.)

**COLUMBIA RIVER, VANCOUVER, WASH.,
TO MOUTH OF WILLAMETTE RIVER.
(WW-2-l)**

PROJECTS:

First paragraph. Add reference 92, 2867.
Langitt paragraph. Add reference 05, 676,
677.

**COLUMBIA RIVER, OREG.; CANAL, CAS-
CADES. (WW-2-k)**

COMMERCE.—Sixth paragraph. Add reference
81, 2578.

CONTRACTS.—1889. Price of Carrel contract,
\$1.35 per c. f.

(Page 1630.)

ENGINEERS (Boards).—First paragraph.

Width of lock increased from 50' to 70'; ap-
proved by Secretary of War.

OPERATIONS:

1879-80. The 237 c. y. masonry not laid.
1883-84. Add reference 84, 2255.
1886-87. 58,035 c. y. rock removed.
1887-88. 138 c. y. stone quarried.
1890-91. 8,711 c. f. is correct. 15,520 c. f. is
correct. 1,544 c. y. of stone laid in lock walls.

(Page 1631.)

1891-92. The first two clauses should read
"79,210 c. f. dimension granite, basalt, and
basalt face stone cut; 2,110 c. y. dimension
stone and 604 c. y. rubble quarried."

PROJECTS:

First paragraph. The 2 locks were to be
8' x 46' x 250'.

Paragraph beginning "In 1888 iron." Substi-
tute "metal" for "iron."

(Page 1632.)

SURVEYS.—Maps. Reference of 89, 2550 re-
fers to gauge readings, dump cars, and trestles.

(Page 1633.)

**COLUMBIA RIVER AT THREEMILE
RAPIDS. (WW-2-n)**

ENGINEERS (Chief of).—Add reference 79, 183.

ENGINEERS (Board of).—Third paragraph.
Seventh line should read: "canal on Oregon
side from above Celilo Falls to below Five-
mile."

(Page 1634.)

OPERATIONS.—1910-11. Fifth line. Omit
"over," and change "6,000" to 6,048.

PROJECTS.—Paragraph beginning "By BE.,
1889." Add reference 90, 3041.

(Page 1635.)

**COLUMBIA (UPPER) AND SNAKE
RIVERS, OREG., WASH., AND IDAHO.
(WW-2-o)**

ENGINEERS (Assistants):

Randall reference is to 75, ii, 786.
Habersham reference is to 75, ii, 787, also.
Schubert reference is 03, 2247.

OPERATIONS:

(Upper Columbia River.) 1873-74. Reference
is 74, 118.
(Columbia and Snake Rivers.) 1879-80.
Homely is correct.

(Page 1636.)

PRIVATE WORK.—Add reference 07, 760.

PROJECTS.—Paragraph beginning "Act 1902
au.", third line should read: "2d), and \$25,000
for imp. above Lewiston, 02, 545, 2375."

(Page 1637.)

**COLUMBIA RIVER AND TRIBUTARIES,
ABOVE CELILO FALLS. (WW-2-p)**

ENGINEERS (Chief of).—Add reference 05, 752.

OPERATIONS:

1908-09. 1,180 c. y. bowlders, in last line, is
correct.
1909-10. Insert after "Rapids," in second
line, the following: "Homly Rapids and
Devils Bend Rapids."

(Page 1638.)

COLUMBIA RIVER, UPPER. (WW-2-r)

COMMERCE.—The 1893 reference is 93, 3384.

PHYSICAL CHARACTERISTICS. — Third
paragraph. Add reference 93, 3383.

SURVEYS.—Maps. Omit references to pages
126-9. ♦

**COLUMBIA RIVER, ROCK ISLAND
RAPIDS TO FOSTER CREEK RAPIDS,
WASH. (WW-2-s)**

OPERATIONS.—1896-97. Boom was under
construction.

(Page 1639.)

**COLUMBIA RIVER, WENATCHEE TO
BRIDGEPORT, WASH. (WW-2-t)**

OPERATIONS.—1910-12. Entiat is correct
spelling.

**COLUMBIA RIVER, BRIDGEPORT TO
KETTLE FALLS, WASH. (WW-2-u)**

PROJECT.—Correct reference is to H. D. 16,
60th, 2d.

(Page 1640.)

YOUNGS AND KLASKUINE RIVERS, OREG. (WW-6-a)

PLANS.—Klaskuine is correct spelling.

SURVEYS.—Reference is 90, 2991.

(Page 1641.)

CLATSKANIE RIVER, OREG. (WW-20)

COMMERCE.—In 1906 it was 10,399 tons.

PRIVATE WORK.—Second paragraph. Low water, not mean low water, is correct.

SCAPPOOSE BAY AND CREEK, OREG. (WW-26)

SURVEYS.—Au. by act June 3, 1896, not 1899.

(Page 1642.)

WILLAMETTE RIVER ABOVE PORTLAND, AND YAMHILL AND LONG TOM RIVERS, OREG. (WW-30-b)**COMMERCE:**

In the sixth paragraph, the 1908 reference is 08, 819, 2262.

In the seventh paragraph, the 1908 reference is to 08, 818.

CONTRACTS:

1875. The reference is to 76, ii, 660.

1898. The contractor is "Normile, Fastabend and McGregor."

(Page 1643.)

ENGINEERS (In charge).—Add to Maj. McIndoe's reports 09, 2225.**LEGAL PROCEEDINGS.—**Add reference 05, 002.**OPERATIONS:**

1852. Wing dam, not wing dams, is probably correct.

1871-72. Add reference 72, 984.

1879-80. Scraping on 5 bars only.

1895-96. Over 2,000 snags, not 1,000, is correct.

1899-00. Over 3,700 snags removed.

(Page 1644.)

1906-07. Careys Bend is correct.

PRIVATE WORKS. — Second paragraph. Willamette Transportation and Locks Co. is correct.

(Page 1645.)

PROJECTS.—Paragraph beginning "BE., 1899." Estimate, \$456,000.**SURVEYS.—**Paragraph beginning "Pre. ex. au. act June 13, 1902." Add reference 04, 3564.

(Page 1646.)

WILLAMETTE RIVER AT WILLAMETTE FALLS, OREG. (WW-30-d)**PHYSICAL CHARACTERISTICS.—**Willamette Falls Canal and Locks Co. is correct.**WILLAMETTE RIVER, OREG. ABOVE OREGON CITY. (WW-30-e)****COMMERCE.—**Reference to tonnage in second paragraph is 93, 3530.**TUALATIN RIVER, OREG. (WW-32)**

Spelling is as shown herewith.

(Page 1647.)

YAMHILL RIVER, OREG. (WW-33-a)**PLANS.—**First paragraph. Add reference 75, ii, 795.**SURVEYS.—**By Maj. Michler in 1874.

(Page 1648.)

OPERATIONS:

1900-01. Add reference 01, 3555.

1907-08. Grouting 1,000 square feet of pavement is correct.

(Page 1649.)

COLUMBIA RIVER, OREG. AND WASH. DREDGING PLANT. (WW-41-a)**PROJECTS.—**Includes tender and scows.**LEWIS RIVER, WASH. (WW-44)****COMMERCE.—**Small boat, not small boats, makes trips above Woodland to Runyon.**ENGINEERS (In charge).—**Maj. W. L. Fisk is correct.

(Page 1650.)

PHYSICAL CHARACTERISTICS. — Second paragraph. East Fork, not South Fork, is correct.

(Page 1651.)

COWLITZ RIVER, WASH. (WW-49)**ENGINEERS (In charge).—**Maj. Fisk report for 1899 is 99, 3249.**ENGINEERS (Assistants).—**Habersham's report for 1880 takes reference 80, 2332.**OPERATIONS.—**1911-12. Jetty, not jetties, repaired at Keegans Bar.**PROJECTS.—**Second paragraph. Appropriation combined by act of 1902.

(Page 1652.)

BAKERS AND WILLAPA BAYS, WASH. CANAL.**PLANS.—**By Capt. Powell, 1882, is correct.

XX.—SEATTLE, WASH., DISTRICT.

(Page 1656.)

WATERWAY LIST.

Togiak Bay, Alaska (XX-167).

Title as shown herewith is correct.

Manopiknak R., Alaska (XX-186).

Title as shown herewith is correct.

(Page 1657.)

Dagitli R., Alaska (XX-234).

Title as shown herewith is correct.

WILLAPA BAY TO COLUMBIA RIVER, OREG. (XX-2-a)

PLANS.—Second paragraph. Canal 24,554' long
is correct.

WILLAPA RIVER AND HARBOR, WASH. (XX-9)

COMMERCE.—In 1911, 771 SS. and 30 sailing
vessels entered harbor.

CONTRACTS.—1895. Dickinson contract, piles
were 8½¢ l. f., not c. y.

(Page 1658.)

ENGINEERS (Chief).—The 1906 references are
06, 766, 767, 787; and the 1910 references are
10, 968, 968.

(Page 1675.)

BELLINGHAM BAY AND HARBOR, WASH. (XX-103)

ENGINEERS (Assistants).—Capt. Francis A.
Pope is correct.

(Page 1676.)

SPOKANE RIVER, IDAHO. (XX-107)

ENGINEERS (In charge).—Reference is to re-
port for 1893.

(Page 1679.)

WRANGELL NARROWS, ALASKA. (XX-122-b)

PHYSICAL CHARACTERISTICS. — First
paragraph. Omit reference to page 3157.

SURVEYS.—Fifth line. Omit "(length to be
300')."

(Page 1680.)

YUKON RIVER, ALASKA. (XX-188)

SURVEYS.—Omit reference 12, 1267.

YY.—INSULAR RIVERS AND HARBORS.

(Page 1685.)

WATERWAY LIST.

Fajardo R. (YY-5) is preferable spelling.

Salinas R. (YY-9) is preferable spelling.

Bayamon R. (YY-28) is preferable spelling.

Hawaiian Islands: The following is another ar-
rangement of the landmarks of these islands.

(See copy on next page.)

HAWAIIAN ISLANDS, PACIFIC OCEAN.

YY 1 Kauai Isld.
 YY 2 Hanalei B. (1)
 YY 3 Keala B. (1)
 YY 4 Hanamaulu B. (1)
 YY 5 Nawiliwili B. (1)
 YY 6 Koloa Ldg. (1)
 YY 7 Hanapepe H. (1)
 YY 8 Waimea R. (1)
 YY 9 Kumukahi Chan. (1) (10)

YY 10 Niihau Isld.
 YY 11 Kii Ldg. (10)
 YY 12 Kaunakakai B. (10)
 YY 13 Nonopapa Ldg. (10)

YY 14 Oahu Isld.
 YY 15 Laie B. (14)
 YY 16 Kahana B. (14)
 YY 17 Kaneohe B. (14)
 YY 18 Kailua B. (14)
 YY 19 Waimanalo B. (14)
 YY 20 Maunaloa H. (14)
 YY 21 Honolulu H. (14)
 YY 22 Kailua H. (14)
 YY 23 Pearl H. (14)
 YY 24 Pokai H. (14)
 YY 25 Waimanalo B. (14)
 YY 26 Waimea B. (14)

YY 27 Molokai Isld.
 YY 28 Kalaupapa Ldg. (27)
 YY 29 Halawa B. (27)
 YY 30 Palolo Chan. (27)
 YY 31 Pukoo Ldg. (27)
 YY 32 Kaunakakai H. (27)

YY 33 Lanai Isld.
 YY 34 Kalohi Chan. (33) (37)
 YY 35 Halepalaoa Ldg. (33)
 YY 36 Manele B. (33)

YY 37 Maui Isld.
 YY 38 Honokahau H. (37)
 YY 39 Kahului H. (37)
 YY 40 Keanae Ldg. (37)
 YY 41 Pucokahi B. (37)
 YY 42 Kipahulu Ldg. (37)
 YY 43 La Perouse Ldg. (37)

YY 44 Maalaea B. (37)
 YY 45 Lahaina Ldg. (37)
 YY 46 Kaanapali Ldg. (37)

YY 47 Kahoolawe Isld.
 YY 48 Kanapou B. (47)
 YY 49 Smuggler Cove Ldg. (47)

YY 50 Hawaii Isld.
 YY 51 Honolulu Ldg. (50)
 YY 52 Awaeli H. (50)
 YY 53 Walpio H. (50)
 YY 54 Laupahoehoe Ldg. (50)
 YY 55 Hilo H. (50)
 YY 56 Kuhio B. (50) (55)
 YY 57 Keauhou Ldg. (50)
 YY 58 Punaluu H. (50)
 YY 59 Honuapo H. (50)
 YY 60 Kaalualu H. (50)
 YY 61 Hoopuloa Ldg. (50)
 YY 62 Kauhako B. (50)
 YY 63 Kealahou B. (50)
 YY 64 Kailua B. (50)
 YY 65 Kiholo B. (50)
 YY 66 Kawaihae H. (50)
 YY 67 Mahukona Ldg. (50)

(Page 1687.)

MAYAGUEZ HARBOR, P. R. (YY-20)

ENGINEERS (Chief of).—The 1907 reference is also 07, 807.

(Page 1688.)

HONOLULU HARBOR, HAWAII. (YY-45)

APPROPRIATIONS.—Reference to the 1905 item is 05, 2564, 2566.

(Page 1690.)

HILO HARBOR, HAWAII. YY-73)

APPROPRIATIONS.—Reference to 1912 item is 12, 2873.

PART VII

CONSOLIDATED FINDING LIST

VOLS. I AND II

**United States Rivers and Harbors, Fortifications,
Bridges, Wrecks, and all other data
in Pages 1-2846 of this Index**

ALPHABETICAL FINDING LIST.

NOTE.

The following list is, in the main, an alphabetical arrangement of the names of the waterways, harbors, or places of the United States, as found in Vols. I and II of this Index, with the addition of special references to data relating to fortifications, bridges, wreck removal, harbor lines, etc., as found in the two volumes of this Index. The names of special subjects found in the two volumes are also listed.

Each name is usually followed by (a) the district letter, (b) the district number of the waterway, and (c) the page number of this Index whereon further information concerning the subject is found.

This finding list does not contain references to special points embraced by a waterway, except in a few instances; as, for example, the instances of the Ohio, Missouri, Mississippi, and the Columbia. The abstracts concerning these waterways have their own indexes, and in this finding list the page reference is to the page of this Index whereon the special index contains the waterway or waterway point name listed herein. A star (*) follows the page reference in all these cases.

The Index has, as far as practicable, preserved the different spellings of waterway names. For example, on page 131 of this Index three different spellings are given of "Potonowut." These different names are listed herein.

The different names or titles given waterways have also been preserved. On page 318 of this Index "Smyrna River" is listed also as "Duck Creek," and this waterway is found under both titles in this list.¹

COMPOUND WORDS.—Compound words are listed generally according to the initial of the first or prefix word. For example, Bay Pompadour is listed in the B's. The more generally used prefixes are Bay, Big, Bogue, Broad, East, Fort, Lake, Little, Lower, Middle, New, North, Old, Saint, San, South, Upper, West, White.

¹In the following finding list the class term "river" does not possess a definiteness of meaning found in words like "ocean," "lake," "bay," or even "gulf." There is an indiscriminate use of such words as "creek," "bayou," "river," "branch," "brook," and "slough." The reports have used the names popularly given to a waterway, so that the class name does not indicate the physical character of the stream as it might do were something like the following meanings to be applied to the terms referred to:

RIVER.—Streams with channel cross section for at least 1 mile from mouth equal to bearing two of the largest steamships moving side by side. (See Panama Canal dimensions on p. 2571 of this Index.)

CREEK.—Channel cross section for at least 1 mile equal to bearing but one of the largest steamships.

BAYOU.—Channel cross section for at least 1 mile equal to bearing a ship of not more than 100 tons burden.

BRANCH.—Cross section profitable for waterpower.

BROOK.—Cross section not practicable for waterpower.

The addition of Roman numerals following a class term of a stream could indicate its situation with respect to the final receiving body of water. *Illustration:* Delaware River (I), flows directly into the ocean. Schuylkill River (II), flows into a primary, or into the Delaware. Chicago River (III), flows into the Great Lakes (II), and the latter into the St. Lawrence (I).—J. McC.

GENERAL FINDING LIST.

A.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------|---------------------|-------------------|---------------------------|---------------------|----------------------------|
| Abagadasset R., Me. | A-229 | i, 29 | Adams Cr., La. | R-98-d | i, 647 |
| Abaline Cr., Kans. | GG-1322 | i, 1035 | Adams Cr., N. C. | M-200 | i, 455 |
| Abbey Isld. Cr., Md. | J-951 | i, 338 | Appro. | | ii, 2292 |
| Abbot Cove, Md. | J-425 | i, 334 | Bridges. | | ii, 2139, 2231 |
| Abbott Cr., Ky. | DD-235 | i, 961 | Adams, Ft., R. I. | | ii, 1808 |
| Abbott Cr., N. C. | N-50 | i, 499 | Adams Isld., N. Y.: | | |
| Abbreviations. | | i, 15 | Harbor lines. | | ii, 2253 |
| Abels B., N. C. | M-42 | i, 454 | Adams Landing, Vt. | E-82 | i, 177, 203 |
| Aberdeen, Wash.: | | | Agate B. H., Minn. | LL-14 | i, 1269 |
| Harbor lines. | | ii, 2253 | (See notes, p. 2835.) | | |
| Aberdeen Cr., Md. | J-1247 | i, 340 | Appro. | | ii, 2298 |
| Abilene Cr., Kans.: | | | Agate B., Minn. | LL-14 | i, 1265 |
| (See notes, p. 2822.) | | | Agate H., Mich. | LL-37 | i, 1265 |
| Abita R., La. | S-23 | i, 681 | Agawam R., Mass. | C-45 | i, 107 |
| Abraham Cr., Pa. | J-694 | i, 336 | Agel R., Wyo. | GG-690 | i, 1030 |
| Abrahams Bluff Cut-off, | | | Agency Cr., Tenn. | AA-78 | i, 848 |
| Ga. | O-486 | i, 536 | Agua Caliente Cr., Cal. | TT-40 | i, 1555 |
| Abraham Lincoln House, | | | Agusan R., P. I. | YY-180 | i, 1686 |
| D. C. | | ii, 2039, 2066 | Ahnapee H. and R., Wis. | MM-25 | i, 1320 |
| Abrams Cr., Tenn. | AA-104 | i, 849 | Navigation rules. | | ii, 2041, 2107 |
| Absecon Cr., N. J. | I-18 | i, 299, 303 | Appro. | | ii, 2298 |
| Appro. | | ii, 2290 | Ahnapee R., Wis. | MM-25 | i, 1297 |
| Absecon Inlet, N. J. | I-17 | i, 299, 303 | Bridges. | | ii, 2139 |
| I-16-a. | | i, 303 | Ahpah Cr., Cal. | TT-195 | i, 1556 |
| Harbor lines. | | ii, 2253 | Alsquith Cr., Md. | J-1216 | i, 340 |
| Wrecks. | | ii, 2263 | Altin Co. | (HH) | i, 1071* |
| Academy Cr., Ga. | O-445 | i, 536 | Alabama: | | |
| Academy of Sciences: | | | Forts. | | ii, 1801, 1816, 1965, 1970 |
| Surveys. | | ii, 2041, 2120 | Alabama and Tennessee | | |
| Accomac Co., Va. | L-85-b | i, 417 | Rs. (canal to connect) | AA-18-i | i, 868 |
| Accotink B., Va. | K-96 | i, 373, 390 | Alabama Bayou, La. | S-542 | i, 685 |
| Appro. | | ii, 2291 | Alabama R. | (CC) | i, 909* |
| Accotink Cr., Va. | K-96 | i, 390 | (See notes, p. 2801.) | | |
| Appro. | | ii, 2291 | Appro. | | ii, 2294 |
| Acoaksett R., Mass.: | | | Bridges. | | ii, 2139 |
| Bridges. | | ii, 2139 | Alabama R., Ala. | Q-49 | i, 611, 633 |
| Acre Cr., Md. | J-52 | i, 331 | R-22. | | i, 646 |
| Acts: | | | Alafia R., Fla. | P-304 | i, 571, 601 |
| (See notes, p. 2781.) | | | Bridges. | | ii, 2139 |
| Appro. | | ii, 2279 | Alaqua Bayou, Fla. (bar | | |
| Acushnet R., Mass. | C-54 | i, 107 | at mouth of) | Q-36 | i, 628 |
| Bridges. | | ii, 2139 | Alaqua Cr., Fla. | Q-36 | i, 611 |
| Harbor lines. | | ii, 2253 | Alalakelki Chan., Hawaii. | YY-63 | i, 1685 |
| Ada Cr., Mont. | GG-616 | i, 1029 | Alameda Cr., Cal. | TT-52 | i, 1555, 1562 |
| (See notes, p. 2817.) | | | Alameda H., Cal.: | | |
| Adams B., La. | S-328 | i, 683 | Harbor lines. | | ii, 2253 |
| (See notes, p. 2804.) | | | Alamicut R., Wash. | WW-63 | i, 1615 |
| Adams Bayou, Tex.: | | | WW-68-a. | | i, 1652 |
| (See notes, p. 2806.) | | | (See notes, p. 2841.) | | |
| Adams Branch, Mo. | GG-112 | i, 1026 | Alamitos B., Cal. | SS-15 | i, 1543 |
| (See notes, p. 2813.) | | | Bridges. | | ii, 2142 |
| Adams Cr., Ga. | O-106 | i, 533 | Alaska: | | |
| Adams Cr. (Inland water- | | | Explorations. | | ii, 2040, 2090 |
| way, Pamlico Sound to | | | Roads. | | ii, 2041, 2117 |
| Beaufort Inlet, N. C.) | M-205 | i, 471 | Alatna R., Alaska | XX-229 | i, 1657 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Albany..... | (HH)..... | i, 1071* | Algoma, Wis..... | MM-28..... | i, 1297 |
| Albany, N. Y.: | | | Appro..... | | ii, 2298 |
| Harbor lines..... | | ii, 2253 | Algonac, Mich..... | PP-93..... | i, 1420, 1448 |
| Albany Falls, Mont..... | (WW-2)..... | i, 1616* | Alhambra Slough, Cal.: | | |
| Albamarle..... | (HH)..... | i, 1071* | Bridges..... | | ii, 2140, 2214 |
| Albamarle and Chesa- | | | Alkali Cr., Mont..... | GG-649..... | i, 1030 |
| peake Canal..... | L-173-l..... | i, 436 | (See notes, p. 2817.) | | |
| Albamarle and Chesa- | | | Alki Pt., Wash.: | | |
| peake Canal, N. C..... | L-251..... | i, 413 | Harbor lines..... | | ii, 2253 |
| | L-261..... | i, 413 | Allabaha R., Ga..... | O-478..... | i, 536 |
| Albamarle and Chesa- | | | Allapaha R., Fla..... | P-359..... | i, 572 |
| peake Canal, Va..... | L-188..... | i, 412 | Allegheny and Mononga- | | |
| | L-243..... | i, 413 | hela Rs., junction with | | |
| Albemarle Sound, N. C... | L-219..... | i, 413 | Ohio R. at Pittsburgh, | | |
| | M-1..... | i, 454 | Pa..... | FF-5..... | i, 1003 |
| (See notes, p. 2796.) | | | Allegheny City, Pa.: | | |
| Appro..... | | ii, 2292 | Harbor lines..... | | ii, 2253 |
| Bridges..... | | ii, 2139 | Allegheny R..... | (CC)..... | i, 909* |
| Wrecks..... | | ii, 2263 | Allegheny R., Pa..... | FF-20..... | i, 1003, 1014 |
| Albemarle Sound, N. C., | | | | FF-20-b..... | i, 1015 |
| and Atlantic Ocean | | | | FF-20-c..... | i, 1016 |
| (communica-tion be- | | | (See notes, p. 2812.) | | |
| tween) (Croatan Sound) | M-22-b..... | i, 459 | Appro..... | | ii, 2297 |
| Surveys, appropriations..... | | ii, 2279 | Bridges..... | | ii, 2140, 2210 |
| Albemarle Sound, N. C., | | | Harbor lines..... | | ii, 2253 |
| to Norfolk H., Va., | | | Allegheny R., Pa. (build- | | |
| through Currituck | | | ing locks and dams).... | FF-20-d..... | i, 1017 |
| Sound..... | L-173-l..... | i, 436 | Allegheny R., Pa., locks | | |
| Navigation rules..... | | ii, 2041, 2107 | and dams on (operating | | |
| Albina, Oreg.: | | | and care)..... | FF-20-e..... | i, 1019 |
| Harbor lines..... | | ii, 2253 | Allen Branch, Mo..... | GG-60..... | i, 1025 |
| Albion R., Cal..... | TT-143..... | i, 1556 | Allen Cr., Va..... | L-364..... | i, 414 |
| Albro Cr., Va..... | L-145..... | i, 412 | Allen Cr., W. Va..... | EE-32..... | i, 983 |
| Alcatraz, Ft..... | | ii, 1801 | Allen Fresh, Md..... | K-69..... | i, 373 |
| Alcatraz Isld., Cal.: | | | Allens Cove, Me..... | A-68..... | i, 27 |
| Forts..... | | ii, 2005 | Allens Cr., N. C..... | L-390..... | i, 414 |
| Alcony R., Ga..... | O-352..... | i, 535 | Allequa Cr., Fla..... | Q-36..... | i, 611 |
| Alden Run, Pa..... | J-816..... | i, 337 | Alley Cr., N. Y.: | | |
| Alder Branch, Md..... | J-439..... | i, 334 | Bridges..... | | ii, 2140 |
| Alder Cr., Cal..... | TT-140..... | i, 1556 | Alligator Bayou, Ark..... | Y-49..... | i, 818 |
| Alenuihaha Chan., Ha- | | | Alligator Bayou, La..... | S-108..... | i, 682 |
| wall..... | YY-62..... | i, 1685 | | S-119..... | i, 682 |
| Alequa Cr., Fla.: | | | | S-127..... | i, 682 |
| Bridges..... | | ii, 2139 | | S-285..... | i, 683 |
| Alexander Cr., La..... | S-267..... | i, 683 | | P-271..... | i, 571 |
| Alexander Cr., Tenn..... | AA-137..... | i, 849 | Alligator Cr. opposite | | |
| Alexandria..... | (HH)..... | i, 1071* | McClellanville, S. C., | | |
| Alexandria B., N. Y..... | RR-67..... | i, 1493, 1535 | and Charleston H., S. | | |
| Harbor lines..... | | ii, 2253 | C. (inland waterways | | |
| Alexandria Canal, D. C. | | | between)..... | N-202-b..... | i, 518 |
| and Va. (canal to Wash- | | | Alligator Cr., S. C..... | N-201..... | i, 500, 518 |
| ington)..... | K-46-h..... | i, 381 | (See notes, p. 2798.) | | |
| Alexandria H., Va..... | K-46-i..... | i, 381 | Appro..... | | ii, 2292 |
| | K-46-g..... | i, 381 | Alligator Head H., Mata- | | |
| Alexandria, Va.: | | | gorda B., Tex..... | U-47-a..... | i, 766 |
| Harbor lines..... | | ii, 2253 | Alligator Lake, La..... | S-737..... | i, 687 |
| Wrecks..... | | ii, 2263 | Alligator R., Fla..... | P-259..... | i, 571 |
| Alexandria, Va., to Mary- | | | Alligator R., N. C..... | M-7..... | i, 454, 458 |
| land slide (channel).... | K-46-j..... | i, 381 | Bridges..... | | ii, 2140 |
| Alger Slough, Wash..... | WW-64..... | i, 1615 | Alligator R., S. C..... | N-201..... | i, 518 |
| Bridges..... | | ii, 2139 | Allisons Cr., S. C..... | N-132..... | i, 500 |
| Algiers..... | (HH)..... | i, 1071* | Allonez. See Allouez Bay. | | |
| Algiers, La.: | | | Allouez B., Wis..... | LL-18-f..... | i, 1276 |
| Wrecks..... | | ii, 2263 | | LL-23-b..... | i, 1281 |
| Algoma. See Ahnapee. | | | (See notes, p. 2836.) | | |
| | | | Harbor lines..... | | ii, 2253 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|----------------------|------------------------------------|---------------------|-------------------|
| Alloway Cr., N. J. | I-42..... | i, 299, 307 | Amityville R., N. Y. | F-65..... | i, 215 |
| Appro..... | ..... | ii, 2290 | Ammonosook Canal, N. | | |
| Bridges..... | ..... | ii, 2140 | H. | A-234-a..... | i, 29, 52 |
| Alma | (HH)..... | i, 1071* | Amos Bayou | (HH)..... | i, 1071* |
| Almond Cr., Va. | L-143..... | i, 412 | Amos Cr., N. J.: | | |
| Almshouse Cr., Md. | J-1256..... | i, 340 | Bridges..... | ..... | ii, 2141, 2184 |
| Alpena H., Mich. | PP-50..... | i, 1419, 1433 | Amoureux Canal, La. | S-399..... | i, 684 |
| Appro..... | ..... | ii, 2299 | Anacortes H., Wash. | XX-100-a..... | i, 1675 |
| Wrecks..... | ..... | ii, 2263 | Harbor lines..... | ..... | ii, 2253 |
| Alsea B., Ore. | VV-41..... | i, 1593 | Anacostia R., D. C. (East- | | |
| Appro..... | ..... | ii, 2300 | ern Branch of Potomac | | |
| Alsea B., H., and R., Ore. | VV-41..... | i, 1605 | R.) | K-46-c..... | i, 378 |
| Appro..... | ..... | ii, 2300 | Bridges..... | ..... | ii, 2141, 2142 |
| Alsea R., Ore. | VV-42..... | i, 1593 | Harbor lines..... | ..... | ii, 2253 |
| Alsek R., Alaska | XX-125..... | i, 1656 | Wrecks..... | ..... | ii, 2263 |
| Altamaha and Tennessee | | | Anacostia R., Md. | K-85..... | i, 373 |
| Rs. (canal to connect) .. | AA-18-j..... | i, 869 | Anacostia R., D. C.: | | |
| Altamaha Canal, Ga. | O-416..... | i, 536 | Flats..... | ..... | ii, 2039, 2067 |
| Altamaha Cr., S. C.: | | | Anaheim Inlet, Cal.: | | |
| Bridges..... | ..... | ii, 2143 | Bridges..... | ..... | ii, 2142 |
| Altamaha R. | (CC)..... | i, 909* | Anahuac Chan. | U-5-a..... | i, 736 |
| Altamaha R., Ga. | O-237..... | i, 534, 552 | Anahuac Chan., Tex. | U-10..... | i, 739 |
| Appro..... | ..... | ii, 2293, 2296 | Appro..... | ..... | ii, 2295 |
| Bridges..... | ..... | ii, 2140, 2141, 2208 | Anahuac H., Tex. | U-10..... | i, 735 |
| Altamaha R. ("Transporta- | | | Anasco R., P. R. | YY-21..... | i, 1685 |
| tion Routes to Sea- | | | Anchor Landing | (HH)..... | i, 1071* |
| board") | AA-18-k..... | i, 869 | Anclote Anchorage, Fla.: | | |
| Altamaha Sound, Ga. | O-232..... | i, 534 | Wrecks..... | ..... | ii, 2263 |
| Alton | (HH)..... | i, 1071* | Anclote B., Fla. | P-328-a..... | i, 603 |
| (See notes, p. 2833.) | | | Appro..... | ..... | ii, 2293 |
| Alton, Ill. | II-7..... | i, 1229 | Anclote H., Fla. | P-328-a..... | i, 603 |
| Alum Cr., Ohio. | DD-457..... | i, 962 | Anclote R., Fla. | P-328..... | i, 571 |
| Alva R., P. I. | YY-106..... | i, 1686 | P-328-a..... | ..... | i, 603 |
| Alviso Cr., H., R., and | | | Andalusia | (HH)..... | i, 1071* |
| Slough, Cal. | TT-36..... | i, 1561 | Anderson Cr., Pa. | J-806..... | i, 337 |
| Appro..... | ..... | ii, 2300 | Anderson Crossing | (HH)..... | i, 1071* |
| Alviso Slough, Cal. | TT-36..... | i, 1555 | (See notes, ii, 2831.) | | |
| Appro..... | ..... | ii, 2300 | Andersons Cr., N. C. | M-189..... | i, 455 |
| Private dams..... | ..... | ii, 2249 | Andover Sewell Branch, | | |
| Amaranth | (HH)..... | i, 1071* | Md. | J-451..... | i, 334 |
| Ambrose Chan. (see New | | | Andre (Bayou), La. | S-409..... | i, 684, 698 |
| York, N. Y.): | | | Andrew, Ft., Mass...... | ..... | ii, 1855 |
| Navigation rules..... | ..... | ii, 2107, 2041 | Androscoggin R., Bruns- | | |
| Wrecks..... | ..... | ii, 2263 | wick Canal and H., Me. | A-233-a..... | i, 52 |
| Amelia R., Fla. | O-526..... | i, 537 | Androscoggin R., Me. | A-233..... | i, 29, 51 |
| P-3..... | ..... | i, 569, 575 | Angeles, Wash.: | | |
| American Cr., S. Dak. | GG-366..... | i, 1028 | Forts..... | ..... | ii, 2030 |
| (See notes, ii, 2815.) | | | Angelfish Cr., Fla. | P-178..... | i, 570 |
| American Crow Cr., S. | | | Angellna R., Tex. | T-6..... | i, 721 |
| Dak. | GG-880..... | i, 1032 | (See notes, ii, 2806.) | | |
| (See notes, ii, 2819.) | | | Appro..... | ..... | ii, 2294 |
| American Fork, Mont. | GG-590..... | i, 1029 | Angel Isld., Cal.: | | |
| (See notes, ii, 2816.) | | | Forts..... | ..... | ii, 2005 |
| American R., Cal. (see | | | Angelo Slough, Cal. | TT-21..... | i, 1555 |
| Cal. Débris Comm.) | UU-56..... | i, 1577, 1589 | Anglefish Cr., Fla. | P-177..... | i, 570 |
| Ames | (HH)..... | i, 1071* | Angola | (HH)..... | i, 1071* |
| Ames Towhead (HH): | | | Annapolis H., Md. | J-1243..... | i, 369 |
| (See notes, ii, 2829.) | | | Appro..... | ..... | ii, 2291 |
| Amherstburg Chan., | | | Harbor lines..... | ..... | ii, 2253 |
| Mich. | PP-117..... | i, 1420 | Annaville Cr., N. Y.: | | |
| Amite R., La. | S-62..... | i, 681 | Bridges..... | ..... | ii, 2142 |
| S-62-a..... | ..... | i, 693 | Annesmessex R., Md.: | | |
| Appro..... | ..... | ii, 2294 | Bridges..... | ..... | ii, 2142 |
| | | | Annie Smith Lake, Ga. | O-289..... | i, 535 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|-------------------------------------|---------------------|-----------------------|
| Annisquam H., Mass. | B-67..... | i, 69 | Apple Cr., N. Dak. | GG-393..... | i, 1028 |
| Bridges..... | | ii, 2170 | (See notes, ii, 2815.) | | |
| Anoka | (HH)..... | i, 1071* | Apple Cr., Ohio | DD-401..... | i, 962 |
| Ansons Cr., S. Dak. | GG-355..... | i, 1027 | Apple R. | (HH)..... | i, 1071* |
| (See notes, ii, 2815.) | | | (See notes, ii, 2827.) | | |
| Antelope Cr., Kans. | GG-1374..... | i, 1035 | Apple R., Ill. | JJ-23..... | i, 1234 |
| (See notes, ii, 2823.) | | | Apple R., Wis. | KK-49..... | i, 1247 |
| Antelope Cr., Mont. | GG-456..... | i, 1028 | Appletree Gut, N. C. | L-358..... | i, 414 |
| | GG-490..... | i, 1029 | Application, Engineer | | |
| | GG-621..... | i, 1029 | School of | | ii, 2039, 2057 |
| (See notes, ii, 2816, 2817, 2819.) | | | Appomattox R., Va. | L-150..... | i, 412 |
| Antelope Cr., Nebr. | GG-913..... | i, 1032 | (See notes, ii, 2796.) | | |
| (See notes, ii, 2819.) | | | Appro. | | ii, 2291 |
| Antelope Cr., N. Dak. | GG-777..... | i, 1031 | Navigation rules | | ii, 2041, 2107 |
| (See notes, ii, 2818.) | | | Wrecks | | ii, 2263 |
| Antelope, Cr., S. Dak. | GG-809..... | i, 1031 | Appomattox R., Va. (Pe- | | |
| | GG-908..... | i, 1032 | tersburg to mouth) | L-150..... | i, 424 |
| (See notes, ii, 2818, 2819.) | | | Apponaug H., R. I. | C-91..... | i, 107, 131 |
| Antelope Cr., Wyo.: | | | Apponaug R., R. I. | C-90..... | i, 107 |
| (See notes, ii, 2819.) | | | Apponagansett R., Mass.: | | |
| Anthony's Cr., W. Va. | EE-112..... | i, 984 | Bridges..... | | ii, 2142 |
| Antipolson Cr., Va. | K-169..... | i, 374 | Apponegansett H., Mass. | C-55..... | i, 107 |
| Antis Cr., Pa. | J-837..... | i, 337 | Apponegansett R., Mass. | C-56..... | i, 107 |
| Anvik R., Alaska | XX-238..... | i, 1657 | Appoquinimink R., Del. | I-61..... | i, 299, 317 |
| Anyaguk R., Alaska | XX-172..... | i, 1656 | Appro. | | ii, 2290 |
| Aowa Cr., Nebr. | GG-939..... | i, 1032 | Bridges..... | | ii, 2142 |
| (See notes, ii, 2819.) | | | Wrecks | | ii, 2263 |
| Apalachee B., Fla. | Q-7..... | i, 611 | Appropriations | | i, 21; ii, 2039, 2042 |
| Apalachicola, Fla.: | | | Forts | | ii, 1796, 1799, 1801 |
| Navigation rules | | ii, 2041, 2107 | Panama Canal | | ii, 2357 |
| Apalachicola B., Fla. | Q-20..... | i, 611 | Permanent annual— | | |
| | Q-20..... | i, 614 | Gauging Miss. R., etc | | ii, 2286 |
| (See notes, ii, 2800.) | | | Maintenance, South | | |
| Wrecks | | ii, 2263 | Pass, Miss. R. | | ii, 2285 |
| Apalachicola R. and St. | | | Snagboats, dredges, | | |
| Andrews B., Fla. (chan- | | | Miss. R. | | ii, 2285 |
| nel between) | Q-26..... | i, 623 | Snagboats, Ohio R. | | ii, 2286 |
| Apalachicola R., Fla. | Q-21..... | i, 611 | Snags, Miss. R. | | ii, 2285 |
| (See notes, ii, 2800.) | | | Surveys, South Pass, | | |
| Appro. | | ii, 2293 | Miss. R. | | ii, 2284 |
| Bridges | | ii, 2142, 2166 | Permanent indefinite— | | |
| Wrecks | | ii, 2263 | Canals, etc | | ii, 2284 |
| Apalachicola R., Fla. (in- | | | Wrecks | | ii, 2284 |
| cluding Chipola R.) | Q-21..... | i, 616 | Rivers and harbors | | ii, 2041, 2103 |
| Apalachicola R. (Includ- | | | Relation of works to | | |
| ing the cut-off, Lees | | | one another | | ii, 2287 |
| Slough, and lower Chi- | | | Wrecks, snagboats, | | |
| pola R.) | Q-21-a..... | i, 616 | dredges, etc. | | ii, 2279 |
| Apalachicola R. (Includ- | | | States, contributions by; | | |
| ing the cut-off, Lees | | | waterways | | ii, 2041, 2109 |
| Slough, lower Chipola | | | Summary | | ii, 2279 |
| and upper Chipola Rs., | | | Aqueduct Bridge, D. C. | | ii, 2039, 2060 |
| Fla.) | Q-21-c..... | i, 618 | Harbor lines | | ii, 2253 |
| Apalachicola R. to St. | | | Aqueduct Bridge to Mt. | | |
| Andrews B., Fla. (water- | | | Vernon, D. C. and Va.: | | |
| way) | Q-26..... | i, 611 | Road | | ii, 2040, 2075 |
| Apalachin Cr., Pa. and | | | Aqueduct, Washington, | | |
| N. Y. | J-650..... | i, 336 | D. C. | | ii, 2040, 2077, 2080 |
| Apes Hole Cr., Md. | J-38..... | i, 331 | Aquila Cr., Va. | K-107..... | i, 374, 393 |
| Apopka Run, Fla. | P-51..... | i, 569 | Appro. | | ii, 2291 |
| Appalachee R., Ala. | R-16..... | i, 646 | Bridges | | ii, 2142, 2204 |
| Appalachee R., Ga. | O-294..... | i, 535 | Arago | (GG-2)..... | i, 1038* |
| Apple Cr. (HH): | | | Aransas B., St. Charles | | |
| (See notes, ii, 2827.) | | | B., Tex. | U-67-d..... | i, 772 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|----------------------------|-------------------|
| Aransas B., Tex. | U-67..... | i, 735 | Arkansas R., Ark., Okla., and Kans.—Continued. | | |
| | U-67-a..... | i, 769 | Appro..... | ii, 2295 | |
| Aransas H., Tex. | U-67..... | i, 735 | Bridges..... | ii, 2142, 2143, 2213, 2216 | |
| | U-67-a..... | i, 769 | Wrecks..... | ii, 2263 | |
| Aransas Pass H. to Rock- port, Tex. | U-67-c..... | i, 772 | Arkansas R., Ark. (front of Crawford Co. Levee).. | Y-2-k..... | i, 825 |
| Aransas Pass to Corpus Christi, Tex. (including Turtle Cove Chan.) | U-68-b..... | i, 773 | Arkansas R., Fort Smith, Ark. | Y-2-j..... | i, 824 |
| Aransas Pass to Pass Cavallo, Tex. | U-38-f..... | i, 759 | Arkansas R., Ind. T.: | | |
| Aransas Pass, Tex. | U-67..... | i, 735, 769 | Bridges..... | ii, 2142 | |
| | U-67-a..... | i, 769 | Arkansas R., Little Rock to mouth | Y-2-i..... | i, 824 |
| Appro..... | | ii, 2295 | Arkansas R., Okla.: | | |
| Aransas Pass, Tex. (deep- water harbor at Harbor Isld.) | U-67-b..... | i, 772 | Bridges..... | ii, 2142 | |
| Aransas R., Tex. | U-66..... | i, 735 | Arkansas R., Pine Bluff. | Y-2-h..... | i, 823 |
| Arapahoe Cr., Colo. | GG-1033..... | i, 1033 | Arkansas R. (removing obstructions) | Y-2-g..... | i, 823 |
| Ararat R., N. C. | N-51..... | i, 499 | Arkansas (State) | (HH)..... | i, 1071* |
| Arbita R., La. | S-23..... | i, 691 | Arlington R., Fla. | P-79..... | i, 569 |
| Arbuckle Cr., Fla. | P-247..... | i, 571 | Armament: | | |
| Arcadia H., Mich. | OO-52..... | i, 1377, 1408 | Defenses..... | ii, 1824 | |
| Appro..... | | ii, 2298 | Armells Cr., Mont. | GG-568..... | i, 1029 |
| Arch Cr., Fla. | P-163..... | i, 570 | | GG-706..... | i, 1039 |
| Archers | (GG-2)..... | i, 1038* | (See notes, ii, 2817.) | | |
| Archers Cr., S. C. | N-260..... | i, 501, 529 | Armories: | | |
| Appro..... | | ii, 2292 | Equipment..... | ii, 1814, 2041, 2133 | |
| Archers Hope R., Va. | L-116..... | i, 412, 422 | Armstrong Bar | (HH)..... | i, 1071* |
| (See notes, ii, 2795.) | | | Armstrong Cr., Ga. | O-468..... | i, 536 |
| Appro..... | | ii, 2291 | Armstrong Cr., Pa. | J-601..... | i, 335 |
| Arch, Memorial; Valley | | | Armstrong Cr., W. Va. | EE-75..... | i, 983 |
| Forge, Pa. | | ii, 2040, 2096 | Army War College: | | |
| Ards Cr., La. | R-93-a..... | i, 647 | Buildings, D. C. | ii, 2039, 2066 | |
| Arecibo H., P. R. | YY-26..... | i, 1687 | Aroostook R., Me. | A-2..... | i, 27, 29 |
| Arecibo R., P. R. | YY-26..... | i, 1685 | Arrow Cr., Mont. | GG-556..... | i, 1029 |
| Areneuse Cr., N. C. | L-267..... | i, 413 | Arrow R., Mont.: | | |
| Argao, P. I. | YY-122..... | i, 1686 | (See notes, ii, 2816.) | | |
| Arid lands; irrigation | | ii, 2040, 2087 | Arrow Rock | (GG-2)..... | i, 1038* |
| Reclamation..... | | ii, 2040, 2087 | Arroyo Colorado, Tex. | U-73..... | i, 735, 774 |
| Wyoming and Colorado, appro..... | | ii, 2297 | Arsenal Isld. | (HH)..... | i, 1071* |
| Arizona: | | | Arsene (Bayou), La. | S-808..... | i, 688 |
| Field service, troops, etc..... | | ii, 2039, 2047 | Arthur Kill, N. Y. and N. J. | G-21..... | i, 247, 254 |
| Arkadelphia, Ark., to Camden (Ouachita R.). | X-29-b..... | i, 805 | | G-27..... | i, 253 |
| Arkansas: | | | | G-27-b..... | i, 254 |
| Forts..... | | ii, 1801, 1816 | Appro..... | ii, 2290 | |
| Arkansas City | (HH)..... | i, 1071* | Bridges..... | ii, 2143 | |
| (See notes, ii, 2831.) | | | Harbor lines..... | ii, 2253 | |
| Arkansas Cr., Wyo. | GG-1015..... | i, 1033 | Wrecks..... | ii, 2263 | |
| Arkansas Levees | (HH)..... | i, 1071* | Arthur Kill, Staten Isld. Sound, and channel be- tween Staten Isld. and N. J., including channel north of Shooters Isld.. | G-27..... | i, 253 |
| Arkansas R., Ark., Okla., and Kans. | Y-2..... | i, 818 | Arthurs Cove, Va. | K-155..... | i, 374 |
| | Y-2-c..... | i, 820 | Artchoke R., Mass. | B-51..... | i, 69 |
| | Y-2-d..... | i, 820 | Artillery, Coast: | | |
| | Y-2-e..... | i, 820 | Equipment..... | ii, 1814 | |
| | Y-2-f..... | i, 822 | Arundel Cove, Md. | J-1162..... | i, 339 |
| | (CC)..... | i, 909* | Ashbrook Neck | (HH)..... | i, 1071* |
| | (GG-2)..... | i, 1038* | Ashby Cr., Kans. | GG-1192..... | i, 1034 |
| | (HH)..... | i, 1071* | Ashbys Cr., N. C. | M-26..... | i, 454 |

(See notes, ii, 2808.)

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|-------------------------------------|----------------------|-------------------|
| Ash Cr., Conn. | D-75..... | i, 141 | Assistants, civilian: | | |
| Ash Cr., Kans. | GG-1355..... | i, 1035 | Engineers, Corps of..... | ii, 2039, 2060 | |
| (See notes, ii, 2822, 2823.) | | | Engineer Troops..... | ii, 2039, 2059 | |
| Ash Cr., Nebr.: | | | Association, Navigation | | |
| (See notes, ii, 2820.) | | | Congresses: | | |
| Ash Cr., Nebr. and Wyo. .. | GG-1076..... | i, 1033 | Appro..... | ii, 2283 | |
| Ash Cr., S. Dak.: | | | Assonet R., Mass. | C-71..... | i, 107, 125 |
| (See notes, ii, 2819.) | | | Astoria, Oreg. | (WW-2)..... | i, 1616 |
| Ashepool R., S. C. | N-244..... | i, 501, 527 | Harbor lines..... | ii, 2253 | |
| Appro..... | ii, 2292 | | Astronomical observa- | | |
| Bridges..... | ii, 2143 | | tions: | | |
| Wrecks..... | ii, 2263 | | Great Lakes..... | ii, 2041, 2124 | |
| Ashepool R., S. C. (below | | | Asylum Slough, Cal. | TT-110..... | i, 1556 |
| Charleston & Savan- | | | Atchafalaya. | (HH)..... | i, 1071* |
| nah R. R. bridge). | N-244-b..... | i, 527 | Atchafalaya B., La. | S-490..... | i, 685 |
| Ashepool to South Edisto | | | S-490-a..... | i, 701 | |
| Rs., Mosquito Cr., S. C. | N-243..... | i, 527 | (See notes, ii, 2805.) | | |
| Asher Fork, Ky. | DD-42..... | i, 959 | Atchafalaya B. and R., | | |
| Ashland, Ky. | (CC)..... | i, 909* | La.: | | |
| Harbor lines..... | ii, 2253 | | Appro..... | ii, 2294 | |
| Ashland H., Wis. | LL-32..... | i, 1282 | Atchafalaya B. Ship | | |
| Ashland, Wis. | LL-32..... | i, 1265 | Chan., La. | S-491..... | i, 685 |
| Appro..... | ii, 2298 | | Atchafalaya (head of) to | | |
| Harbor lines..... | ii, 2253 | | Fulton. | X-28-d..... | i, 799 |
| Ashley Cr., Ga. | O-182..... | i, 534 | Atchafalaya R., La. | S-293..... | i, 683 |
| Ashley Pt. | (HH)..... | i, 1071* | S-495..... | i, 685 | |
| (See notes, ii, 2832.) | | | S-501..... | i, 685 | |
| Ashley R., S. C. | N-214..... | i, 500, 523 | S-502..... | i, 685 | |
| (See notes, ii, 2798.) | | | S-490-a..... | i, 701 | |
| Appro..... | ii, 2292 | | (See notes, ii, 2808.) | | |
| Bridges..... | ii, 2143 | | Appro., snags..... | ii, 2285 | |
| Harbor lines..... | ii, 2253 | | Bridges..... | ii, 2143 | |
| Wrecks..... | ii, 2263 | | Atchison, Kans. | (GG-2)..... | i, 1038* |
| Ashleys Cove, Va. | K-166..... | i, 374 | Atherton. | (GG-2)..... | i, 1038* |
| Ashpool Swamp, N. C. | N-36..... | i, 499 | Atkins B., Me. | A-239..... | i, 29 |
| Ashport. | (HH)..... | i, 1071* | Atkins B., Kennebec R., | | |
| Ash R., Minn. | KK-223..... | i, 1249 | Me.: | | |
| Ashtabula H., Ohio | QQ-31..... | i, 1461, 1485 | Bridges..... | ii, 2143 | |
| Appro..... | ii, 2299 | | Atlantic Basin (see New | | |
| Bridges..... | ii, 2143 | | York), N. Y.: | | |
| Harbor lines..... | ii, 2253 | | Harbor lines..... | ii, 2253 | |
| Navigation rules..... | ii, 2041, 2107 | | Atlantic City, N. J. | I-17..... | i, 299, 303 |
| Wrecks..... | ii, 2263 | | Atlantic City, N. J. (see | | |
| Ashtabula R., Ohio | QQ-32..... | i, 1461 | Absecon Inlet): | | |
| Ashton Chute. | (HH)..... | i, 1071* | (See notes, ii, 2794.) | | |
| Asotin. | (WW-2)..... | i, 1616* | Appro..... | ii, 2290 | |
| Aspen Run, Md. | J-1129..... | i, 339 | Bridges..... | ii, 2230, 2237, 2238 | |
| J-1132..... | i, 339 | | Harbor lines..... | ii, 2253 | |
| | | | Wrecks..... | ii, 2263 | |
| Aspinwall, Pa.: | | | Atlantic City, Va.: | | |
| Harbor lines..... | ii, 2253 | | Bridge..... | ii, 2253 | |
| Assabet R., Mass. | B-45..... | i, 69 | Atlantic Highlands, N. J. .. | G-50..... | i, 247, 266 |
| Assateague Entrance, Va.: | | | Atlantic Ocean: | | |
| Wrecks..... | ii, 2263 | | Wrecks..... | ii, 2263 | |
| Assawoman B., Del. and | | | Atlantic Ocean and Albe- | | |
| Md. | I-82..... | i, 299 | marle Sound, N. C. | | |
| Assinniboine Cr., Mont. .. | GG-431..... | i, 1028 | (communication be- | | |
| (See notes, ii, 2815.) | | | tween) (Croatian Sound) | M-22-b..... | i, 459 |
| Assinpink Cr., N. J. | H-10..... | i, 271 | Appro., surveys..... | ii, 2279 | |
| Assiscunk Cr., N. J. | H-4..... | i, 271 | Atlantic Ocean, waterway | | |
| Bridges..... | ii, 2143 | | across Florida. | O-510-b..... | i, 565 |
| Assistants: | | | (See notes, ii, 2799.) | | |
| Rivers and harbors..... | ii, 2041, 2104 | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|---------------------|-------------------|
| Atlantic Ocean to Gulf of Mexico (canal between). | P-1-a. | i, 572 | Augusta to Savannah, Ga., Savannah R. | O-2-c. | i, 542 |
| Atlantic to Mississippi ("Transportation Routes to Seaboard"). | AA-18-k. | i, 869 | August B., La. | S-193. | i, 682 |
| Atlas. | (HH). | i, 1071* | Ausable H. and R., Mich. | PP-53. | i, 1434 |
| Atwood R., Ga. | O-214. | i, 534 | Appro. | | ii, 2299 |
| Auau Chan., Hawaii. | YY-56. | i, 1085 | Au Sable R., Mich. | PP-53. | i, 1419 |
| Aucilla R., Fla. | Q-5. | i, 611 | Au Sable R., N. Y. | E-89. | i, 177 |
| (See notes, ii, 2800.) | | | Austin Bayou, Tex. | U-37. | i, 735 |
| Au Dles Bayou, La. | S-358. | i, 684 | Austin Cr., Kans. | GG-1193. | i, 1034 |
| Aughwick Cr., Pa. | J-889. | i, 337 | Austins Run, Va. | K-108. | i, 374 |
| Augialze R., Ohio. | QQ-10. | i, 1461 | Aux Bees Scies, Mich. | OO-53. | i, 1409 |
| Au Gres R., Mich. | PP-58. | i, 1419, 1435 | Aux Bees Scies H., Mich.: | | |
| Augusta, Ga. (above), Sa- vannah R. | O-2-d. | i, 544 | Appro. | | ii, 2298 |
| Augusta, Ga. (Savannah R. at). | O-2-f. | i, 545 | Aux Plain R., Wis. | KK-16. | i, 1247 |
| Augusta Narrows, White R., Ark. | Y-23-g. | i, 832 | Auxvasse Cr., Mo. | GG-52. | i, 1025 |
| | | | (See notes, ii, 2813.) | | |
| | | | Awael H., H. I.: | | |
| | | | (See notes, ii, 2846.) | | |
| | | | Aydelotte Branch, Md. | J-25. | i, 331 |
| | | | Azeun R., Alaska. | XX-185. | i, 1656 |
| | | | Azun R. | XX-185. | i, 1651 |

B.

| | | | | | |
|--------------------------------|----------|-------------|--------------------------------|---------|----------|
| Babb Cr., Pa. | J-756. | i, 336 | Back Cr., Md. (continued). | J-1176. | i, 339 |
| Baboosic Brook, N. H. | B-38. | i, 69 | | J-1238. | i, 340 |
| Babruty Cr., Mo. | GG-1459. | i, 1036 | | K-10. | i, 373 |
| (See notes, p. ii, 2823.) | | | Wrecks. | | ii, 2263 |
| Babylon Cr., N. Y. | F-63. | i, 228 | Back Cr., N. C. | M-71. | i, 454 |
| Bacheldor Cr., N. C. | M-179. | i, 455 | | M-207. | i, 455 |
| Bachelor Cr., Iowa. | GG-286. | i, 1027 | Back Cr., N. J. | H-8. | i, 271 |
| Bachelor Cr., Mo. | GG-34. | i, 34 | | I-37. | i, 299 |
| (See notes, ii, 2813.) | | | Back Cr., Pa. | J-734. | i, 336 |
| Bachelor Cr., S. Dak.: | | | Back Cr., Va. | K-281. | i, 375 |
| (See notes, ii, 2814.) | | | | L-78. | i, 411 |
| Bachelor Isld. Slough. | (WW-2). | i, 1616* | | L-178. | i, 412 |
| Bachelors Isld. Slough, | | | | L-375. | i, 414 |
| Wash. | WW-42. | i, 1615 | | EE-89. | i, 983 |
| Back B., Biloxi, Miss. | R-78. | i, 646, 670 | Wrecks. | | ii, 2263 |
| Bridges. | | ii, 2144 | Backer Run, Pa. | J-822. | i, 337 |
| Back B., Handsboro, Miss. | R-78-a. | i, 670 | Back R. Cove, Me. | A-164. | i, 28 |
| Back B., Va. | L-233. | i, 413 | Back R., Ga. | O-115. | i, 534 |
| Back Cove, Md. | J-183. | i, 332 | | O-201. | i, 534 |
| Back Cove, Me.: | | | | O-225. | i, 534 |
| Appro. | | ii, 2288 | | O-426. | i, 536 |
| Bridges. | | i, 2144 | Bridges. | | ii, 2144 |
| Harbor lines. | | ii, 2253 | Back R. (Kennebec R.), Me. | A-220. | i, 28 |
| Back Cove, Portland H., Me. | A-263. | i, 29, 55 | Back R., Me. | A-163. | i, 28 |
| Back Cr., Md. | J-71. | i, 331 | | A-220. | i, 28 |
| | J-215. | i, 332 | Bridges. | | ii, 2144 |
| | J-244. | i, 333 | Back R., Md. | J-1067. | i, 339 |
| | J-357. | i, 333 | Bridges. | | ii, 2144 |
| | J-521. | i, 335 | Back R., Mass. | B-163. | i, 70 |
| | J-533. | i, 335 | | C-36. | i, 107 |
| | J-947. | i, 338 | Back R. (Sheepscot R.), Me. | A-206. | i, 28 |
| | J-1157. | i, 339 | Back R., S. C. | O-6. | i, 533 |
| | J-1167. | i, 339 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|----------------------|
| Back R., Va. | L-93..... | i, 412 | Bailse | (HH)..... | i, 1071* |
| | L-98..... | i, 417 | Bailze Bayou, La. | S-220..... | i, 683 |
| | L-115..... | i, 412 | Ballard, Wash.: Harbor lines..... | | ii, 2253 |
| Back, R., W. Va. and O.: Bridges..... | | ii, 2212 | Ball Club R., Minn.: Bridges..... | | ii, 2144 |
| Back Water Cr., Del. and Md. | J-119..... | i, 332 | Ball Cr., S. Dak. | GG-899..... | i, 1032 |
| Back (Weymouth) R., Mass. | B-193..... | i, 93 | | GG-904..... | i, 1032 |
| Back Wye R., Md. | J-391..... | i, 334 | Ball Cr., Va. | K-145..... | i, 374 |
| Bacolod, P. I. | YY-134..... | i, 1686 | | L-242..... | i, 413 |
| Bad Axe | (HH)..... | i, 1071* | Balloon Cr., Mont. | GG-724..... | i, 1030 |
| Bad Axe R., Wis. | KK-24..... | i, 1247 | Ballows Bayou, Tex.: (See notes, ii, 2806.) | | |
| Bad R., Mich. | PP-71..... | i, 1419 | Balls Cr., Md. | J-345..... | i, 333 |
| | PP-69-a..... | i, 1438 | Balls Cr., N. C. | M-140..... | i, 455 |
| Badger Cr., Colo. | GG-1111..... | i, 1033 | Baltimore Bend | (GG-2)..... | i, 1033* |
| (See notes, ii, 2820.) | | | Baltimore H., Md. | J-1090..... | i, 339, 366 |
| Badger Cr., Mont. | GG-485..... | i, 1028 | Appro..... | | ii, 2287, 2291 |
| Badger Cr., S. Dak. | GG-878..... | i, 1032 | Fortis..... | | ii, 1796, 1823, 1914 |
| (See notes, ii, 2819.) | | | Harbor lines..... | | ii, 2253 |
| Bad Land Cr., S. Dak. | GG-893..... | i, 1032 | Navigation rules..... | | ii, 2041, 2107 |
| (See notes, ii, 2819.) | | | Wrecks..... | | ii, 2263 |
| Bad R., S. Dak. | GG-857..... | i, 1031 | Baltimore, Md., District . J. | | i, 329 |
| (See notes, ii, 2819.) | | | Appro..... | | ii, 2291 |
| Bad R., Wis. | LL-33..... | i, 1265 | (See notes, ii, 2795.) | | |
| Baffins B., Tex. | U-71..... | i, 735 | Baltimore, Md., to Poto- mac R. (canal) | K-46-m..... | i, 385 |
| Bagaduce R., Me. | A-97..... | i, 27, 37 | Balza R., Alaska | XX-230..... | i, 1657 |
| Appro..... | | ii, 2287 | Banana Cr., Fla. | P-117..... | i, 570 |
| Bagleys Cr., La. | S-26..... | i, 681 | Banana R., Fla. | P-115..... | i, 570 |
| Bagwell Lake, Ark. | Y-53..... | i, 818 | Banger H., Me. | A-104..... | i, 28 |
| Bahia Honda, Fla. | P-192..... | i, 570 | Harbor lines..... | | ii, 2253 |
| Bridges..... | | ii, 2144 | Bannister Cr., N. Y. | F-77..... | i, 215, 379 |
| Balley Cr., Va. | L-152..... | i, 412 | Baptist Colets Bayou, La. | S-205..... | i, 682 |
| Balleys Cr., Mo. | GG-1516..... | i, 1036 | Baraboo R., Wis. | KK-20..... | i, 1247 |
| (See notes, ii, 2824.) | | | Barataria | (HH)..... | i, 1071* |
| Balleys Cr., N. C. | M-106..... | i, 455 | Barataria B., La. | S-339..... | i, 684 |
| Balleys Cut, Ga. | O-464..... | i, 536 | Forts..... | | ii, 1976 |
| Bainbridge | (HH)..... | i, 1071* | Barataria B., La., Grand Pass to New Orleans | S-339..... | i, 698 |
| Baines Cr., Va.: Bridges..... | | ii, 2144 | Barataria Bayou, La. | S-357..... | i, 684 |
| Balsman Branch, Md. | J-1035..... | i, 338 | Private dams..... | | ii, 2249 |
| Baker B. | (WW-2)..... | i, 1616* | Barbadoes Pond, Md. | J-162..... | i, 332 |
| Baker Brook, N. H. | B-22..... | i, 69 | Barbary Bayou, La. | S-63..... | i, 681 |
| Baker Cove, Md. | J-554..... | i, 335 | Barber Cr., N. C. | M-81..... | i, 454 |
| Baker Cr., Va. | K-316..... | i, 375 | Barbers Cr., Ga. | O-292..... | i, 535 |
| Baker R., N. H. | B-28..... | i, 69 | Barbours Isld. R., Ga. | O-196..... | i, 534 |
| Baker R., Wash. | XX-95..... | i, 1655 | Barclay Branch, Mo. | GG-99..... | i, 1025 |
| Bakers and Willapa Bs., Wash. (canal between) | WW-69..... | i, 1652 | Bardel Canal, La. | S-198..... | i, 682 |
| Bakers B., Wash. | WW-69..... | i, 1615 | Barger Cr., Pa. | J-853..... | i, 337 |
| (See notes, ii, 2844.) | | | Bar H., Me. (breakwater) | A-52..... | i, 35 |
| Bakers Bar | GG-2..... | i, 1038 | Bar H., Me. | A-52..... | i, 27 |
| Bakers Cr., Ga. | O-128..... | i, 534 | Appro..... | | ii, 2287 |
| Bakers Isld. | (CC)..... | i, 909* | Forts..... | | ii, 1841 |
| Bakers Shoals | (GG-2)..... | i, 1038* | Bar H. and Bar Isld., Me.: Bridges..... | | ii, 2144 |
| Balabac, P. I. | YY-147..... | i, 1686 | Bark B., Wis. | LL-27..... | i, 1265 |
| Bald Cypress Branch, Del. | J-20..... | i, 331 | Bark Camp Cr., Ga. | O-127..... | i, 534 |
| Bald Eagle Cr., Pa. | J-824..... | i, 337 | Barker Cr., Md. | J-307..... | i, 333 |
| Bald Head Cove, Me. | A-242..... | i, 29 | Barker Cr., W. Va. | EE-27..... | i, 983 |
| Baldwin R., N. Y. | F-68..... | i, 215, 229 | Barlows R., Mass.: Bridges..... | | ii, 2144 |
| Baler B., P. I. | YY-91..... | i, 1686 | | | |
| Baleshed Dike | (HH)..... | i, 1071* | | | |
| (See notes, ii, 2830.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|------------------------------------|---------------------|----------------------------------|
| Barnegat and Great Egg | | | Bass H. Bar, Me. | A-57 | i, 27, 36 |
| H. Bs., N. J. (sound be- tween)..... | I-2-a | i, 300 | (See notes, ii, 2783.) | | |
| Barnegat B., N. J. | I-2 | i, 299 | Bass Isld., reef near, Lake | | |
| Bridges..... | I-2-b | i, 300 | Erie..... | QQ-15-b | i, 1467 |
| Barnegat Inlet, N. J. | I-2 | i, 299, 300 | Bassing H., Mass. | B-214 | i, 70 |
| Wrecks..... | | ii, 2264 | Bass Lake | (HH) | i, 1071* |
| Barnegat Light, N. J.: | | | Bass Lake, Ga. | O-266 | i, 535 |
| Wrecks..... | | ii, 2264 | Bass R., Mass. | B-94 | i, 69 |
| Barnes Cove, Md. | J-185 | i, 332 | (See notes, ii, 2786.) | C-7 | i, 107, 108 |
| Barnes Cr., La. | S-833 | i, 688 | Appro..... | | ii, 2288 |
| Barnes Cr., N. C. | L-308 | i, 413 | Bridges..... | | ii, 2144 |
| Barnes Cr., Va. | K-151 | i, 374 | Wrecks..... | | ii, 2264 |
| Barnes Landing Cr., Md. | J-188 | i, 332 | Bass R., Mich. | OO-26 | i, 1377 |
| Barnes Run | (CC) | i, 909* | Basswood Lake, Minn. | | |
| Barnes Sound, Fla. | P-168 | i, 570 | and Canada..... | KK-234 | i, 1249 |
| Barnett Cr., N. C. | L-258 | i, 413 | Bastian B., La. | S-326 | i, 683 |
| Barnetts Cr., Fla. | P-352 | i, 571 | Bastrop Bayou, Tex. | U-36 | i, 735, 756 |
| Barnstable B., Mass. | B-194 | i, 70, 100 | U-5-a..... | | i, 736 |
| Appro..... | | ii, 2288 | Appro..... | | ii, 2295 |
| Barnstable H., Mass. | B-186 | i, 70 | Bridges..... | | ii, 2144 |
| Barracks Chan., Fla. | P-199 | i, 570 | Batchelor B., N. C. | L-341 | i, 414 |
| Barracks, Jefferson, Mo.: | | | Batchelors Bend | (HH) | i, 1071* |
| (See Engineers)..... | | ii, 2039, 2056 | Bat Cr., Tenn. | AA-92 | i, 849 |
| Barrancas, Ft., Fla. | | ii, 1802, 1965 | Batemans Lake, La. | S-501 | i, 685 |
| Barren and Green Rs., | | | Bates Branch, Mo. | GG-30 | i, 1025 |
| Ky. (locks and dams, care and operating)..... | BB-7-d | i, 895 | Bates Chute | (HH) | i, 1071* |
| Barren Cr., Md. | J-118 | i, 332 | Bates Cr., Wyo.: | | |
| Barren R. | (CC) | i, 909* | (See notes, ii, 2820.) | | |
| Barren R. and L. and D. | | | Bates Isld. | (HH) | i, 1071* |
| 1, Bowling Green, Ky.... | BB-7 | i, 892 | Bates Isld. Bend. | (GG-2) | i, 1088* |
| Barren R., Ky. | BB-9 | i, 891 | Batesville, Miss.: | | |
| BB-7..... | | i, 892 | (See notes, ii, 2807.) | | |
| Appro..... | | ii, 2296 | Batesville, Miss., to mouth | | |
| Navigation rules..... | | ii, 2041, 2107 | of Coldwater R. | X-10-d | i, 791 |
| Barrington R., R. I.: | | | Bath Cr., Beaufort Co., | | |
| Bridges..... | | ii, 2144 | N. C. | M-70 | i, 454, 463 |
| Barrow Lake, Ga. | O-401 | i, 536 | Bath, Me.: | | |
| Barrows Canal, La. | S-449 | i, 685 | Harbor lines..... | | ii, 2253 |
| S-499..... | | i, 685 | Bath, Me. (gut opposite) | A-221 | i, 50 |
| Bridges..... | | ii, 2144 | Bat Isld. | (CC) | i, 903* |
| Bartholomew Bayou, Ark. | | | Baton Rouge | (HH) | i, 1071* |
| and La. | X-37 | i, 785, 808 | Batsells Bar | (HH) | i, 1071* |
| Appro..... | | ii, 2295 | Batsoms Cut | (HH) | i, 1071* |
| Bridges..... | | ii, 2144 | Batsons Cut (HH): | | |
| Bartholomew Bayou, La. | S-685 | i, 687 | (See notes, ii, 2827.) | | |
| Bridges..... | | ii, 2144 | Battalion of Engineers | | ii, 2039, 2053, 2058 |
| Bartletts Brook, Mass. | B-11 | i, 69 | Batteries | | ii, 1796, 1797, 1799, 1809, 1834 |
| Bartletts H., Me. | A-130 | i, 28 | Insular Possessions..... | | ii, 1809 |
| Bartletts Narrows, Me. | A-60 | i, 27 | Batteries, Pneumatic | | ii, 1809 |
| Barwick Bayou, La. | S-768 | i, 687 | Battery and Governors | | |
| Base Lines, Great Lakes | | ii, 2041, 2124 | Isld., N. Y. H., N. Y. | | |
| Basilan Straits, P. I. | YY-168 | i, 1686 | (channel between)..... | F-105-l | i, 241 |
| Basin (The), Ga. | O-496 | i, 536 | Battery Isld., Md. | J-556-e | i, 365 |
| Bass Chan., N. Y. | F-84 | i, 216 | Appro..... | | ii, 2291 |
| Bass Cr., Mass. | B-173 | i, 70 | Battery, N. Y. | F-105-l | i, 241 |
| B-187..... | | i, 70 | Harbor lines..... | | ii, 2253 |
| Bass Cr., Minn. | YY-87 | i, 1248 | Battery Reef, N. Y. | E-17 | i, 184 |
| Bass H., Mass. | C-7 | i, 108 | Battle Cr., Md. | K-16 | i, 373 |
| Bass H. Bar and Deer Isld. | | | Battle Cr., Mich. | OO-18 | i, 1377 |
| Thoroughfare, Me. | A-57-a | i, 36 | Battle Cr., Mont. | GG-438 | i, 1028 |
| | | | Battle Cr., Mont. and | | |
| | | | Canada: | | |
| | | | (See notes, ii, 2815.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|------------------------|
| Battle Cr., Nebr..... | GG-961..... | i, 1032 | Bay Ronquille, La..... | S-336..... | i, 684 |
| Battle Cr., S. Dak..... | GG-844..... | i, 1031 | Bay St. Elaine, La..... | S-454..... | i, 685 |
| (See notes, ii, 2819.) | | | Bay St. Louis, Miss..... | R-89..... | i, 646 |
| Battle Cr., Tenn..... | AA-192..... | i, 849 | Bridges..... | | ii, 2144 |
| Battle or La Barge Cr., N. Dak..... | GG-787..... | i, 1031 | Bay Shore, N. Y..... | F-62..... | i, 215, 228 |
| Battle Rapids..... | (HH)..... | i, 1071* | Bayston Branch, Md..... | J-1003..... | i, 338 |
| Batts Cr., Mo..... | JJ-119..... | i, 1026 | Bay Tambour, La..... | S-413..... | i, 684 |
| (See notes, ii, 2813.) | | | Bazile Cr., Nebr..... | GG-933..... | i, 1033 |
| Baudette R., Minn..... | KK-215..... | i, 1249 | (See notes, ii, 2819.) | | |
| Bridges..... | KK..... | ii, 2144 | Beach Chan., N. Y..... | F-80..... | i, 215 |
| Baums Cr., N. C..... | M-25..... | i, 454 | Beach Cr., S. C..... | N-115..... | i, 500 |
| Baxter Cr., N. Y..... | E-18..... | i, 177 | Beach Cr., Ga..... | O-503..... | i, 536 |
| Baxter Lake, Ga..... | O-477..... | i, 536 | Beach Cr., Va..... | K-183..... | i, 374 |
| Bay: | | | Beach Thoroughfare, N. J..... | I-20..... | i, 299, 303 |
| (See also last word of compound name be- ginning with "Bay.") | | | Bridges..... | | ii, 2145, 2183 |
| Bay Adams, La.: (See notes, ii, 2804.) | | | Beacon Cr., Ga..... | O-228..... | i, 534 |
| Bayamon R. (YY): (See notes, ii, 2845.) | | | Beaglin Branch, Md..... | J-101..... | i, 331 |
| Bay Batiste, La..... | S-340..... | i, 684 | Beaklance Bayou, La..... | S-580..... | i, 686 |
| Bay Boudreau, La..... | S-161..... | i, 682 | Bear Butte Cr., S. Dak..... | GG-836..... | i, 1031 |
| Bay Chaland, La..... | S-453..... | i, 685 | (See notes, ii, 2819.) | | |
| (See notes, ii, 2804.) | | | Bear Cabin Branch, Md..... | J-966..... | i, 338 |
| Bay Champagne, La..... | S-416..... | i, 684 | Bear Cr. (branch of Yazoo R.), Miss..... | X-14..... | i, 792 |
| Bay Chene Fleur, La..... | S-341..... | i, 684 | Bear Cr., Colo..... | GG-1090..... | i, 1033 |
| Bay City..... | (CC)..... | i, 909* | (See notes, ii, 2820.) | | |
| (HH)..... | | i, 1071* | Bear Cr. H., N. Y..... | RR-41-b..... | i, 1521 |
| Bay City H., Mich..... | PP-65..... | i, 1419 | Bear Cr., Ind..... | BB-17..... | i, 891 |
| Bay Coquette, La..... | S-312..... | i, 683 | Bear Cr., Ky..... | AA-272..... | i, 850 |
| Bay Cr., Ga..... | O-405..... | i, 536 | DD-103..... | | i, 960 |
| Bay des Illettes, La..... | S-407..... | i, 684 | DD-215..... | | i, 960 |
| (See notes, ii, 2804.) | | | T-2-jj..... | | i, 717 |
| Bayfield H., Wis..... | LL-30..... | i, 1282 | Bear Cr., La..... | | (See notes, ii, 2805.) |
| Bayfield, Wis..... | LL-30..... | i, 1265 | Bear Cr., Md..... | J-1084..... | i, 339 |
| Bay Horse Cr., Mont. and Wyo..... | GG-736..... | i, 1030 | Bridges..... | | ii, 2145 |
| (See notes, ii, 2818.) | | | Bear Cr., Miss..... | X-14..... | i, 785 |
| Bay Isld..... | (HH)..... | i, 1071* | Appro..... | | ii, 2295 |
| Bay Jacque, La..... | S-310..... | i, 683 | Bridges..... | | ii, 2145 |
| Bay Joe Wise, La..... | S-331..... | i, 683 | Bear Cr., Mo..... | GG-23..... | i, 1025 |
| Bay Long, La..... | S-335..... | i, 684 | GG-88..... | | i, 1025 |
| Bay Lourse, La..... | S-401..... | i, 684 | GG-231..... | | i, 1026 |
| Bay Marchand, La..... | S-418..... | i, 684 | GG-1429..... | | i, 1036 |
| Bay Natchez, La..... | S-517..... | i, 685 | (See notes, ii, 2813, 2814, 2823, 2824.) | | |
| Bay of Superior (entrance to)..... | LL-18-a..... | i, 1271 | Bear Cr., Nebr..... | GG-912..... | i, 1032 |
| Bayonne, N. J.: Harbor lines..... | | ii, 2253 | (See notes, ii, 2819.) | | |
| Bayou (see the word or name which usually accompanies this word or name). | | | Bear Cr., N. C..... | M-89..... | i, 454 |
| Bay Pompadour, La..... | S-322..... | i, 683 | M-133..... | | i, 455 |
| Bay Portage, Miss..... | R-90..... | i, 646 | M-289..... | | i, 456 |
| Bay Ridge Chan., N. Y. H., N. Y..... | F-105-g..... | i, 239 | Bear Cr., N. Dak..... | GG-314..... | i, 1027 |
| Bay R., Ark..... | Y-54..... | i, 839 | Bear Cr., Ohio..... | DD-343..... | i, 961 |
| Bay R. to Pamlico R., N. C. (waterway)..... | M-123-a..... | i, 465 | DD-447..... | | i, 962 |
| Bay R., N. C..... | M-130..... | i, 455 | Bear Cr., Pa..... | J-604..... | i, 335 |
| Appro..... | | ii, 2292 | Bear Cr., Wyo..... | GG-1018..... | i, 1033 |
| Bridges..... | | ii, 2144 | (See notes, ii, 2820.) | | |
| | | | Beard Cr., Cal..... | TT-44..... | i, 1555 |
| | | | Beard Cr., Ga..... | O-93..... | i, 533 |
| | | | Beards Bayou, Tex.: (See notes, ii, 2806.) | | |
| | | | Beards Cr., Md..... | J-1254..... | i, 340 |
| | | | Beards Cr., N. C..... | M-164..... | i, 455 |
| | | | Beards Isld..... | (HH)..... | i, 1071* |
| | | | Beards Lake, Tex.: (See notes, ii, 2806.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|--------------------------|-------------------|--|---------------------|-------------------|
| Bear Head Cr., La..... | S-852..... | i, 688 | Beaufort, N. C., to Charleston, S. C. (wa- terway)..... | N-204..... | i, 500 |
| Bear Hole Fork, W. Va..... | EE-35..... | i, 983 | Beaufort, N. C., to North R. (waterway)..... | M-256..... | i, 456 |
| Bear in the Lodge Cr., S. Dak..... | GG-889..... | i, 1032 | Beaufort R., S. C..... | N-259..... | i, 501, 528 |
| (See notes, ii, 2819.) | | | Wrecks..... | | ii, 2264 |
| Bear Isld. Lake, Minn.: Private dams..... | | ii, 2249 | Beaufort - Charleston, S. C. (Inland waterway be- tween)..... | N-204..... | i, 522 |
| Bear Meadow Brook, Mass..... | B-9..... | i, 69 | Beaufort to Charleston: Wrecks..... | | ii, 2265, 2269 |
| Bear R., Cal. (see Cal. Débris Comm.)..... | | i, 1580 | Beaufort-Newbern, N. C. (waterway)..... | M-196..... | i, 455 |
| Bear R., Cal..... | TT-170..... | i, 1556 | | M-271..... | i, 456 |
| Bear R., Ga..... | UU-58..... | i, 1577 | Beaufort, S. C.: Appro..... | | ii, 2292 |
| Bears Cut, Fla..... | O-165..... | i, 534 | Beaufort to Newbern, N. C. (Inland line of navi- gation between, via Clubfoot, Harlow, and Newport Rs.)..... | M-257-f..... | i, 477 |
| Bearse Shoal, Mass.: Wrecks..... | P-157..... | i, 570 | (See notes, ii, 2797.) | | |
| Beasleys B., N. C..... | | ii, 2264 | Beaufort, Tex., Neches R. to..... | T-3-b..... | i, 719 |
| Beau Bayou, La..... | L-223..... | i, 413 | Beaumont, Tex.: (See notes, ii, 2806.) | | |
| Beauchamp Cr., Mont..... | S-635..... | i, 686 | Beauvais Fork, Mont. and Wyo..... | GG-679..... | i, 1030 |
| (See notes, ii, 2816.) | GG-466..... | i, 1028 | (See notes, ii, 2817.) | | |
| Beaufort H., N. C. (see "Beaufort" below)..... | | | Beaver B., Minn..... | LI-11..... | i, 1265 |
| | M-257..... | i, 456 | Beaver B., Minn. (harbor of refuge)..... | LI-11..... | i, 1269 |
| | M-257-a..... | i, 472 | Beaver Bayou, La..... | S-89..... | i, 682 |
| Beaufort H., N. C.: Appro..... | | ii, 2292 | Beaver Brook, Mass..... | B-13..... | i, 69 |
| Fortis..... | | ii, 1936 | Beaver Cr., Colo..... | GG-1030..... | i, 1033 |
| Wrecks..... | | ii, 2264 | (See notes, ii, 2820.) | | |
| Beaufort H., N. C., New R. to..... | M-257-e..... | i, 476 | Beaver Cr., Colo. and Wyo.: (See notes, ii, 2820.) | | |
| Beaufort H., N. C., North R. to (water route)..... | M-257-d..... | i, 476 | Beaver Cr., Colo., Kans., and Nebr..... | GG-1304..... | i, 1035 |
| Beaufort H., N. C. (water- ways to or from)..... | M-257-c-f..... | i, 474 | Beaver Cr., Iowa..... | GG-263..... | i, 1027 |
| Beaufort Inlet, N. C..... | M-258..... | i, 456 | | GG-272..... | i, 1027 |
| | M-258-a..... | i, 478 | Beaver Cr., Kans..... | GG-1314..... | i, 1035 |
| Appro..... | | ii, 2292 | (See notes, ii, 2822.) | | |
| Beaufort Inlet, N. C., and waterways to or from..... | M-258..... | i, 478 | Beaver Cr., Ky..... | AA-273..... | i, 850 |
| Beaufort Inlet, N. C., to Norfolk H., Va..... | L-173-k..... | i, 435 | | DD-238..... | i, 961 |
| Beaufort Inlet to Pamlico Sound, N. C. (Inland waterway)..... | | | | AA-239..... | i, 878 |
| | M-205..... | i, 545 | Beaver Cr., Left Fork, Ky..... | DD-244..... | i, 961 |
| | M-268..... | i, 456 | Beaver Cr., La..... | S-43..... | i, 681 |
| Beaufort Inlet to Pamlico Sound, N. C. (Inland waterway via Adams Cr.)..... | M-205..... | i, 471 | | S-69..... | i, 681 |
| Navigation rules..... | | ii, 2041, 2107 | | S-771..... | i, 687 |
| Beaufort Inlet to South Mills, N. C. (waterway via)..... | M-258-b..... | i, 479 | Beaver Cr., Minn..... | KK-147..... | i, 1248 |
| Beaufort, N. C.: (See notes, ii, 2797.) | | | Beaver Cr., Mo..... | Y-40..... | i, 818 |
| Appro..... | | ii, 2292 | | GG-1525..... | i, 1037 |
| Fortis..... | | ii, 1807, 1935 | | GG-1531..... | i, 1037 |
| Wrecks..... | | ii, 2264 | (See notes, ii, 2824.) | | |
| Beaufort, N. C. (break- water)..... | M-257-b..... | i, 474 | Beaver Cr., Mont..... | GG-455..... | i, 1028 |
| Beaufort, N. C., to Bos- ton, Mass. (Intracoastal waterway)..... | M-257-c.i, 474; ii, 2116 | | | GG-509..... | i, 1029 |
| | | | | GG-562..... | i, 1029 |
| | | | | GG-717..... | i, 1030 |

(See notes, ii, 2816, 2818.)

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Beaver Cr., Nebr. | GG-936.....i, | 1032 | Beaver R., Pa. | FF-38.....i, | 1021 |
| | GG-969.....i, | 1032 | Beaver Run Cr., Ga. | O-369.....i, | 535 |
| | GG-1290.....i, | 1035 | Beaver Run Cr., Ohio. | DD-356.....i, | 962 |
| (See notes, ii, 2819, 2822.) | | | Beaver Run, Md. | J-1137.....i, | 339 |
| Beaver Cr., Nebr., Kans., and Colo.: | | | Beaver Run, Ohio. | DD-406.....i, | 962 |
| (See notes, ii, 2822, 2823.) | | | Beaver Slough. | (WW-2).....i, | 1616* |
| Beaver Cr., N. Dak. | GG-316.....i, | 1027 | Beaver Slough, Cal. | UU-49.....i, | 1577 |
| | GG-389.....i, | 1028 | Beaver Slough, Oreg. | VV-14.....i, | 1593 |
| | GG-406.....i, | 1028 | | WW-19.....i, | 1615 |
| (See notes, ii, 2815.) | | | Bechnel Bayou, La. | S-382.....i, | 684 |
| Beaver Cr., N. Dak. and Mont. | GG-755.....i, | 1031 | Beck Cr., Pa. | J-585.....i, | 335 |
| (See notes, ii, 2818.) | | | Becks Landing. | (HH).....i, | 1071* |
| Beaver Cr., Ohio. | DD-369.....i, | 962 | Beckwith Cr., La. | S-846.....i, | 688 |
| | DD-448.....i, | 962 | Beckwith Cr., Md. | J-242.....i, | 332 |
| Beaver Cr., Pa. | J-593.....i, | 335 | Bedico Cr., La. | S-30.....i, | 681 |
| | J-909.....i, | 337 | Bedloes Isld., New York | | |
| Beaver Cr., S. C. | N-119.....i, | 500 | H., N. Y.: | | |
| Beaver Cr., S. Dak. | GG-289.....i, | 1027 | Forts. | ii, | 1807, 1881 |
| | GG-346.....i, | 1027 | Bee Branch, Mo. | GG-161.....i, | 1026 |
| | GG-845.....i, | 1031 | Bee Cr. | (GG-2).....i, | 1038* |
| | GG-853.....i, | 1031 | Bee Cr., Mo.: | | |
| (See notes, ii, 2814, 2815, 2819.) | | | (See notes, ii, 2814.) | | |
| Beaver Cr., S. Dak. and Wyo.: | | | Beech Cr., Pa. | J-825.....i, | 337 |
| (See notes, ii, 2819.) | | | Beech Cr., Tenn. | AA-130.....i, | 849 |
| Beaver Cr., Tenn. | AA-124.....i, | 849 | | AA-224.....i, | 850 |
| | AA-159.....i, | 849 | Beech Cr., W. Va. | DD-320.....i, | 961 |
| Beaver Cr., Wyo. | GG-691.....i, | 1030 | Beech Cr., W. Va. and Va. | DD-308.....i, | 961 |
| | GG-1044.....i, | 1033 | Beech Fork, Ky. | DD-123.....i, | 960 |
| (See notes, ii, 2817, 2820.) | | | Beech Fork, Middle Fork, Kentucky R., Ky. | DD-78.....i, | 969 |
| Beaver Cr., Wyo. and Colo. | GG-1026.....i, | 1033 | Beech Fork, W. Va. | EE-7.....i, | 983 |
| (See notes, ii, 2820.) | | | Beechridge. | (HH).....i, | 1071* |
| Beaver Dam. | (HH).....i, | 1071* | Beech R., Tenn. | AA-27.....i, | 848, 869 |
| (See notes, ii, 2827.) | | | Bee Cr., Mo. | GG-225.....i, | 1026 |
| Beaverdam Branch, Md. | J-303.....i, | 333 | Beef R., Wis. | KK-29.....i, | 1247 |
| | K-86.....i, | 376 | Beef Slough. | (HH).....i, | 1071* |
| Beaver Dam Cr., Ga. | O-29.....i, | 533 | Beetree Run, Md. and Pa. | J-1013.....i, | 338 |
| | O-66.....i, | 533 | Belceger Cr., N. Dak.: | | |
| | O-71.....i, | 533 | (See notes, ii, 2818.) | | |
| Beaver Dam Cr., La. | S-251.....i, | 683 | Belceger Cr., N. Dak. | GG-768.....i, | 1031 |
| Beaverdam Cr., S. C. | N-38.....i, | 499 | Belfast B. and H., Me. | A-137-a.....i, | 42 |
| Beaverdam Cr., Md. | J-30.....i, | 331 | Belfast B., Me. | A-137.....i, | 28 |
| | J-97.....i, | 331 | Appro. | ii, | 2287 |
| | J-142.....i, | 332 | Bridges. | ii, | 2145 |
| | J-159.....i, | 332 | Belfast H., Me. | A-138.....i, | 28 |
| | J-225.....i, | 332 | (See notes, ii, 2783.) | | |
| Beaver Dam Cr., N. C. | M-107.....i, | 455 | Appro. | ii, | 2287 |
| Beaverdam Cr., S. C. | N-156.....i, | 500 | Belfast R., Ga. | O-175.....i, | 534 |
| | N-175.....i, | 500 | Belhaven, N. C. | M-58-a.....i, | 460 |
| Beaverdam Ditch, Md. | J-298.....i, | 333 | Bellaire Bayou, La.: | | |
| Beaverdam Run, Md. | J-1033.....i, | 338 | (See notes, ii, 2804.) | | |
| Beaver Dam Run, Pa. | J-814.....i, | 337 | Bellaire, Ohio. | (CC).....i, | 909* |
| Beaver Head R., Mont. | GG-517.....i, | 1029 | Bellamy R., N. H. | A-286.....i, | 29, 63 |
| (See notes, ii, 2816.) | | | Appro. | ii, | 2288 |
| Beaver Isld. | (HH).....i, | 1071* | Bell Cr., Md. | J-274.....i, | 333 |
| Beaver Pond Bayou, La. | S-86.....i, | 682 | Bell Cr., Mont. | GG-549.....i, | 1029 |
| Beaver R. | (CC).....i, | 909* | Belle Cr., Minn. | JJ-33.....i, | 1234 |
| Beaver R. Cr., Ga. | O-382.....i, | 536 | Bellefontaine. | (GG-2).....i, | 1038* |
| Beaver R., Ohio and Pa. | FF-38.....i, | 1003 | Belle Fourche R., S. Dak. and Wyo.: | | |
| | | | (See notes, ii, 2818.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Belle H., N. Y.: | | | Bennetts Cr., N. C. | L-305 | i, 443 |
| Harbor lines | | ii, 2253 | Bennetts Cr., Va.: | | |
| Belle Isle Inlet, Mass. | B-116 | i, 70 | Bridges | | ii, 2145 |
| Belle Pt. Cr., Ga. | O-427 | i, 536 | Bennetts R., N. C. | L-305 | i, 443 |
| Belle R., La. | S-514 | i, 685 | Bennie Field Lake, Ga. | O-316 | i, 535 |
| Belle R., Mich. | PP-92 | i, 1419 | Ben Run, Md. | J-1115 | i, 339 |
| Appro. | | ii, 2299 | Benson Cr., Ky. | DD-9 | i, 959 |
| Bridges | | ii, 2145 | Bentley Cove, Md. | J-217 | i, 332 |
| Wrecks | | ii, 2264 | Bentley Cr., N. Y. and Pa. | J-650 | i, 336 |
| Belle R., Mich. (Ice harbor of refuge) | PP-92 | i, 1447 | Benton H., Mich. | OO-2-a | i, 1379 |
| Belleville Cr., Va. | K-282 | i, 375 | Benton Isld. | (HH) | i, 1071* |
| Belleville Isld. | (CC) | i, 909* | Bents Cr., Mass. | B-140 | i, 70 |
| Bellevue | (HH) | i, 1071* | Benwood | (CC) | i, 909* |
| Belfontaine Bayou, Miss. | R-74 | i, 646 | Berard Bayou, La. | S-629 | i, 686 |
| Bell Gap Run, Pa. | J-868 | i, 337 | Bergen Neck, N. J. | G-5 | i, 247 |
| Bellingham B. and H., Wash. | XX-103 | i, 1675 | Harbor lines | | ii, 2253 |
| (See notes, ii, 2845.) | | | Bergen Neck, N. J. (ship canal across) | G-5 | i, 248 |
| Appro. | | ii, 2301 | Bergen Pt., N. J. | E-28-c | i, 195 |
| Harbor lines | | ii, 2253 | Bering Sea | XX-161 | i, 1656 |
| Bellingham B., Wash. | XX-103 | i, 1655 | Beris Branch, Mo. | GG-1513 | i, 1036 |
| Harbor lines | | ii, 2253 | Bermudian Cr., Pa. | J-910 | i, 337 |
| Bellingham, Wash.: | | | Bernards Bayou, Miss. | R-82 | i, 646 |
| Harbor lines | | ii, 2253 | Bridges | | ii, 2145 |
| Belmans Cr., N. J. | G-11 | i, 247 | Berrien Isld., N. Y.: | | |
| Bridges | | ii, 2145 | Harbor lines | | ii, 2253 |
| Bellows B., N. C. | L-239 | i, 413 | Berrians Cr., N. Y. | F-4 | i, 215, 216 |
| Bellport B., N. Y. | F-55 | i, 215 | Berry Lake, Ind. | NN-18-c | i, 1366 |
| Bell Run, Pa. | J-807 | i, 337 | Berry Run, Md. | J-275 | i, 333 |
| Bells B., N. C. | M-40 | i, 454 | Berrys Cr., N. J. | G-13 | i, 247 |
| Bells Cr., N. C. | M-267 | i, 456 | Bridges | | ii, 2145 |
| Bells Cr., Va. | K-154 | i, 374 | Berwick B., La. | S-502 | i, 685, 703 |
| Bells Cr., W. Va. | EE-125 | i, 984 | Bridges | | ii, 2145 |
| Bellsire Bayou, La. | S-646 | i, 686 | Bete Grise B., Mich. | LE-39 | i, 1265 |
| (See notes, ii, 2804.) | | | Bethel Cr., Fla. | P-113 | i, 570 |
| Bellsman Cr., S. Dak. | GG-799 | i, 1031 | Bethel Cr., N. C. | L-294 | i, 413 |
| (See notes, ii, 2818.) | | | Betsie R., Mich. | OO-54 | i, 1377 |
| Bells R., Fla. | O-524 | i, 537 | Betsy Slough | (HH) | i, 1071* |
| | O-528 | i, 537 | Betts Cr., Kans.: | | |
| Belmont B., Va. | K-99 | i, 373 | (See notes, ii, 2821.) | | |
| Belmont Bend | (GG-2) | i, 1038* | Betty Bowman Cr., Ky. | DD-27 | i, 959 |
| Belmont Slough, Cal. | TT-20 | i, 1555 | Beulah Lake | (HH) | i, 1071* |
| Belt Cr., Kans. | GG-1182 | i, 1034 | Bevens Cr., Minn. | KK-141 | i, 1248 |
| Belt Cr., Mont.: | | | Beverly Run, Va. | K-306 | i, 375 |
| (See notes, ii, 2816.) | | | Beverly Cove, Mass. | B-90 | i, 69 |
| Belvedere and Tiburon, Cal.: | | | Beverly Cr., Mass. | B-94 | i, 69 |
| Bridges | | ii, 2145 | Beverly H., Mass. | B-92 | i, 69, 80 |
| Belvidere H., San Fran- cisco B., Cal. | TT-129-b | i, 1568 | (See notes, ii, 2784.) | | |
| Bemidji, Minn. | (HH) | i, 1071* | Appro. | | ii, 2288 |
| Bena, Minn. | (HH) | i, 1071* | Bridges | | ii, 2145 |
| Ben Cr., W. Va. | DD-319 | i, 961 | Biddeford Pool, Me.: | | |
| Benclia: | | | Wrecks | | ii, 2264 |
| Harbor lines | | ii, 2253 | Biddleford Pool, Me. | A-270 | i, 29 |
| Benjamin R., Me. | A-79 | i, 27 | Blennvenue Bayou, La. | S-145 | i, 682 |
| Bennets Bayou, Ark. and Mo. | Y-37 | i, 818 | Battery | | ii, 1803 |
| Bennett Branch, Pa. | J-790 | i, 337 | Blennvenue, Ft. | | ii, 1976 |
| Bennett Cr., N. C. | L-305 | i, 413 | Big and Little Fork Rs., Minn. | KK-218-a | i, 1262 |
| Bennett Cr., N. Y. | J-668 | i, 336 | Big Annemessex R., Md. | J-51 | i, 331 |
| Bennett Cr., Pa. | J-688 | i, 336 | Big Barren Cr., Tenn. | AA-166 | i, 849 |
| Bennett Cr., Va. | L-91 | i, 412, 417 | Big Barren R., Ky. (above mouth of), Green R. | BB-7-b | i, 893 |
| Bennett Cr., Va. | L-169 | i, 412 | Big Barren R., Ky. (exten- sion of slackwater im- provement) | BB-7-e | i, 896 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Big Bay de Noc, Mich. | MM-4..... | i, 1297 | Big Cottonwood Cr., | | |
| Big B., Mich. | LL-50..... | i, 1265 | Nebr.: | | |
| Big Bayou Canal, Ala. | R-42..... | i, 646 | (See notes, ii, 2810.) | | |
| Big Bayou Castaing, La. ... | S-17..... | i, 681 | Big Cottonwood R., Minn. | KK-159..... | i, 1248 |
| Big Bear Cr., Ala. and | | | Big Coulee Cr., Mont. | GG-593..... | i, 1029 |
| Miss. | AA-34..... | i, 848 | (See notes, ii, 2817.) | | |
| Big Bear Cr. (branch of | | | Big Cowan Cr., Ky. | DD-132..... | i, 960 |
| Tennessee R.), Miss. | AA-34..... | i, 869 | Big Cr., Ark. | Y-24..... | i, 818 |
| Big Bear Cr. (communi- | | | Big Cr., Cal. | TT-160..... | i, 1556 |
| cation with Tennessee | | | Big Cr., Ga. | O-131..... | i, 534 |
| by way of). | R-23-c..... | i, 653 | O-272..... | | i, 535 |
| Big Bear Cr., Pa. | J-728..... | i, 336 | O-276..... | | i, 535 |
| Big Beaver Cr., La. | S-80..... | i, 681 | O-483..... | | i, 536 |
| Big Beaver Cr., S. C. | N-196..... | i, 500 | Big Cr., Kans. | GG-1330..... | i, 1035 |
| | N-231..... | i, 500 | (See notes, ii, 2822.) | | |
| Big Beaver Cr., Wyo. and | | | Big Cr., Ky. | DD-119..... | i, 960 |
| Colo. | GG-1027..... | i, 1033 | DD-280..... | | i, 961 |
| Big Beaver R., Pa., to Ohio | | | DD-297..... | | i, 961 |
| Canal (for canal). | FF-38-a..... | i, 1021 | Big Cr., La. | S-38..... | i, 681 |
| Big Bend. | (WW-2)..... | i, 1616* | Big Cr., Mo. | GG-144..... | i, 1026 |
| Big Berger Cr., Mo. | GG-1541..... | i, 1037 | GG-207..... | | i, 1026 |
| (See notes, ii, 2824.) | | | Big Cr., Mo. and La.: | | |
| Big Black. | (HH)..... | i, 1071* | (See notes, ii, 2814, 2824.) | | |
| Big Blackfoot R. | (WW-2)..... | i, 1616* | Big Cr., N. C. | M-214..... | i, 455 |
| Big Black R., Miss. | X-3..... | i, 785, 786 | Big Cr., Ohio. | QQ-30..... | i, 1461 |
| Appro..... | | ii, 2295 | QQ-30-a..... | | i, 1485 |
| Bridges..... | | ii, 2145 | Appro..... | | ii, 2299 |
| Big Blaine Cr., Ky. | DD-216..... | i, 960 | Big Cr., S. C. | N-186..... | i, 500 |
| Big Blue R. | (CC)..... | i, 909* | Big Cr., Tenn. | AA-141..... | i, 849 |
| Big Blue R., Mo. and | | | AA-170..... | | i, 849 |
| Kans.: | | | Big Cr., W. Va. | EE-51..... | i, 983 |
| (See notes, ii, 2823.) | | | Big Cr., Wyo.: | | |
| Big Blue R., Ind. | BB-15..... | i, 891 | (See notes, ii, 2820.) | | |
| Big Blue R., Nebr. and | | | Big Crow Cr., Ala. and | | |
| Kans. | GG-1248..... | i, 1034 | Tenn. | AA-194..... | i, 849 |
| (See notes, ii, 2821.) | | | Big Cub Cr., W. Va. | EE-40..... | i, 983 |
| Big Box Elder Cr., Mont. .. | GG-575..... | i, 1029 | Big Dam. | (HH)..... | i, 1071* |
| (See notes, ii, 2816.) | | | Big Dam Swamp, S. C. | N-84..... | i, 499 |
| Big Box Elder Cr., N. | | | Big Ditch, N. C. | M-228..... | i, 456 |
| Dak., S. Dak., and | | | Big Dry Cr., Mont. | GG-609..... | i, 1029 |
| Mont.: | | | (See notes, ii, 2817.) | | |
| (See notes, ii, 2818.) | | | Big Duckett Cr., Mo. | GG-5..... | i, 1025 |
| Big Branch, Ky. | DD-144..... | i, 960 | (See notes, ii, 2813.) | | |
| | DD-153..... | i, 960 | Big Eddy. | (WW-2)..... | i, 1616* |
| | DD-158..... | i, 960 | Big Eddy Cr., Kans. | GG-1177..... | i, 1034 |
| | DD-162..... | i, 960 | Big Elk Cr., Md. | J-539..... | i, 335 |
| | DD-171..... | i, 960 | Big Elk Cr., Mont. | GG-589..... | i, 1029 |
| Big Branch, Pa. | J-927..... | i, 338 | Big Elk R., Oreg. | VV-48..... | i, 1593 |
| Big Buffalo Cr., Nebr. | GG-979..... | i, 1032 | | VV-45..... | i, 1607 |
| Big Buffalo Cr., S. C. | N-68..... | i, 499 | Bigelow Cr., Mo. | GG-9..... | i, 1025 |
| Big Bull Cr., S. C. | N-23..... | i, 499 | (See notes, ii, 2813.) | | |
| Big Bull Swamp, S. C. | N-227..... | i, 500 | Big Fishing Cr., Pa. | J-832..... | i, 337 |
| Big Burley Cr., Md. | J-1169..... | i, 339 | Big Flat Cr., Ga. | O-354..... | i, 535 |
| Big Buzzard Cr., Ga. | O-240..... | i, 534 | Big Flat Cr., Tenn. | AA-147..... | i, 849 |
| Big Carlos Pass, Fla. | P-226..... | i, 570 | Big Fork and Little Shoals | | |
| Big Carrion Crow Bayou, | | | R., Minn.: | | |
| La. | S-488..... | i, 685 | Bridges..... | | ii, 2145 |
| Big Catawissa Cr., Pa. | J-619..... | i, 335 | Big Fork R., Minn. | KK-218..... | i, 1249 |
| Big Cedar Cr., Ga. | O-25..... | i, 533 | Bridges..... | | ii, 2145 |
| Big Cheyenne R., S. Dak. | GG-823..... | i, 1031 | Logs, floating..... | | ii, 2041, 2109 |
| Big Coal R., W. Va. | EE-68-a..... | i, 994 | Big Fox Cr., Va. | DD-270..... | i, 961 |
| | EE-71..... | i, 983 | Big Goddel, La. | S-515..... | i, 685 |
| Big Cohasie R., N. C. | M-315..... | i, 456 | Big Grave Cr., W. Va. and | | |
| | | | Pa. | EE-191..... | i, 984 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Biggs Rapids | (WW-2)..... | i, 1616* | Big R., Wis. | KK-46..... | i, 1247 |
| Big Guana Cr., W. Va. | EE-153..... | i, 984 | Big Rosebud R., Mont. | GG-671..... | i, 1030 |
| Big Hatchle R., Tenn. | AA-4..... | i, 851 | (See notes, ii, 2817.) | | |
| Appro..... | | ii, 2296 | Big Run Cr., Ohio | DD-344..... | i, 961 |
| Bridges..... | | ii, 2145 | Big Run, Pa. | J-826..... | i, 337 |
| Big Haynes Cr., Ga. | O-357..... | i, 535 | | J-903..... | i, 337 |
| Big Hickory Pass, Fla. | P-223..... | i, 570 | Big Run, W. Va. | EE-46..... | i, 983 |
| Big Hocking | (CC)..... | i, 909* | Big Sable R., Mich. | OO-46..... | i, 1377 |
| Big Hocking R., Ohio | DD-442..... | i, 962, 978 | Big Sage Cr., Wyo. | GG-1019..... | i, 1033 |
| Big Hog Bayou, La. | S-660..... | i, 686 | (See notes, ii, 2820.) | | |
| Big Hole R., Mont.: | | | Big Salkehatchie R. | N-255..... | i, 501 |
| (See notes, ii, 2816.) | | | Big Sandy Cr., Ga. | O-286..... | i, 535 |
| Big Horn R., Mont. and | | | | O-297..... | i, 535 |
| Wyo..... | GG-678..... | i, 1030 | Big Sandy Cr., Mont. | GG-446..... | i, 1028 |
| (See notes, ii, 2817.) | | | (See notes, ii, 2815.) | | |
| Bridges..... | | ii, 2145 | Big Sandy Cr., Nebr.: | | |
| Big Horse Cr., Ga. | O-395..... | i, 536 | (See notes, ii, 2822.) | | |
| Big Horse Cr., S. C. | O-8..... | i, 533 | Big Sandy Cr., N. Y. | RR-50-b..... | i, 1531 |
| Big Huff Cr., W. Va. | EE-42..... | i, 983 | Appro..... | | ii, 2299 |
| Big Hurricane Cr., Ga. | O-481..... | i, 536 | Big Sandy R., Ky. and | | |
| Big Hurricane Cr., W. Va. .. | DD-332..... | i, 961 | W. Va..... | (CC)..... | i, 909* |
| | EE-66..... | i, 983 | | DD-213..... | i, 960, 969 |
| Big Indian Cr., Ga. | O-384..... | i, 536 | | DD-213-b..... | i, 969 |
| Big Indian Cr., Ohio | DD-379..... | i, 962 | Appro..... | | ii, 2296 |
| Big Lotts Cr., Ga. | O-145..... | i, 534 | Bridges..... | | ii, 2145, 2210 |
| Big Lagoon, Cal. | TT-188..... | i, 1556 | Navigation rules..... | | ii, 2041, 2107 |
| Big Lake, Miss. | R-79..... | i, 646 | Big Sandy R., Ky. and | | |
| Big Marco Pass, Fla. | P-214..... | i, 570 | W. Va. (lock and dam, | | |
| Big Marco R., Fla. | P-215..... | i, 570 | operating and care)..... | DD-213-e..... | i, 974 |
| Big Miami | (CC)..... | i, 909* | Big Sandy R., Levisa | | |
| Big Miami R., Ohio | DD-491..... | i, 963 | Fork, Ky..... | DD-213-c..... | i, 972 |
| Big Mission Cr., Wash. | XX-57..... | i, 1655 | Big Sandy R., Ohio R. | EE-1..... | i, 983 |
| Big Monegaw Cr., Mo. | GG-1471..... | i, 1036 | Big Sandy R., Tenn. | AA-22..... | i, 848, 869 |
| (See notes, ii, 2824.) | | | | (AA-18)..... | i, 855 |
| Big Mouth Bayou, La. | S-787..... | i, 688 | Big Sandy R., Tug Fork, | | |
| Big Muddy Cr., Mont. | GG-495..... | i, 1029 | Ky..... | DD-213-d..... | i, 973 |
| (See notes, ii, 2816.) | | | Big Sarasota Pass, Fla. | P-282..... | i, 571 |
| Big Muddy R. | (HH)..... | i, 1071* | Big Scioto | (CC)..... | i, 909* |
| (See notes, ii, 2827, 2829.) | | | Big Sioux | (GG-2)..... | i, 1038* |
| Big Muddy R., Ill. | II-3..... | i, 1229 | Big Sioux R., Iowa and S. | | |
| Bridges..... | | ii, 2145 | Dak..... | GG-274..... | i, 1027, 1059 |
| Big Muddy R., Mont. and | | | | (GG-2)..... | i, 1037* |
| Canada..... | GG-412..... | i, 1028 | (See notes, ii, 2814.) | | |
| (See notes, ii, 2815.) | | | Big Slough | (WW-2)..... | i, 1616* |
| Big Nance Cr., Ala. | AA-41..... | i, 848 | Big Slough Cr., Kans. | GG-1206..... | i, 1034 |
| Big Nemaha R., Nebr. | | | (See notes, ii, 2821.) | | |
| and Kans..... | GG-1141..... | i, 1034 | Big Slough, Wash. | WW-52..... | i, 1615 |
| (See notes, ii, 2821.) | | | Big Solder Cr., Kans. | GG-1232..... | i, 1034 |
| Big Oak Bayou, La. | S-668..... | i, 687 | (See notes, ii, 2821.) | | |
| Big Pass, Clearwater H., | | | Big Splice Cr., Mo. | GG-1445..... | i, 1036 |
| Fla..... | P-322..... | i, 571 | (See notes, ii, 2823.) | | |
| Big Pigeon Bayou, La.: | | | Big Spring Cr., Ala. | AA-53..... | i, 848, 870 |
| Wrecks..... | | ii, 2264 | Big Stillwater, Ohio | DD-363..... | i, 962 |
| Big Pigeon R., Tenn. and | | | Big Stone Lake, Minn. | | |
| N. C..... | AA-121..... | i, 849 | and S. Dak..... | KK-153..... | i, 1248 |
| Big Piney Cr., Ark. | Y-6..... | i, 818 | | KK-153-a..... | i, 1256 |
| Big Pond, Md. | J-1262..... | i, 340 | | KK-170-c..... | i, 1258 |
| Big Porpoise B., N. C. | M-125..... | i, 455 | | KK-190..... | i, 1259 |
| Big Reed Isld. Cr., Va. | EE-102..... | i, 984 | | KK-190-b..... | i, 1260 |
| Big Rennix Cr., Ky. | AA-288..... | i, 850 | (See notes, ii, 2834.) | | |
| Big R., Alaska | XX-176..... | i, 1656 | Appro..... | | ii, 2297 |
| Big R., Cal. | TT-146..... | i, 1556 | Big Stony Islds., N. Y.: | | |
| Big R., Iowa and Mo. | GG-139..... | i, 1026 | Harbor lines..... | | ii, 2253 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Big Stranger Cr., Kans. | GG-1188..... | i, 1034 | Biloxi, Miss., Back B. | R-78..... | i, 646, 670 |
| (See notes, ii, 2821.) | | | Biloxi R., Miss. | R-80..... | i, 646 |
| Big Sugar Cr., Kans.: | | | Bridges..... | | ii, 2146 |
| (See notes, ii, 2824.) | | | Birch Cr., Mont. | GG-471..... | i, 1028 |
| Big Sugar Cr., Mo. | GG-1479..... | i, 1036 | (See notes, ii, 2816.) | GG-486..... | i, 1028 |
| Big Sugar Cr., S. C. | N-127..... | i, 500 | Birch H., Me. | A-41..... | i, 27 |
| Big Sunflower R., Miss. | X-15..... | i, 785, 792 | Birch Isld. Run, Pa. | J-797..... | i, 337 |
| Appro..... | | ii, 2295 | Birch Lake, Minn.: | | |
| Bridges..... | | ii, 2146 | Private dams..... | | ii, 2249 |
| Big Sur R., Cal. | TT-2..... | i, 1555 | Birch R., Minn. | KK-235..... | i, 1249 |
| Big Swamp, S. C. | N-62..... | i, 499 | Birch R., W. Va. | EE-143..... | i, 984 |
| Big Tarkio Cr., Iowa and | | | Bridges..... | | ii, 2146 |
| Mo. | GG-243..... | i, 1027 | Birchwood Cr., Nebr. | GG-984..... | i, 1032 |
| Big Tarkio Cr., Mo.: | | | Bird Cr., Mich. | PP-29..... | i, 1419 |
| (See notes, ii, 2814.) | | | Bird Cr., Mont. | GG-542..... | i, 1029 |
| Big Tavern Cr., Mo. | GG-49..... | i, 1025 | (See notes, ii, 2816.) | | |
| | GG-1504..... | i, 1036 | Bird Cr., Okla. | Y-14..... | i, 818 |
| | GG-1553..... | i, 1037 | Bird Isld. Sound, La. | S-204..... | i, 682 |
| (See notes, ii, 2813, 2824.) | | | Bird Pt., Mo. | II-11..... | i, 1229 |
| Big Thompson Cr., Colo. | GG-1086..... | i, 1033 | (See notes, ii, 2829, 2834.) | | |
| (See notes, ii, 2820.) | | | Bird R., Md. | J-1048..... | i, 339 |
| Big Thorofare, Md. | J-191..... | i, 332 | Birdsong Cr., Tenn. | AA-25..... | i, 848 |
| Big Thoroughfare R., Md. | J-190-a..... | i, 348 | Birds Pt. | (HH)..... | i, 1071* |
| Appro..... | | ii, 2291 | (See notes, ii, 2829.) | | |
| Big Timber Cr., Kans. | GG-1345..... | i, 1035 | Birds Rapids. | (GG-2)..... | i, 1038* |
| (See notes, ii, 2823.) | | | Birds Run, Ohio. | DD-360..... | i, 962 |
| Big Timber Cr., Mont. | GG-610..... | i, 1029 | Bird Tail Cr., Mont. | GG-501..... | i, 1029 |
| | GG-659..... | i, 1030 | Birdwood Cr., Nebr.: | | |
| (See notes, ii, 2817.) | | | (See notes, ii, 2820.) | | |
| Big Timber Cr., N. J. | I-49..... | i, 299 | Birmingham, Ala. (canal | | |
| Bridges..... | | ii, 2146 | from), to Warrior R..... | R-23-n..... | i, 662 |
| Big Timber Cr., S. Dak. | GG-827..... | i, 1031 | Biscayne B., Fla. | P-159..... | i, 570, 587 |
| (See notes, ii, 2818.) | | | Appro..... | | ii, 2293 |
| Big Tom Cr., Ga. | O-161..... | i, 534 | Bridges..... | | ii, 2146 |
| Big Tom, Ga. | O-167..... | i, 534 | Bischoffs Dike | (HH)..... | i, 1071* |
| Big Trout Cr., Minn. | JJ-52..... | i, 1234 | Bishops Canal Locks | | ii, 2041, 2106 |
| Big Trout Cr., Mont. | GG-563..... | i, 1029 | Bislig B., P. I. | YY-156..... | i, 1686 |
| (See notes, ii, 2816.) | | | Bismarek | (GG-2)..... | i, 1038* |
| Big Ugly Cr., W. Va. | EE-47..... | i, 983 | Bismarek, N. Dak. | (GG-2)..... | i, 1037* |
| Big Wan Cr., Tenn. | AA-164..... | i, 849 | Bissells Cove, R. I. | C-98..... | i, 108, 132 |
| Big Wapwallopen Cr., Pa. | J-622..... | i, 335 | Bissells Pt. | (HH)..... | i, 1071* |
| Big Wax Bayou, La. | S-653..... | i, 686 | (See notes, ii, 2827.) | | |
| Big Whiskey Cr., Iowa. | GG-267..... | i, 1027 | Bixbys Crossing | (HH)..... | i, 1071* |
| (See notes, ii, 2814.) | | | Black and Ouachita Rs., | | |
| Bijou Bayou, La. | S-512..... | i, 685 | La. and Ark..... | X-29..... | i, 802 |
| Bijou Cr., Colo. | GG-1110..... | i, 1033 | | X-29-a..... | i, 802 |
| (See notes, ii, 2820.) | | | Black B., La. | S-181..... | i, 682 |
| Biles Cr., Pa. | H-12..... | i, 271 | Black Bayou, La. | S-499..... | i, 685, 702 |
| Billups Cr., Va. | K-255..... | i, 375 | | S-533..... | i, 685 |
| Bill Williams Fork, Ariz. | SS-3..... | i, 1543 | | S-540..... | i, 685 |
| Biloxi | (HH)..... | i, 1071* | | S-550..... | i, 686 |
| Biloxi B. and H., Miss.: | | | | S-672..... | i, 687 |
| Appro..... | | ii, 2294 | | S-799..... | i, 688 |
| Biloxi B., Miss. | R-75..... | i, 646 | | T-2-f..... | i, 717 |
| | R-83..... | i, 670 | (See notes, ii, 2805.) | | |
| (See notes, ii, 2803.) | | | Appro..... | | ii, 2294 |
| Bridges..... | | ii, 2146 | Black Bayou, La. (be- | | |
| Biloxi Bayou, La. | S-155..... | i, 682 | tween Calcasieu Lake | | |
| Biloxi Chan., Miss. | R-84..... | i, 646 | and Sabine Lake)..... | S-799..... | i, 714 |
| Biloxi H., Miss. | R-83..... | i, 646, 670 | Blackberry Cr., Ky. | DD-299..... | i, 961 |
| Biloxi, Miss.: | | | Blackbird Cr., Del. | I-62..... | i, 299 |
| (See notes, ii, 2803.) | | | Blackbird Cr., Nebr. | GG-943..... | i, 1032 |
| Bridges..... | | ii, 2046 | (See notes, ii, 2819.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------|---------------------|-------------------|--------------------------------|---------------------|-------------------|
| Blackbird Isld. | (HH) | i, 1071* | Black R. B., N. Y. | RR-59 | i, 1493 |
| Blackbourne Cr., Va. | K-215 | i, 374 | Black R., La. | X-29 | i, 785 |
| Blackburn Branch, Md. | J-1148 | i, 339 | Bridges. .... | ..... | ii, 2146 |
| Black Cr., Fla. | P-30 | i, 569 | Black R., Mass.: ..... | ..... | ..... |
| ..... | Q-35 | i, 611 | Bridges. .... | ..... | ii, 2201 |
| Bridges. .... | ..... | ii, 2146 | Black R., Mich. | LL-34-b | i, 1284 |
| Black Cr., Ga. | O-73 | i, 533 | ..... | OO-14 | i, 1377 |
| ..... | O-143 | i, 534 | ..... | PP-52 | i, 1419 |
| Black Cr., La. | R-98-w | i, 647 | ..... | PP-89 | i, 1419, 1444 |
| ..... | S-74 | i, 681 | ..... | PP-90 | i, 1419 |
| ..... | S-100 | i, 682 | Appro. .... | ..... | ii, 2299 |
| ..... | S-818 | i, 688 | Bridges. .... | ..... | ii, 2147 |
| ..... | S-828 | i, 688 | Harbor lines. .... | ..... | ii, 2253 |
| Black Cr., Mont. | GG-435 | i, 1028 | Wrecks. .... | ..... | ii, 2264 |
| (See notes, ii, 2815.) | ..... | ..... | Black R., Mich. (mouth | ..... | ..... |
| Black Cr., N. C. | N-55 | i, 499 | of) | PP-89-a | i, 1444 |
| Black Cr., N. J. | H-5 | i, 271 | ..... | PP-89-b | i, 1445 |
| Black Cr., Ohio. | DD-378 | i, 962 | Black R., Minn. | KK-217 | i, 1249 |
| ..... | DD-404 | i, 962 | Black R., Miss. | R-68 | i, 646 |
| Black Cr., Pa. | J-590 | i, 335 | Bridges. .... | ..... | ii, 2146 |
| Black Cr., S. C. | N-59 | i, 499 | Black R., N. Y. | RR-60 | i, 1493 |
| ..... | N-228 | i, 500 | ..... | RR-59-a | i, 1532 |
| Black Cr. Shoal, N. Y., | ..... | ..... | ..... | RR-59-b | i, 1533 |
| Lake Ontario. | RR-45-b | i, 1524 | Appro. .... | ..... | ii, 2299 |
| Blackfeet Cr., S. Dak. | GG-790 | i, 1031 | Black R., N. C. | M-312 | i, 456, 492 |
| Blackfish Bayou, Ark. | Y-50 | i, 818 | Appro. .... | ..... | ii, 2292 |
| ..... | Y-47-d | i, 838 | Bridges. .... | ..... | ii, 2146-2147 |
| Black Fish Cr., Mass. | B-202 | i, 70 | Wrecks. .... | ..... | ii, 2264 |
| Blackfish Lake, La. | S-739 | i, 687 | Black R., Ohio. | QQ-23 | i, 1461 |
| Blackfoot Cr., S. Dak.: ..... | ..... | ..... | ..... | QQ-22 | i, 1474 |
| (See notes, ii, 2818.) | ..... | ..... | Appro. .... | ..... | ii, 2299 |
| Blackford Cr., Ky. | BB-12 | i, 891 | Bridges. .... | ..... | ii, 2146 |
| Black Fork, Ohio. | DD-410 | i, 962 | Wrecks. .... | ..... | ii, 2264 |
| Blackgarden Cr., Md. | J-147 | i, 332 | Black R., Port Huron, | ..... | ..... |
| Blackgarden Pond, Md. | J-148 | i, 332 | Mich. | PP-89-c | i, 1446 |
| Black Hall R., Conn. | D-26 | i, 141 | Black R., S. C. | N-74 | i, 499, 509 |
| Black Haw Cr., La. | T-2-ee | i, 717 | ..... | N-212 | i, 500 |
| (See notes, ii, 2805.) | ..... | ..... | Black R., Wash. | XX-76 | i, 1655 |
| Black Hawk Chute. | (HH) | i, 1071* | ..... | XX-73 | i, 1671 |
| Black Hawk Cr., N. Dak.: ..... | ..... | ..... | Bridges. .... | ..... | ii, 2146-2147 |
| (See notes, ii, 2818.) | ..... | ..... | Black R., Wis. | KK-26 | i, 1247 |
| Black Hog Cr., Pa. | J-891 | i, 337 | Black Rock Chan., Va. | L-52 | i, 411 |
| Blackhole Cr., Md. | J-1190 | i, 340 | Black Rock Cr., Mass. | B-4 | i, 69 |
| Black Lake H., Mich. | OO-22 | i, 1388 | Black Rock H. and Chan.: ..... | ..... | ..... |
| Black Lake, La. | S-860 | i, 688 | N. Y. | RR-17 | i, 1493 |
| Black Lake, Mich.: ..... | ..... | ..... | ..... | RR-13-e | i, 1508 |
| Appro. .... | ..... | ii, 2298 | Black Rock H., Conn. | D-72 | i, 141, 166 |
| Black Lick Cr., Pa. | FF-23 | i, 1003 | (See notes, ii, 2791.) | ..... | ..... |
| Black Pipe Cr., S. Dak. | GG-892 | i, 1032 | Appro. .... | ..... | ii, 2289 |
| (See notes, ii, 2819.) | ..... | ..... | Black Rock H., N. Y. | RR-13 | i, 1501 |
| Black Prince Bayou, La. | S-375 | i, 684 | ..... | RR-13-d | i, 1507 |
| Black R. | (HH) | i, 1071* | (See notes, ii, 2839.) | ..... | ..... |
| Black R., Alaska. | XX-181 | i, 1656 | Appro. .... | ..... | ii, 2299 |
| ..... | XX-212 | i, 1656 | Bridges. .... | ..... | ii, 2147 |
| Black R. and Lake, Mich. | PP-39 | i, 1419 | Harbor lines. .... | ..... | ii, 2253 |
| Black R., Ark. | Y-23 | i, 827 | Black Rock H., N. Y. | ..... | ..... |
| ..... | Y-23-a | i, 827 | (north breakwater) | RR-13-c | i, 1506 |
| Appro. .... | ..... | ii, 2295 | Black Rock H., N. Y. | ..... | ..... |
| Bridges. .... | ..... | ii, 2146-2147 | (pier extension) | RR-13-b | i, 1506 |
| Wrecks. .... | ..... | ii, 2264 | Blackrock Run, Md. | J-1031 | i, 338 |
| Black R., Ark. and Mo. | Y-28 | i, 818, 834 | Blacks Cr., Mass. | B-137 | i, 70 |
| (See notes, ii, 2808.) | ..... | ..... | Blacks Cr., Pa. | J-751 | i, 336 |
| Appro. .... | ..... | ii, 2295 | ..... | ..... | ..... |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Blackshears Lake, Ga. | O-400..... | i, 536 | Blackwater R., Fla. and | | |
| Blacks Isld. | (CC)..... | i, 909* | Ala. (including Black- | | |
| Blacksmith. | (HH)..... | i, 1071* | water and East Bs.) | Q-41..... | i, 611, 630 |
| Blacksmith Cr., Kans. | GG-1389..... | i, 1036 | (See notes, ii, 2801.) | | |
| Blacksmith Isld. | (HH)..... | i, 1071* | Appro..... | ii, 2293 | |
| Blackstump Cr., Va. | L-121..... | i, 412 | Bridges..... | ii, 2147 | |
| Black Swamp Cr., Md. | K-25..... | i, 373 | Blackwater R., Md. | J-145..... | i, 332 |
| Blacktail Cr., Mont. | GG-760..... | i, 1031 | Blackwater R., Mo. | GG-1433..... | i, 1036 |
| Blacktail Cr., N. Dak. | GG-766..... | i, 1031 | (See notes, ii, 2823.) | | |
| (See notes, ii, 2818.) | | | Blackwater R., Va. | L-312..... | i, 413, 444 |
| Blacktail Deer Cr., Mont. | GG-522..... | i, 1029 | (See notes, ii, 2796.) | | |
| (See notes, ii, 2816.) | | | Appro..... | ii, 2291 | |
| Black Thunder Cr., Wyo.: | | | Bridges..... | ii, 2147 | |
| (See notes, ii, 2819.) | | | Blackwater Sound, Fla. | P-170..... | i, 570 |
| Black Vermillion R., Kans.: | | | Blackwater, Va. | L-376..... | i, 414 |
| (See notes, ii, 2821.) | | | Blackwells Cr., La. | R-98-o..... | i, 647 |
| Black Vermillion R., Nebr. | GG-1254..... | i, 1034 | Blain Branch, Ky. | DD-57..... | i, 959 |
| Blackwalnut Cove, Md. | J-355..... | i, 333 | Blaine H., Wash. | XX-105-b..... | i, 1676 |
| Blackwalnut Cr., Md. | J-1240..... | i, 340 | Blaine, Wash.: | | |
| Black Walnut H., Md. | J-355..... | i, 354 | Harbor lines..... | ii, 2253 | |
| Black Warrior, Ala. | R-25..... | i, 646 | Blair. | (GG-2)..... | i, 1038* |
| Black Warrior R., Ala. and | | | Blair Run Bar. | (CC)..... | i, 909* |
| Miss.: | | | Blake Cr., Md. | K-60..... | i, 373 |
| (See notes, ii, 2803.) | | | Blakeley R., Ala. | R-11..... | i, 646 |
| Appro..... | ii, 2294 | | Blakely Cr., Kans. | GG-1288..... | i, 1035 |
| Bridges..... | ii, 2147 | | (See notes, ii, 2822.) | | |
| Navigation rules..... | ii, 2041, 2107 | | Blanchard R., Ohio. | QQ-13..... | i, 1461 |
| Black Warrior - Locust | | | Blanchards Rapids. | (HH)..... | i, 1071* |
| Fork, Ala. | R-28..... | i, 646 | Bledsoe Cr., Tenn. | AA-303..... | i, 850 |
| Black Warrior - Mulberry | | | Blennerhassett Isld. | (CC)..... | i, 909* |
| Fork, Ala. | R-31..... | i, 646 | Blind B., La. | S-214..... | i, 682 |
| Black Warrior R., Ala. | R-23-k..... | i, 658 | Blind Pass, Fla. | P-255..... | i, 571 |
| Black Warrior R. and | | | | P-318..... | i, 571 |
| Five-Mile Cr., Ala. (ca- | | | Blind R., La. | S-112..... | i, 682 |
| nal to connect, via Val- | | | Bridges..... | ii, 2147 | |
| ley Cr.) | R-23-o..... | i, 662 | Blind Slough. | (WW-2)..... | i, 1616* |
| Black Warrior, Warrior, | | | Blind Slough, Ore. | WW-13..... | i, 1615 |
| and Tombigbee Rs., | | | Bridges..... | ii, 2147 | |
| Ala. and Miss. | R-23..... | i, 651 | Blinthorne Cr., Md. | J-266..... | i, 333 |
| Black Warrior, Warrior, | | | Blo Buck Point Pass, Tex.: | | |
| and Tombigbee Rs., | | | (See notes, ii, 2806.) | | |
| Ala. and Miss. (includ- | | | Block House Run, Pa. | J-750..... | i, 336 |
| ing survey for water | | | Block Isld., R. I. | C-103..... | i, 108, 134 |
| communication with | | | (See notes, ii, 2787.) | | |
| the Tennessee by way | | | Appro..... | ii, 2288 | |
| of Big Bear Cr.) | R-23-c..... | i, 653 | Wrecks..... | ii, 2264 | |
| Black Warrior, Warrior, | | | Block Isld., R. I. (harbor | | |
| and Tombigbee Rs., | | | of refuge) | C-104..... | i, 108, 135 |
| Ala. and Miss. (lock | | | (See notes, ii, 2787.) | | |
| and dam building) | R-23-l..... | i, 660 | Appro..... | ii, 2288 | |
| Black Warrior, Warrior, | | | Block Isld. Sound, N. Y. | | |
| and Tombigbee Rs., | | | and Conn. | F-29..... | i, 215 |
| Ala. (operating and care | | | Block Isld. Sound, R. I.: | | |
| of locks and dams) | R-23-m..... | i, 661 | Wrecks..... | ii, 2264 | |
| Blackwater B., Fla. and | | | Blockston Branch, Md. | J-300..... | i, 333 |
| Ala. | Q-41..... | i, 630 | Blood Cr., Kans.: | | |
| Black Water Bayou, La. | S-90..... | i, 682 | (See notes, ii, 2823.) | | |
| Black Water Cr., Md.: | | | Blood Cr., Mont. | GG-573..... | i, 1029 |
| Bridges..... | ii, 2147 | | (See notes, ii, 2816.) | | |
| Blackwater Cr., Va. | K-277..... | i, 375 | Blood R., Ky. and Tenn. | AA-21..... | i, 848 |
| | L-245..... | i, 413 | Blood R., La. | S-56..... | i, 681 |
| Blackwater, Ky. | DD-196..... | i, 960 | Bloody Isld. | (HH)..... | i, 1071* |
| | | | Bloody Pt. Cr., Md. | J-408..... | i, 334 |
| | | | Bloody Run Cr., S. Dak. | GG-378..... | i, 1028 |
| | | | (See notes, ii, 2815.) | | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol and page. | | District and No. | Vol. and page. |
|--|------------------------|------------------|---------------------------------|---------------------|-------------------|
| Bloom Cr., Mont.: (See notes, ii, 2818.) | | | Boards—Continued. | | |
| Bloomers, N. Y.: | | | Board of Engineers on | | |
| Harbor lines..... | ii, | 2253 | Rivers and Harbors..... | ii, 2041, 2104 | |
| Blossom Rock, San Fran- | | | Endicott Board..... | ii, 1809, 1817 | |
| cisco H., Cal..... | TT-15-b..... | i, 1558 | Board of Engineers, Pa- | | |
| Blounts Cr., N. C..... | M-96..... | i, 455 | cific coast..... | ii, 1817 | |
| Bridges..... | ii, | 2147 | Board, Roosevelt (Taft)..... | ii, 1821 | |
| Blue Bayou, La..... | S-435..... | i, 685 | National Defense Board..... | ii, 1821 | |
| | S-669..... | i, 687 | Board, Torpedo System..... | ii, 1817 | |
| | S-774..... | i, 687 | | | |
| Blue Blanket Cr., S. Dak. | GG-384..... | i, 1028 | Boat Cut - off Slough, | | |
| (See notes, ii, 2815.) | | | Cal..... | TT-115..... | i, 1556 |
| Blue Buck Point, Tex.: | | | Boat Meadow R., Mass... | B-199..... | i, 70 |
| (See notes, ii, 2806.) | | | Boats: | | |
| Blue Cr., Cal..... | TT-196..... | i, 1556 | (See Dredges.) | | |
| Blue Cr., N. C..... | M-301..... | i, 456 | Derrick boats, list..... | ii, 2341 | |
| Blue Cr., Va..... | L-381..... | i, 414 | Drill boats, list..... | ii, 2344 | |
| Blue Cr., W. Va..... | EE-135..... | i, 984 | Maneuver boats..... | ii, 2345 | |
| Blue Earth R., Minn..... | KK-163..... | i, 1248 | Quarter boats, list..... | ii, 2353 | |
| Blue Fish Brook, Mass... | B-164..... | i, 70 | Tow and survey boats, list..... | ii, 2347 | |
| Blue Hammock Bayou, | | | Snag boats..... | ii, 2340 | |
| La..... | S-479..... | i, 685 | Tug and survey boats, list..... | ii, 2345 | |
| Bluehill B., Me..... | A-56..... | i, 27 | Bobs Cr., Pa..... | J-879..... | i, 337 |
| Bluehill H., Me..... | A-66..... | i, 27 | Boca Celga R., Fla..... | P-315..... | i, 571 |
| Blue Hill H., Me..... | A-66..... | i, 37 | | P-323-a..... | i, 602 |
| Blues Lake, Ga..... | O-469..... | i, 536 | Appro..... | ii, 2293 | |
| Blue Mills Isld..... | (GG-2)..... | i, 1038* | Boca Chica Chan., Fla... | P-197..... | i, 570 |
| Blue R., Mo. and Kans... | GG-1412..... | i, 1036 | Boca Grande Chan., Fla.: | | |
| Blue R., Nebr..... | GG-993..... | i, 1032 | Wrecks..... | ii, 2264 | |
| (See notes, ii, 2820.) | | | Boca Grand H., Fla..... | P-257..... | i, 571 |
| Blue R., Okla..... | T-14..... | i, 717 | Bocilla Pass, Fla..... | P-267..... | i, 571 |
| Blue R., Wis..... | KK-6..... | i, 1247 | Bodega B., Cal..... | TT-133..... | i, 1556, 1569 |
| Blue Run, Fla.: | | | Bodine Cr., N. Y.: | | |
| Bridges..... | ii, 2147, 2246 | | Bridges..... | ii, 2147 | |
| Blues Cr., Ohio..... | DD-467..... | i, 962 | Bodkin Cr., Md..... | J-1175..... | i, 339 |
| Blue Springs Run, Fla..... | P-70..... | i, 569 | Boeuf Bayou, La..... | S-323..... | i, 683 |
| | P-346..... | i, 571 | | S-367..... | i, 684 |
| Blue Stone Cr., Va..... | L-368..... | i, 414 | | S-387..... | i, 684 |
| Blue Stone R., Va. and | | | | S-500..... | i, 685 |
| W. Va..... | EE-82..... | i, 983 | | S-563..... | i, 686 |
| Blewater Cr., Ala. and | | | | S-587..... | i, 686 |
| Tenn..... | AA-212..... | i, 850 | | S-563..... | i, 703 |
| Blue Water Cr., Mont..... | GG-674..... | i, 1030 | Bridges..... | ii, 2144, 2147 | |
| Bluff Cr., Ala..... | AA-218..... | i, 850 | Boeuf Cr., Mo..... | GG-1543..... | i, 1037 |
| Bluff Cr., Ga..... | O-279..... | i, 535 | (See notes, ii, 2824.) | | |
| | O-387..... | i, 536 | Boeuf R., Ark. and La... | X-35..... | i, 785, 807 |
| | O-397..... | i, 536 | Appro..... | ii, 2295 | |
| Bluff Cr., Kans..... | GG-1357..... | i, 1035 | Bridges..... | ii, 2147 | |
| (See notes, ii, 2821, 2823.) | | | Bogachiel R., Wash..... | XX-33..... | i, 1655 |
| Bluff Cr., La..... | S-82..... | i, 681 | Bogart Cr., Mo..... | GG-178..... | i, 1026 |
| Bluff Cr., Miss..... | R-70..... | i, 646, 669 | Boggy Bayou..... | (HH)..... | i, 1071* |
| Appro..... | ii, 2294 | | Boggy Cr., Ga..... | O-348..... | i, 535 |
| Bluff Cr., Nebr..... | GG-1253..... | i, 1034 | Boggy Cr., La..... | S-838..... | i, 688 |
| Bluff Lake, Ga..... | O-245..... | i, 535 | Boggy Cr., S. C..... | N-79..... | i, 499 |
| Boardman R., Mich..... | OO-57..... | i, 1377 | Boggy Gut Cr., Ga..... | O-54..... | i, 533 |
| Board Run, Md..... | J-1127..... | i, 339 | Boggy Cut, Ga..... | O-62..... | i, 533 |
| Boards (see also special | | | Boggy Swamp, S. C..... | N-86..... | i, 499 |
| boards of engineers un- | | | Bogles Cove, Md..... | J-489..... | i, 334 |
| der heading of "Engi- | | | Bogue Chitto, La..... | R-100..... | i, 647, 678 |
| neers," abstracts): | | | Appro..... | ii, 2294 | |
| Board of Engineers, forts..... | i, 1796, | | Bridges..... | ii, 2147 | |
| | 1799, 1817, 2039, 2042 | | Bogue Chitto, La. and | | |
| | | | Miss..... | R-98-j..... | i, 647 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|----------------------|
| Bogue Falaya, La. | S-20..... | i, 689 | Boone Cr., Nebr. | GG-930..... | i, 1032 |
| Bogue Falla, La. | S-20..... | i, 689 | Boone Fork, Ky. | DD-133..... | i, 960 |
| | S-22..... | i, 681 | | DD-4-a..... | i, 963 |
| Appro..... | | ii, 2294 | Boones Branch, Mo. | GG-114..... | i, 1026 |
| Bogue Inlet, N. C. | M-277..... | i, 456, 481 | Boone Slough, Ore. | VV-52..... | i, 1593 |
| Bogue Loosa Cr., La. | R-99..... | i, 647 | Boones Slough, Ore. | VV-72..... | i, 1593 |
| Bogue Loosa, La. | R-98-g..... | i, 647 | Boonville. | (GG-2)..... | i, 1038* |
| Bogue Lusa Cr., La. | R-99..... | i, 647 | Boothbay H., Me. | A-197..... | i, 28, 48 |
| Bogue Lusa, La. | R-98-g..... | i, 647 | Appro..... | | ii, 2288 |
| Bogue Phallah, Miss. | X-19..... | i, 785, 794 | Bridges..... | | ii, 2147 |
| Bogue Phalla, Miss. | X-19..... | i, 794 | Wrecks..... | | ii, 2264 |
| Bridges..... | | ii, 2147 | Booth B., Me. | A-195..... | i, 28 |
| Bogues B., Va. | I-85-a..... | i, 328 | Booths. | (HH)..... | i, 1071* |
| Appro..... | | ii, 2290 | Booze Ditch, Md. | J-164..... | i, 332 |
| Bogue Sound, N. C. | M-275..... | i, 456 | Boqueron R., P. R. | YY-17..... | i, 1685 |
| Wrecks..... | | ii, 2264 | Bordentown, N. J. (near). | H-3-m..... | i, 286 |
| Bogus B., Va. | I-85..... | i, 299 | Borgne Lake, La.: | | |
| Bohemia R., Md. | J-527..... | i, 335 | Forts..... | | ii, 1803, 1976 |
| Bohol Isld., P. I. | YY-150..... | i, 1686 | Bosque R., Tex. | U-43..... | i, 735 |
| Bois Connie Bayou, La. | S-797..... | i, 688 | Boston H., Mass. | B-113..... | i, 70, 84 |
| Bois de Sioux R., Minn. | | | (See notes, ii, 2784, 2785.) | | |
| and N. Dak..... | KK-189..... | i, 1248 | Appro..... | | ii, 2287, 2288 |
| Bois des Sioux R. | KK-170..... | i, 1248 | Bridges..... | | ii, 2147-2148 |
| Boise R., Idaho. | VV-90..... | i, 1594 | Forts..... | | ii, 1805, 1823, 1855 |
| Bokes Cr., Ohio. | DD-465..... | i, 962 | Harbor lines..... | | ii, 2253-2254 |
| Boles Cr., Fla. | P-293..... | i, 571 | Wrecks..... | | ii, 2264, 2267 |
| Boles. | (GG-2)..... | i, 1038* | Boston, Mass., District... | B (with map)..... | i, 67, 69 |
| Bollnas B., Cal. | TT-131..... | i, 1556 | (See notes, ii, 2784.) | | |
| Bollnbroke Cr., Md. | J-310..... | i, 333 | Appro..... | | ii, 2288 |
| Bollnger Cr., Mo.: | | | Boston, Mass., to Beau- | | |
| (See notes, ii, 2824.) | | | fort, N. C. (Intracoastal | | |
| Bolivar | (HH)..... | i, 1071* | waterway)..... | M-257-c..... | i, 474 |
| (See notes, ii, 2827.) | | | Boston to Rio Grande | | |
| Boltars | (HH)..... | i, 1071* | (Intracoastal waterways)..... | | ii, 2041, 2116 |
| Bolton | (HH)..... | i, 1071* | Boucle Bayou, La. | S-618..... | i, 686 |
| Bonanza Bar. | (CC)..... | i, 909* | Boudreau Bayou, La. | *S-157..... | i, 682 |
| Bonds Cr., N. C. | M-111..... | i, 455 | Boudreau Canal, La. | S-456..... | i, 685 |
| Bondurant. | (HH)..... | i, 1071* | Boulangers | (HH)..... | i, 1071* |
| Bone Cr., Nebr. | GG-1114..... | i, 1033 | Boulder Cr., Mont. | GG-666..... | i, 1030 |
| Bone Hill Cr. | GG-318..... | i, 1027 | (See notes, ii, 2817.) | | |
| Bonfuca Bayou, La. | S-10..... | i, 681 | Boulder R., Mont.: | | |
| Bonfuca Bayou, St. Tam- | | | (See notes, ii, 2816.) | | |
| many Parish, La. | S-10..... | i, 689 | Boundary Cr., Va. | K-315..... | i, 375 |
| Bon Homme Cr., Mo. | GG-1555..... | i, 1037 | Bouquet R., N. Y. | E-93..... | i, 178, 205 |
| (See notes, ii, 2824.) | | | Bourbeau Bayou, La. | S-648..... | i, 686 |
| Bonne Femme Cr., Mo. ... | GG-79..... | i, 1025 | | S-726..... | i, 687 |
| | GG-109..... | i, 1026 | Boush Cr., Va. | L-204..... | i, 412 |
| (See notes, ii, 2813.) | | | Bow Chan, Fla. | P-196..... | i, 570 |
| Bonne Idee Bayou, La. | X-36..... | i, 785 | Bow Cr., Kans.: | | |
| Bonners Ferry | (WW-2)..... | i, 1616* | (See notes, ii, 2822.) | | |
| Bonnet Carre. | (HH)..... | i, 1071* | Bow Cr., Nebr. | GG-937..... | i, 1032 |
| Bon Secour B., Ala., and | | | (See notes, ii, 2819.) | | |
| Pensacola B., Fla. (ca- | | | Bow Cr., Pa. | H-21..... | i, 271 |
| nal)..... | Q-46..... | i, 632 | | J-592..... | i, 335 |
| Bon Secour B.-Pensacola | | | Bowery B., N. Y.: | | |
| B., Ala. (canal)..... | Q-46..... | i, 611 | (See New York, N. Y.) | | |
| Bon Secours B., Ala. | R-5..... | i, 646 | Harbor lines..... | | ii, 2254 |
| Bon Secours R., Ala. | R-6..... | i, 646 | Bowlecamp Cr., Va. | DD-261..... | i, 961 |
| Bonton Bend. | (GG-2)..... | i, 1038* | Bowlesville. | (CC)..... | i, 909* |
| (See notes, ii, 2825.) | | | Bowman Brook, N. H. | B-35..... | i, 69 |
| Booms Lake, Ga. | O-470..... | i, 536 | Bowman Cr., Pa. | J-693..... | i, 336 |
| Boone Cr., Ky. | DD-183..... | i, 960 | Bowmans Run to Cum- | | |
| Boone Cr., Md. | J-322..... | i, 333 | berland, Md. | K-90-c..... | i, 389 |
| | J-975..... | i, 338 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|----------------------|-------------------|---|----------------------|-------------------|
| Box Butte Cr., Nebr.: (See notes, ii, 2819.) | | | Brazos and Galveston Can- nal, Tex. | U-38-c.....i, 758 | |
| Box Canyon. | (WW-2).....i, 1616* | | Brazos and Galveston Can- nal, Tex. (operating and care) | U-38-d.....i, 758 | |
| Box Elder Cr., Colo. | GG-1108.....i, 1033 | | Brazos R. and Galveston B., Tex. (channel be- tween) | U-38-b.....i, 757 | |
| Box Elder Cr., Kans.: (See notes, ii, 2822.) | | | Brazos R. and Matagorda B. (channel between) | U-38-e.....i, 759 | |
| Box Elder Cr., Mont. | GG-448.....i, 1028 | | Brazos R., Tex. | U-2-b.....i, 735 | |
| | GG-548.....i, 1029 | | | U-40.....i, 735, 760 | |
| | GG-745.....i, 1030 | | Appro. |ii, 2295 | |
| (See notes, ii, 2816, 2818.) | | | Bridges |ii, 2148 | |
| Boxelder Cr., S. Dak. (See notes, ii, 2815, 2819.) | GG-369.....i, 1028 | | Brazos R., Tex. (including mouth) | U-40-a.....i, 760 | |
| Box Elder Cr., S. Dak. | GG-841.....i, 1031 | | Brazos R., Tex. (mouth of) | U-40-b.....i, 762 | |
| Box Elder Cr., Wyo. (See notes, ii, 2820.) | GG-1063.....i, 1033 | | Brazos R., Tex. (Old Washington to Waco) | U-40-e.....i, 764 | |
| Boyd Cr., Tenn. | AA-115.....i, 849 | | Brazos R., Tex. (Rich- mond to Old Washing- ton) | U-40-d.....i, 764 | |
| Boyer Cr., Iowa. | GG-258.....i, 1027 | | Brazos R., Tex. (Velasco to Old Washington) | U-40-c.....i, 763 | |
| Boyer R., Iowa.: (See notes, ii, 2814.) | | | Brazos Santiago H., Tex. | U-2-b.....i, 735 | |
| Boynton Slough, Cal. | TT-97.....i, 1555 | | | U-72-a.....i, 773 | |
| Bozile Cr., Nebr. (See notes, ii, 2819.) | GG-934.....i, 1032 | | Appro. |ii, 2295 | |
| Brace Cove, Mass. | B-82.....i, 69 | | Brazos Santiago Pass, Tex. | U-72.....i, 735 | |
| Bradbury Slough. | (WW-2).....i, 1616* | | Breach Inlet, S. C.: Bridges |ii, 2148 | |
| Bradbury Slough, Oreg. | WW-21.....i, 1615 | | Bread and Cheese Cr., Md. | J-1077.....i, 339 | |
| Braddock Pond, N. Y. | RR-34.....i, 1493 | | Breakfast Cr., Ga. | O-117.....i, 534 | |
| Braden Cr., Fla. | P-299.....i, 571 | | Breast or Teton Cr., Mont. | GG-491.....i, 1029 | |
| Bradford's Isld. (See notes, ii, 2841.) | (WW-2).....i, 1616* | | Breches Cr., Pa. | J-905.....i, 337 | |
| Bradleys Cr., Ga. | O-162.....i, 534 | | Bremerton, Wash.: Harbor lines |ii, 2254 | |
| Bradshaw Cr., W. Va. | DD-306.....i, 961 | | Bremner R., Alaska. | XX-127.....i, 1656 | |
| Braggs Branch, Mo. | GG-105.....i, 1026 | | Brenneke Shoals. | (GG-2).....i, 1038* | |
| Brainerd. (HH) | (HH).....i, 1071* | | Breton. | (HH).....i, 1071* | |
| Brainerd to Grand Rapids (HH): (See notes, ii, 2827, 2833.) | | | Breton B., Md. | K-62.....i, 373 | |
| Brair Cr., Pa. | J-701.....i, 336 | | Appro. |ii, 2291 | |
| Brakes Bayou, Tex.: (See notes, ii, 2806.) | | | Breton B., Md. (Leonard- town H.) | K-62.....i, 387 | |
| Branch Cr., Mass. | B-154.....i, 70 | | Breton Sound, La. | S-160.....i, 682 | |
| Brandford Chan., Va. | L-12.....i, 411 | | Bretons Pt., R. I.: Forts |ii, 1808 | |
| Brandon Cr., Fla.: Bridges |ii, 2148 | | Brewer Cr., Md. | J-1231.....i, 340 | |
| Brandywine Cr., Del.: Bridges |ii, 2148 | | | J-1258.....i, 340 | |
| Brandywine R., Del. | I-59.....i, 299, 317 | | Brewer Pond, Md. | J-1230.....i, 340 | |
| Bridges |ii, 2148 | | Brewers. | (HH).....i, 1071* | |
| Wrecks |ii, 2264 | | Brewington Branch, Md. | J-103.....i, 331 | |
| Brantford H., Conn. | D-53.....i, 141, 155 | | Briar Cr., Ga. | O-60.....i, 533 | |
| (See notes, ii, 2790.) | | | Brice Cr., N. C. | M-186.....i, 455 | |
| Appro. |ii, 2289 | | Brice Run, Md. | J-1116.....i, 339 | |
| Wrecks |ii, 2264 | | Brices Cr., N. C.: Bridges |ii, 2148, 2234 | |
| Brantford R., Conn. | D-54.....i, 141 | | Brick Cr., S. C. | N-85.....i, 499 | |
| Brannock B., Md. | J-250.....i, 333 | | Brickeys. | (HH).....i, 1071* | |
| Bratton Cr., Tenn. | AA-255.....i, 850 | | Brick Hill R., Ga. | O-504.....i, 536 | |
| Braud Bayou, La. | S-111.....i, 682 | | | | |
| Brave Bill Cr., S. Dak. | GG-869.....i, 1031 | | | | |
| (See notes, ii, 2819.) | | | | | |
| Brave Boat H., Me.: Bridges |ii, 2148 | | | | |
| Brays Bayou, Tex. | U-22.....i, 735 | | | | |
| Bridges |ii, 2148 | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|----------------------------|-------------------|----------------------------------|---------------------|-------------------|
| Bridge Cr., La.: | | | Broad Cr., Md. | J-39..... | i, 331, 341 |
| (See notes, ii, 2805.) | | | | J-69..... | i, 331 |
| Bridge Cr., Md. | J-335..... | i, 333 | | J-77..... | i, 331 |
| | J-948..... | i, 338 | | J-108..... | i, 331 |
| Bridge Cr., Mont. | GG-613..... | i, 1029 | | J-333..... | i, 333 |
| | GG-689..... | i, 1030 | | J-412..... | i, 334 |
| (See notes, ii, 2817.) | | | | J-456..... | i, 334 |
| Bridge Cr., N. C. | M-182..... | i, 455 | | J-921..... | i, 338 |
| Bridge Meadow Brook, | | | | J-1189..... | i, 340 |
| Mass. | B-41..... | i, 69 | | J-1251..... | i, 340 |
| Bridgeport, Ala. | AA-18..... | i, 855 | | K-83..... | i, 373 |
| Bridgeport H., Conn. | D-66..... | i, 141, 163 | Appro. | | ii, 2291 |
| (See notes, ii, 2791.) | | | Broad Cr., Mass. | B-155..... | i, 70 |
| Appro. | | ii, 2289 | Broad Cr., N. C. | L-263..... | i, 413 |
| Bridges. | | ii, 2148 | | L-348..... | i, 414 |
| Forts. | | ii, 1874 | | L-355..... | i, 414 |
| Harbor lines. | | ii, 2254 | | M-22..... | i, 454 |
| Wrecks. | | ii, 2264 | | M-47..... | i, 454 |
| Bridgeport, Wash. | (WW-2)..... | i, 1616* | | M-59..... | i, 454 |
| (See notes, ii, 2843.) | | | | M-74..... | i, 454 |
| Bridges. | | ii, 2041, 2104 | | M-80..... | i, 454 |
| Bridges, D. C. | ii, 2039, 2062, 2063, 2064 | | | M-145..... | i, 455 |
| Bridges, plan of indexing. | | i, 13 | | M-236..... | i, 456 |
| Bridges, laws. | | ii, 2329 | | M-281..... | i, 456 |
| Bridges, structures other | | | Broad Cr. (1st), S. C. | N-160..... | i, 500 |
| than, navigable water- | | | Broad Cr. (2d), S. C. | N-161..... | i, 500 |
| ways | | ii, 2041, 2109 | Broad Cr., Va. | K-234..... | i, 375 |
| Brien Run, Md. | J-1071..... | i, 339 | | L-197..... | i, 412 |
| Brier Cr., Ga. | O-60..... | i, 547 | Bridges. | | ii, 2148 |
| Briery Cr., Md. | J-350..... | i, 333 | Broadkill Cr., Del. | I-73..... | i, 324 |
| Brigantine Beach and | | | Appro. | | ii, 2290 |
| Inlet, N. J. (channel | | | Broadkill R., Del. | I-73..... | i, 299, 324 |
| behind). | I-16-a..... | i, 303 | Wrecks. | | ii, 2264 |
| Brigantine Inlet, N. J. | I-16..... | i, 299 | Broad Marsh R., Mass. | C-47..... | i, 107 |
| | I-16-a..... | i, 303 | Broad Mouth Cr., S. C. | N-187..... | i, 500 |
| Brigantine Shoal, N. J.: | | | Broad R. above Colum- | | |
| Wrecks. | | ii, 2264 | bia, S. C. | N-147-b..... | i, 517 |
| Brights Cr., N. C. | M-153..... | i, 455 | Broad R., Del. | J-121..... | i, 347 |
| Brilliant Pumping Sta- | | | Broad R., Ga. | O-30..... | i, 533 |
| tion, Pa.: | | | Broad R., N. C. and S. C. | N-147..... | i, 500, 517 |
| Harbor lines. | | ii, 2254 | Broad R., S. C. | N-261..... | i, 501 |
| Brills Cr., Mo. | GG-230..... | i, 1026 | Bridges. | | ii, 2148 |
| Brimstone Cr., Tenn. | AA-293..... | i, 850 | Broad Run, Md. | J-960..... | i, 338 |
| Brinks Cr., Ky. | DD-107..... | i, 960 | | J-993..... | i, 338 |
| Briscoe Cr., Md. | K-50..... | i, 373 | Broad Sound, Boston, | | |
| Bristol H., Me.: | | | Mass.: | | |
| Appro. | | ii, 2288 | Wrecks. | | ii, 2264 |
| Bristol, Pa.: | | | Broad Sound, Me. | A-255..... | i, 29 |
| Harbor lines. | | ii, 2254 | Broadwater Cr., Md. | J-1277..... | i, 340 |
| Broad B., Va. | L-212..... | i, 412 | Broadway Branch, Del. | J-238..... | i, 333 |
| | L-207-a..... | i, 439 | Brokau | (HH)..... | i, 1071* |
| Broad Canal, Mass. | B-126..... | i, 70 | Broken Kettle Cr., Iowa. | GG-275..... | i, 1027 |
| Broad Chan., Hempstead | | | (See notes, ii, 2814.) | | |
| B., N. Y. | F-72..... | i, 215 | Broken Straw Cr., N. Y. | | |
| Broad Chan., Jamaica | | | and Pa. | FF-34..... | i, 1003 |
| B., N. Y. | F-81..... | i, 215 | Bronsons Cr., Ga. | O-192..... | i, 534 |
| Broad Cove, Me. | A-167..... | i, 28 | Bronx Kills, N. Y.: | | |
| | A-261..... | i, 29 | Bridges. | | ii, 2148, 2174 |
| Broad Cove, Mass. | B-144..... | i, 70 | Harbor lines. | | ii, 2254 |
| Broad Cr., Del. | J-121..... | i, 332, 347 | Bronx, Manhattan line, | | |
| Appro. | | ii, 2291 | N. Y. City. | F..... | i, 215 |
| Bridges. | | ii, 2148 | Bronx R., N. Y. | E-21..... | i, 177, 188 |
| Broad Cr., Fla. | P-176..... | i, 570 | Appro. | | ii, 2289 |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|----------------------|
| Bronx R., N. Y.—Contd. | | | Brule Cr., S. Dak. | GG-292 | i, 1027 |
| Bridges | | ii, 2148 | (See notes, ii, 2814.) | | |
| Harbor lines | | ii, 2254 | Brule H., Wis. | LL-24-a | i, 1281 |
| Wrecks | | ii, 2264 | Brule R., Minn. | LL-7 | i, 1265 |
| Brookings B., Me. | A-210 | i, 28 | Brule R., Wis. | LL-24 | i, 1265 |
| Brooklyn, Center H., Me. | A-78 | i, 37 | Bruno Isld., Cal.: | | |
| Brooklyn | (CC) | i, 909* | Harbor lines | | ii, 2254 |
| | (HH) | i, 1072* | Brunot Isld., Pa.: | | |
| Brooklyn, N. Y.: | | | Harbor lines | | ii, 2254 |
| (See New York, N. Y.) | | | Brunson Swamp, N. C. | N-28 | i, 499 |
| Harbor lines | | ii, 2253, 2254 | Brunsons Swamp, S. C. | N-24 | i, 499 |
| Wrecks | | ii, 2264 | Brunswick | (CC) | i, 909* |
| Broom Cr., Wyo. | GG-998 | i, 1032 | | (GG-2) | i, 1038* |
| Brook Neal to mouth of Pig R. | L-367-a | i, 447 | Brunswick Canal and H., Me. | A-233-a | i, 52 |
| Brook Neal to Randolph Station | L-367-b | i, 447 | Brunswick H., Ga. | O-443 | i, 536, 559 |
| Brookport | (CC) | i, 909* | (See notes, ii, 2798.) | | |
| Brooks | (HH) | i, 1072* | Appro. | | ii, 2293 |
| Brooks Break (HH): | | | Forts | | ii, 1948 |
| (See notes, ii, 2827.) | | | Harbor lines | | ii, 2254 |
| Brooks Cr., Md. | J-246 | i, 333 | Navigation rules | | ii, 2041, 2107 |
| Brooks Slough, Wash. | WW-64 | i, 1615 | Wrecks | | ii, 2264 |
| Brook (The), Va. | L-149 | i, 412 | Brunswick, Me. | A-233 | i, 51 |
| Broom Cr., Wyo.: | | | Brunswick Outer Bar, Ga. | O-437-a | i, 558 |
| (See notes, ii, 2820.) | | | Appro. | | ii, 2282, 2283, 2293 |
| Brozo R., Ga. | O-200 | 534 | Brunswick R., Ga. | O-440 | i, 536 |
| Brother Isld.: | | | Brunswick R., N. C. | M-324 | i, 456, 493 |
| (See New York, N. Y.) | | | Brush Cr., Cal. | TT-139 | i, 1556 |
| Harbor lines | | ii, 2254 | Brush Cr., Kans. | GG-1161 | i, 1034 |
| Brow Cr., Mont. | GG-614 | i, 1029 | | GG-1210 | i, 1034 |
| (See notes, ii, 2817.) | | | (See notes, ii, 2821, 2822.) | | |
| Brown Cr., Kans.: | | | Brush Cr., Ky. | DD-109 | i, 960 |
| (See notes, ii, 2822.) | | | Brush Cr., La. | T-2-j | i, 717 |
| Brown Cr., Nebr. | GG-988 | i, 1032 | (See notes, ii, 2805.) | | |
| Brown Cr., S. C. | N-167 | i, 500 | Brush Cr., Mo. | GG-134 | i, 1026 |
| Brown Cr., W. Va. | DD-317 | i, 961 | | GG-156 | i, 1026 |
| Brownell Cr., Nebr. | GG-1130 | i, 1034 | | GG-202 | i, 1026 |
| Brownays Isld., Me.: | | | | GG-1413 | i, 1036 |
| Wrecks | | ii, 2264 | | GG-1425 | i, 1036 |
| Brown, Fort, Tex. | | ii, 1808 | (See notes, ii, 2813, 2814, 2823, 2824.) | | |
| Browns B., Va. | K-295 | i, 375 | Brush Cr., Mo. and Kans.: | | |
| Browns Branch, Md. | J-445 | i, 334 | (See notes, ii, 2823.) | | |
| Browns Cove, Md. | J-423 | i, 334 | Brush Cr., Nebr. | GG-914 | i, 1032 |
| Browns Cr., Ala. | R-36 | i, 646 | Brush Cr., Ohio | DD-433 | i, 962 |
| | AA-52 | i, 848 | | DD-481 | i, 962 |
| Browns Cr., Fla. | P-14 | i, 569 | | DD-482 | i, 963 |
| Browns Cr., Md. | J-457 | i, 334 | | DD-485 | i, 963 |
| | J-1066 | i, 339 | Brush Cr., Va.: | | |
| Browns Cr., N. Y. | F-58 | i, 215, 227 | Bridges | | ii, 2187 |
| Appro. | | ii, 2289 | Brush Cr., Wyo. | GG-1048 | i, 1033 |
| Browns Cr., N. C. | M-149 | i, 455 | (See notes, ii, 2820.) | | |
| | M-218 | i, 455 | Brush Fork, Ky. | DD-225 | i, 960 |
| | N-56 | i, 499 | Brushie Cr., Mo. | GG-1547 | i, 1037 |
| Browns Isld. | (CC) | i, 909* | Brushy Cr., Ga. | O-358 | i, 535 |
| Browns Ledge, Mass.: | | | Brushy Cr., Ky. | AA-240 | i, 850 |
| Wrecks | | ii, 2264 | Brushy Cr., La. | S-822 | i, 688 |
| Brownsville | (GG-2) | i, 1038* | | S-837 | i, 688 |
| | (HH) | i, 1072* | Brushy Cr., S. C. | N-185 | i, 500 |
| (See notes, ii, 2825.) | | | Brushy Fork, Ky. | DD-286 | i, 961 |
| Brownsville, Pa. | (FF-6-a) | i, 1003* | Brushy Fork, Ohio | DD-366 | i, 962 |
| Harbor lines | | ii, 2254 | Brustley Cr., Ga. | O-45 | i, 533 |
| Bruce | (HH) | i, 1072* | Bryan Cr., N. C. | M-83 | i, 454 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Bryans B., Va. | K-292..... | i, 375 | Buffalo Coulee, N. Dak. ... | KK-184..... | i, 1248 |
| Bryant Cr., Ky. | DD-65..... | i, 959 | Buffalo Cr., Colo. | GG-1035..... | i, 1033 |
| Bryants Cr., Mo. | Y-38..... | i, 818 | Buffalo Cr., Ga. | O-277..... | i, 535 |
| Buck Cr., Cal. | TT-158..... | i, 1556 | | O-491..... | i, 536 |
| Buck Cr., Ga. | O-72..... | i, 533 | Buffalo Cr., Kans. | GG-1315..... | i, 1035 |
| | O-273..... | i, 535 | | GG-1327..... | i, 1035 |
| Buck Cr., Iowa. | GG-250..... | i, 1027 | (See notes, ii, 2822.) | | |
| Buck Cr., Kans. | GG-1202..... | i, 1034 | Buffalo Cr., Ky. | DD-51..... | i, 959 |
| (See notes, ii, 2821.) | | | | DD-55..... | i, 959 |
| Buck Cr., Ky. | AA-281..... | i, 850 | | DD-284..... | i, 961 |
| | DD-22..... | i, 959 | Buffalo Cr., Md. | J-1029..... | i, 338 |
| | DD-28..... | i, 959 | Buffalo Cr., Minn. | KK-75..... | i, 1247 |
| | DD-48..... | i, 959 | Buffalo Cr., Mo. | GG-1463..... | i, 1036 |
| Buck Cr., Mo. | GG-1428..... | i, 1036 | (See notes, ii, 2824.) | | |
| (See notes, ii, 2823.) | | | Buffalo Cr., Mont. | GG-650..... | i, 1030 |
| Buck Cr., Nebr. | GG-1124..... | i, 1033 | (See notes, ii, 2817.) | | |
| (See notes, ii, 2821.) | | | Buffalo Cr., Mont. and | | |
| Buck Cr., Pa. | J-684..... | i, 336 | Wyo. | GG-663..... | i, 1030 |
| Buck Cr., Tenn. | AA-156..... | i, 849 | | GG-735..... | i, 1030 |
| Buck Elk Cr., Mo.: | | | (See notes, ii, 2817, 2818.) | | |
| (See notes, ii, 2824.) | | | Buffalo Cr., Nebr. | GG-960..... | i, 1032 |
| Buckeye Cr., Ky. | DD-146..... | i, 960 | (See notes, ii, 2820.) | | |
| Buckeye Cr., Mo. | GG-196..... | i, 1026 | Buffalo Cr., N. Y.: | | |
| (See notes, ii, 2814.) | | | Bridges..... | | ii, 2149 |
| Buckham Cr., Kans. | GG-1191..... | i, 1034 | Buffalo Cr., Ohio. | DD-354..... | i, 982 |
| Buckhannon R., Pa.: | | | Buffalo Cr., Pa. | J-829..... | i, 337 |
| Bridges..... | | ii, 2148, 2210 | | J-840..... | i, 337 |
| Buckhannon R., W. Va. .. | FF-13..... | i, 1003, 1011 | | J-894..... | i, 337 |
| Appro..... | | ii, 2297 | | FF-37..... | i, 1003 |
| Buckhead Cr., Ga. | O-160..... | i, 534 | Buffalo Cr., S. C. | N-159..... | i, 500 |
| Buckhead Cr., S. C. | N-252..... | i, 501 | Buffalo Cr., S. Dak. | GG-816..... | i, 1031 |
| Buckhorn Bayou, La. | S-535..... | i, 685 | Buffalo Cr., Tenn. | AA-297..... | i, 850 |
| Buckhorn Cr., Ky. | DD-163..... | i, 960 | | AA-239..... | i, 878 |
| Buckhorn Cr., N. C. | L-310..... | i, 413 | Buffalo Cr., W. Va. | EE-3..... | i, 983 |
| Buckhorn (The), Va. | L-29..... | i, 411 | | EE-43..... | i, 983 |
| Buck Lake, Ga. | O-487..... | i, 536 | | EE-141..... | i, 984 |
| Buck Lick Cr., Mo. | GG-1544..... | i, 1037 | | FF-9..... | i, 1003 |
| Buckoltz Cr., S. C. | N-58..... | i, 499 | Buffalo Cr., Wyo. | GG-730..... | i, 1030 |
| Buck Pond, N. Y. | RR-37..... | i, 1493 | (See notes, ii, 2818.) | | |
| Bucks Cr., Pa. | J-681..... | i, 336 | Buffalo Fork: | | |
| Bucks Cr., S. C. | N-13..... | i, 499 | Roads, military..... | | ii, 2041, 2119 |
| Bucks H., Me. | A-80..... | i, 27 | Buffalo Fork, Ark. | Y-44..... | i, 818 |
| Buckshutem Cr., N. J. | I-33..... | i, 299, 306 | Buffalo Fork, White R., | | |
| Bucksport, Cal.: | | | Ark. | Y-23-e..... | i, 831 |
| Harbor lines..... | | ii, 2254 | Buffalo H., N. Y. | RR-13..... | i, 1493, 1501 |
| Bucksport H., Me. | A-103..... | i, 28, 40 | | RR-13-a..... | i, 1501 |
| Appro..... | | ii, 2287 | Buffalo Hollow Cr., Tenn. ... | AA-145..... | i, 849 |
| Forts..... | | ii, 1841 | Buffalo Lake, Wis.: | | |
| Buck Swamp, N. C. | N-35..... | i, 499 | Bridges..... | | ii, 2149 |
| Buck Swamp, S. C. | N-40..... | i, 499 | Buffalo, N. Y.: | | |
| Buckwheat Isld., N. J.: | | | Appro..... | | ii, 2299 |
| Harbor lines..... | | ii, 2254 | Forts..... | | ii, 1796, 1994 |
| Buena Vista. | (HH)..... | i, 1072* | Harbor lines..... | | ii, 2254 |
| Buffalo. | (HH)..... | i, 1072* | Lake regulation..... | | ii, 2041, 2124 |
| Buffalo Bayou, Tex. | U-16..... | i, 735 | Navigation rules..... | | ii, 2041, 2107 |
| | U-26..... | i, 740 | Wrecks..... | | ii, 2264 |
| | U-26-b..... | i, 742 | Buffalo, N. Y. (break- | | |
| | U-26-c..... | i, 743 | water). | RR-13-c..... | i, 1506 |
| Appro..... | | ii, 2295 | Buffalo, N. Y., District. ... | RR(with map)i, | 1491 |
| Bridges..... | | ii, 2149 | | | i, 1493 |
| Navigation rules..... | | ii, 2041, 2107 | (See notes, ii, 2838.) | | |
| Wrecks..... | | ii, 2264 | Buffalo, N. Y., Scaja- | | |
| | | | quada Cr. | RR-18..... | i, 1512 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|----------------------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Buffalo R., Minn. | KK-192..... | i, 1248 | Burlington B., Minn. | LL-13..... | i, 1265, 1269 |
| Buffalo R., Miss. | S-278..... | i, 683, 694 | Burlington H., Vt. | E-115..... | i, 178, 208 |
| Buffalo R., N. Y. | RR-14..... | i, 1493 | Burlington, Vt.: | | |
| Buffalo R., South Branch, Minn. | KK-193..... | i, 1248 | Appro..... | | ii, 2289 |
| Buffalo R., Tenn. | AA-228..... | i, 850 | Burnett Cr., Mo. | GG-1486..... | i, 1036 |
| Buffalo R., Wis. | KK-29..... | i, 1247 | Burnett R., Wis. | KK-38..... | i, 1247 |
| Bufaloskin Cr., S. Dak.: | | | Burnetts Mill Cr., Va. | L-168..... | i, 412 |
| (See notes, ii, 2818.) | | | Burnham | (HH)..... | i, 1072* |
| Buffalo Slough, Colo. | GG-1098..... | i, 1033 | Burnhams Canal, Wis.: | | |
| (See notes, ii, 2820.) | | | Bridges..... | | ii, 2149 |
| Buffalo to Tonawanda Cr., N. Y. (Erie Canal) .. | RR-19..... | i, 1493 | Burning Fork, Ky. | DD-203..... | i, 960 |
| Buffington Isld. | (CC)..... | i, 909* | Burns Cr., Mont. | GG-631..... | i, 1030 |
| Bugby Light. | (W W-2)..... | i, 1616* | (See notes, ii, 2817.) | | |
| Bugby Cr., Mont. | GG-425..... | i, 1028 | Burns Cut-off, Cal. | UU-29..... | i, 1577 |
| Bug Suek, Ga. | O-409..... | i, 536 | Burnside, Ky. | AA-239..... | i, 878 |
| Buildings, Public Grounds and, D. C. | ii, 2039, 2040, 2065, 2066, 2072 | | Burnside R., Ga. | O-112..... | i, 534 |
| Water supply..... | ii, 2040, 2084 | | Burnt Camp Branch, Ky. | DD-84..... | i, 959 |
| Bullding stones. | ii, 2040, 2089 | | Burnt Coat H., Me. | A-73..... | i, 27 |
| Bulkhead Bar, Delaware R. (see Delaware R.): | | | Burnt Cr., N. Dak.: | | |
| Wrecks..... | ii, 2264 | | (See notes, ii, 2815.) | | |
| Bulkhead Rock, R. I. | C-81..... | i, 125 | Burr Cr., Conn. | D-74..... | i, 141 |
| (See notes, ii, 2787.) | | | Burrells Cr., Ga. | O-515..... | i, 537 |
| Bull B., La. | S-210..... | i, 682 | Burris Fork, Mo.: | | |
| Bull B., N. C. | M-3..... | i, 454 | (See notes, ii, 2823.) | | |
| Bull Branch, Md. | J-1110..... | i, 339 | Burr Oak Cr., Mo. | GG-163..... | i, 1026 |
| Bull Cr., Ga. | O-152..... | i, 534 | (See notes, ii, 2814.) | | |
| Bull Cr., Ky. | DD-73..... | i, 959 | Burrwood | (HH)..... | i, 1072* |
| | DD-237..... | i, 961 | Burt Lake, Mich. | PP-35..... | i, 1419 |
| Bull Cr., N. C. | M-3..... | i, 454 | Burton Cr., S. Dak.: | | |
| Bull Cr., S. C. | N-15..... | i, 499 | (See notes, ii, 2819.) | | |
| Bull Cr., S. Dak. | GG-882..... | i, 1032 | Burtons Cr., La. | S-814..... | i, 688 |
| (See notes, ii, 2819.) | | | Burtons Cr., Tenn. | AA-247..... | i, 850 |
| Bull Cr., Va. | DD-273..... | i, 961 | | AA-239..... | i, 878 |
| Bull Cr., W. Va. | DD-302..... | i, 961 | Bush Br., Ky. | DD-116..... | i, 960 |
| Bullerton | (HH)..... | i, 1072* | Bush Cabin Run, Md. | J-1025..... | i, 338 |
| Bulletins, Great Lakes. | ii, 2041, 2122 | | Bush Canal, La. | S-450..... | i, 685 |
| Bullfoot Cr., Kans.: | | | | S-455..... | i, 685 |
| (See notes, ii, 2822.) | | | Bush Cr., Md. | J-958..... | i, 338 |
| Bullneck Cr., Md. | J-1086..... | i, 339 | Bush Fork Cr., Va. | K-231..... | i, 374 |
| Bullock Cr., R. I. | C-82..... | i, 107 | Bush R., Md. | J-950..... | i, 338, 365 |
| Bullock Pond, Md. | J-151..... | i, 332 | Bridges..... | | ii, 2149 |
| Bullocks Cove, R. I.: | | | Bush R., S. C. | N-174..... | i, 500 |
| Bridges..... | ii, 2149 | | Bushwick Cr., N. Y. | F-108..... | i, 216 |
| Bullocks Cr., S. C. | N-155..... | i, 500 | Harbor lines..... | | ii, 2254 |
| Bull Run Cr., Tenn. | AA-160..... | i, 849 | Butcher Cr., Va. | L-366..... | i, 414 |
| Bull Run, Ky. | DD-143..... | i, 960 | Butcherpen Cr., Fla. | P-28..... | i, 569 |
| Bull Run, Va. | K-101..... | i, 373 | Butchers Cr., Va. | L-79..... | i, 411 |
| Bullsken Cr., Ky. | DD-50..... | i, 959 | Butler Cove, Md. | J-428..... | i, 334 |
| Bulows Cr., Fla. | P-99..... | i, 569 | Butler Cr., Pa. | J-633..... | i, 335 |
| Bulwagga B., N. Y. | E-98..... | i, 178 | Butler R., Ga.: | | |
| Bump Landing Cr., N. C. | L-260..... | i, 413 | Bridges..... | | ii, 2149 |
| Bundek Cr., La. | S-827..... | i, 688 | Butlers Cr., Ga. | O-52..... | i, 533 |
| Bungay Cr., Md. | J-475..... | i, 334 | | O-238..... | i, 534 |
| Bunton Cr., N. C. | M-5..... | i, 454 | Butte Cr., Nebr. | GG-920..... | i, 1032 |
| Burdens Iron Works, N. Y.: | | | Butter Cr., Mont. | GG-654..... | i, 1030 |
| Harbor lines..... | ii, 2254 | | (See notes, ii, 2817.) | | |
| Burke Slough. | (W W-2)..... | i, 1616* | Buttermilk B., Mass.: | | |
| Burlington. | (HH)..... | i, 1072* | Bridges..... | | ii, 2149 |
| | | | Buttermilk Chan., N. Y. | | |
| | | | H., N. Y. | F-105-k..... | i, 240 |
| | | | Buttermilk Chan., N. Y. | | |
| | | | H. (see New York, N. Y.): | | |
| | | | Harbor lines..... | | ii, 2254 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------|---------------------|-------------------|--|---------------------|-------------------|
| Buttermilk Sound, Ga. | O-236 | i, 534 | Buzzards B., Mass. (re- moving Weepectet Rock) | C-34 | i, 116 |
| Butternut | (HH) | i, 1072* | Buzzards Cr., Ga. | O-450 | i, 536 |
| Butterwood Cr., Va. | L-318 | i, 413 | Bybees Isld. | (WW-2) | i, 1616* |
| Buttle Cr., Ga. | O-248 | i, 535 | Byhume Cr., Mo. | GG-56 | i, 1025 |
| Button B., Vt. | E-108 | i, 178 | Bynum Run, Md. | J-961 | i, 338 |
| Butuan B., P. I. | YY-179 | i, 1686 | Byram H., Conn. | D-98 | i, 173 |
| Buxton Cr., La. | S-849 | i, 688 | Byram R., Conn. and N. Y. | D-98 | i, 141 |
| Buxton Cr., N. C. | M-148 | i, 455 | Byram R., N. Y. | E-2 | i, 177 |
| Buzzard | (HH) | i, 1072* | Harbor lines | | ii, 2254 |
| Buzzard Isld. Cr., Md. | K-17 | i, 373 | | | |
| Buzzard Roost, Ga. | O-221 | i, 534 | | | |
| Buzzards B., Mass. | C-34 | i, 107 | | | |
| Appro. | | ii, 2288 | | | |
| Wrecks | | ii, 2264 | | | |

C

| | | | | | |
|---|---------|----------------|--|--------|-------------|
| Cabanosso Bayou, La.: | | | Cadron Cr., Ark. | Y-4 | i, 818 |
| Bridges | | ii, 2150 | Caesars Cr., Fla. | P-175 | i, 570 |
| Cabaret | (HH) | i, 1072* | Cafee B., N. C. | M-35 | i, 454 |
| Cabbage Cr., Ga. | O-169 | i, 534 | Cagayan, P. I. | YY-178 | i, 1686 |
| Cabbage Patch | (CC) | i, 909* | Cagayan R., P. I. | YY-88 | i, 1686 |
| Cabell Cr., W. Va. | EE-59 | i, 983 | Cahaba R., Ala. | Q-60 | i, 611, 642 |
| Cabin Branch, Md. | J-1155 | i, 339 | (See notes, ii, 2802.) | | |
| Cabin Cove, Md. | J-493 | i, 334 | Appro. | | ii, 2294 |
| Cabin Cr., Ga. | O-368 | i, 535 | Bridges | | ii, 2150 |
| Cabin Cr., Md. | J-265 | i, 333, 352 | Cahokia | (HH) | i, 1072* |
| | J-396 | i, 334 | Caillow B., La. | S-465 | i, 685 |
| Cabin Cr., Mont. | GG-742 | i, 1030 | Caillow Lake, La. | S-470 | i, 685 |
| (See notes, ii, 2818.) | | | Cain Cr., S. Dak. | GG-331 | i, 1027 |
| Cabin Cr., N. C. | M-141 | i, 455 | (See notes, ii, 2815.) | | |
| Cabin Cr., Pa. | J-919 | i, 338 | Caïro | (CC) | i, 909* |
| Cabin Cr., W. Va. | EE-73 | i, 983 | (HH) | | i, 1072* |
| Cabinet Rapids | (WW-2) | i, 1616* | (See notes, ii, 2827, 2828, 2829, 2831, 2832.) | | |
| Cabin Fork, W. Va. | EE-34 | i, 983 | Caïro H., Ill. (vicinity op- posite) | BB-3 | i, 891 |
| Cabin John Br., D. C. | | ii, 2039, 2062 | Caïro, opposite (HH): | | |
| Cabin John Cr., Md. | J-526 | i, 335 | (See notes, ii, 2827.) | | |
| Cache | (HH) | i, 1072* | Caïro, Ill. | II-2 | i, 1229 |
| Cache Cr., Mont. | GG-723 | i, 1030 | (See notes, ii, 2828.) | | |
| (See notes, ii, 2818.) | | | Caïro R., Ky. | AA-17 | i, 848 |
| Cache Cr., Nebr. | GG-958 | i, 1032 | Calamus R., Nebr.: | | |
| (See notes, ii, 2819.) | | | (See notes, ii, 2820.) | | |
| Cached Cr., Mont. | GG-611 | i, 1029 | Calaveras R., Cal. | UU-40 | i, 1577 |
| (See notes, ii, 2817.) | | | Calcasieu Lake and Sa- bine Lake (between), Black Bayou, La. | S-799 | i, 714 |
| Cache La Poudre R., Colo. | GG-1085 | i, 1033 | Calcasieu Lake, La. | S-794 | i, 688 |
| (See notes, ii, 2820.) | | | | S-793 | i, 712 |
| Cache R., Ark. | Y-25 | i, 818, 833 | Calcasieu Pass, Lake, and R., La.: | | |
| (See notes, ii, 2808.) | | | Appro. | | ii, 2294 |
| Appro. | | ii, 2295 | Calcasieu Pass, La. | S-793 | i, 683, 712 |
| Bridges | | ii, 2150, 2216 | | S-793 | i, 688 |
| Cache R., Ark. (obstruc- tions removed from) | Y-23-c | i, 829 | Calcasieu R., La. | S-798 | i, 688 |
| Cache R., Ill. | BB-40 | i, 891 | | S-793 | i, 712 |
| Cache Slough, Cal. | UU-62 | i, 1577 | | | ii, 2150 |
| Caddo Lake, Tex. and La. | T-18 | i, 717 | | | |
| (See notes, ii, 2807.) | | | | | |
| Cadiz, P. I. | YY-127 | i, 1686 | | | |
| Cadle Cr., Md. | J-1265 | i, 340 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|----------------------------|--|---------------------|-------------------|
| Calcasieu R., La. (West Fork) | S-840..... | i, 688 | Calumet R. to Lake Michigan, Ill. (canal) | NN-18-b..... | i, 1366 |
| Calcasieu R. to Sabine R., La. (inland waterway canal) | S-858..... | i, 688 | Calvert B., Md. | K-51..... | i, 373 |
| Calcite H., Mich. | PP-43..... | i, 1419 | Cambridge | (GG-2)..... | i, 1038* |
| Caldwell Run | (CC)..... | i, 909* | Cambridge H., Md. | J-258..... | i, 333, 350 |
| Calf Cr., Ga. | O-346..... | i, 535 | Appro..... | | ii, 2291 |
| Calf Cr., Mont. | GG-469..... | i, 1028 | Bridges..... | | ii, 2151 |
| (See notes, ii, 2816.) | | | Wrecks..... | | ii, 2264 |
| Calf Cr., N. C. | M-94..... | i, 455 | Cambridge, Mass.: | | |
| Calf Pasture Cove, Md. | J-494..... | i, 334 | Harbor lines..... | | ii, 2254 |
| Calhoun, Fort, Va. | | ii, 1808, 1927 | Camden | (GG-2)..... | i, 1038* |
| Calhoun, Ky. | BB-7..... | i, 892 | Camden and Columbia to Charleston, S. C. | N-203-b..... | i, 522 |
| Calhoun Pt. | (HH)..... | i, 1072* | Camden, Ark. (above), to Philadelphia, Ark. | | |
| Calico Cr., N. C. | M-274..... | i, 456 | Ouachita B..... | X-29-b..... | i, 805 |
| Calico Isld. | (HH)..... | i, 1072* | Camden H., Me. | A-142..... | i, 28, 43 |
| (See notes, ii, 2827, 2829.) | | | Camden, Me.: | | |
| California: | | | (See notes, ii, 2783.) | | |
| Field service in..... | | ii, 2039, 2047 | Appro..... | | ii, 2287 |
| Forts..... | | ii, 1801, 1816, 2001, 2005 | Camden, N. J. (harbor), Delaware R. | H-3-1..... | i, 285 |
| Irrigation..... | | ii, 2040, 2087 | Harbor lines..... | | ii, 2254 |
| California B., La. | S-192..... | i, 682 | Camel Cr., S. Dak. | GG-357..... | i, 1027 |
| California Cr., Fla. | P-362..... | i, 572 | | GG-371..... | i, 1028 |
| California Débris Comm. | UU-6-d-e-f..... | i, 1580 | | GG-877..... | i, 1032 |
| | | ii, 2041, 2108 | | | |
| (See notes, ii, 2840.) | | | (See notes, ii, 2819.) | | |
| Appro..... | | ii, 2300 | Cameron Cr., Mont. | GG-582..... | i, 1029 |
| California, Department of: | | | (See notes, ii, 2816.) | | |
| Work in the field..... | | ii, 2040, 2086 | Caminada B., La. | S-412..... | i, 684 |
| California (inland waterway) | TT-171-b..... | i, 1569 | Caminada Pass, La. | S-411..... | i, 684 |
| California (north coast, sites for harbors) | TT-131-a..... | i, 1568 | Campbell | (GG-2)..... | i, 1038* |
| Callaghans Cr., N. C. | M-27..... | i, 454 | Campbell Cr., S. Dak.: | | |
| Callahan Cr., Mo. | GG-98..... | i, 1025 | (See notes, ii, 2815.) | | |
| (See notes, ii, 2813.) | | | Campbell Cr., W. Va. | EE-132..... | i, 984 |
| Callaisa Cr., Fla. | P-109..... | i, 570 | Campbell Ditch Run, Md. | J-26..... | i, 331 |
| Callaway Branch, Mo. | GG-8..... | i, 1025 | Campbells Chain | (HH)..... | i, 1072* |
| (See notes, ii, 2813.) | | | Campbells Cr., N. C. | M-116..... | i, 455 |
| Calls Cr., Va. | K-253..... | i, 375 | Campbells Swamp, S. C. | N-83..... | i, 499 |
| Calloway Cr., Ky. | DD-16..... | i, 959 | Camp Branch, Ky. | DD-142..... | i, 960 |
| Caloosahatchee R., Fla. | P-232..... | i, 571, 591 | Camp Cr., Ga. | O-163..... | i, 534 |
| Appro..... | | ii, 2293 | | O-307..... | i, 535 |
| Bridges..... | | ii, 2150 | | O-497..... | i, 536 |
| Calomet R., Wash. | XX-34..... | i, 1655 | Camp Cr., Kans. | GG-1247..... | i, 1034 |
| Calumet Cr., Kans. and Nebr. | GG-1310..... | i, 1035 | | GG-1263..... | i, 1035 |
| (See notes, ii, 2822.) | | | | GG-1284..... | i, 1035 |
| Calumet H., Ill. | NN-17..... | i, 1349, 1361 | (See notes, ii, 2822.) | | |
| (See notes, ii, 2837.) | | | Camp Cr., Mo. | GG-214..... | i, 1026 |
| Appro..... | | ii, 2298 | | GG-1435..... | i, 1036 |
| Harbor lines..... | | ii, 2254 | (See notes, ii, 2823.) | | |
| Calumet H., Wis., Lake Winnebago | MM-21-d..... | i, 1316 | Camp Cr., Nebr.: | | |
| Calumet R., Ill. and Ind. | NN-18..... | i, 1349, 1364 | (See notes, ii, 2821.) | | |
| (See notes, ii, 2837.) | | | Camp Cr., Nebr. and Kans. | GG-1151..... | i, 1034 |
| Appro..... | | ii, 2298 | Camp Cr., S. C. | N-122..... | i, 500 |
| Bridges..... | | ii, 2150, 2151 | Camp Cr., W. Va. | DD-330..... | i, 961 |
| Wrecks..... | | ii, 2264 | Camp Cr., Wyo. | GG-1060..... | i, 1033 |
| Calumet R., Ind.: | | | (See notes, ii, 2820.) | | |
| Bridges..... | | ii, 2150, 2151 | Camping Cr., S. C. | N-173..... | i, 500 |
| | | | Camuy R., P. R. | YY-25..... | i, 1685 |
| | | | Canaan Cove, N. C. | L-287..... | i, 413 |
| | | | Canada-U. S. boundary | E-74..... | i, 171 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|---------------------|-------------------|
| Canadaway Cr., N. Y. | RR-8..... | i, 1493 | Canals, Locks, Dams, etc.—Continued. | | |
| Canadian R., Colo.: | | | Coosa R., Ga. and Ala., locks and dams. See | | |
| (See notes, ii, 2820.) | | | Coosa R. | | |
| Canadian R., East Fork, | | | Cumberland R., Tenn. and Ky., locks and | | |
| Colo. | GG-1042..... | i, 1033 | dams. See Cumberland R. | | |
| Canadian R., Okla. | Y-18..... | i, 818 | Delaware B., Del., to Rehoboth B. See Dela- | | |
| Canal Cr., Md. | J-980..... | i, 338 | ware B. | | |
| Canals. | ii, 2041, 2106 | | Des Moines Rapids Canal, Mississippi R. See | | |
| Navigation of, regulations for..... | ii, 2137 | | Mississippi R. | | |
| Operating and care, ex- | | | Dismal Swamp Canal, Va. and N. C. See | | |
| penditures..... | ii, 2279 | | Norfolk-North Carolina Sounds waterway. | | |
| Rules and regulations..... | ii, 2041, 2107 | | Duluth Canal, Minn. See Duluth. | | |
| Canals, Locks, Dams, etc.: | | | Elk R. Shoals Canal, Ala. See Tennessee R. | | |
| Albemarle and Chesapeake Canal, N. C. See | | | Estherville-Minim Cr. Canal., S. C. See | | |
| Albemarle Sound-Norfolk waterway. | | | Estherville-Minim Cr. Canal. | | |
| Allegheny R., Pa., locks and dams. See Alle- | | | Expenditures for operation and care. See | | |
| gheny R. | | | Canals, above. | | |
| Appropriation for operating and care. See | | | Fox R., Wis., locks and dams. See Fox R. | | |
| Canals. | | | Galena R., Ill., lock and dam. See Galena R. | | |
| Barren R., Ky., lock and dam. See Barren R. | | | Galveston, Tex., to Brazos R. See Galveston | | |
| Bee Tree Shoals Canal, Ala. See Tennessee R. | | | & Brazos Canal and West Galveston B. | | |
| Benton H. Canal, Mich. See St. Joseph H. | | | Great Kanawha R., W. Va., locks and dams. | | |
| Big Barren R., Ky., lock and dam. See | | | See Kanawha R. | | |
| Barren R. | | | Green R., Ky., locks and dams. See Green R. | | |
| Big Kanawha R., W. Va., locks and dams. | | | Hales Bar, Tennessee R., lock and dam. See | | |
| See Kanawha R. | | | Tennessee R. | | |
| Big Sandy R., W. Va. and Ky., locks and | | | Illinois and Mississippi Canal, Ill. See Illinois | | |
| dams. See Big Sandy R. | | | & Mississippi Canal. | | |
| Black Rock H., N. Y., lock. See Black | | | Illinois R., Ill., locks and dams. See Illinois R. | | |
| Rock H. | | | Kanawha R., W. Va., locks and dams. See | | |
| Black Warrior R., Ala., locks and dams. See | | | Kanawha R. | | |
| Black Warrior R. | | | Kentucky R., Ky., locks and dams. See Ken- | | |
| Boston, Mass., to Rio Grande, survey for intra- | | | tucky R. | | |
| coastal waterway (q. v.). | | | Keokuk (Des Moines Rapids) Canal, Missis- | | |
| Brazos R., Tex., locks and dams. See Brazos | | | sippi R. | | |
| R. | | | Keweenaw B. to Lake Superior. See Kewee- | | |
| Brazos R., Tex., to Galveston. See Galveston | | | naw B.-Lake Superior waterway. | | |
| & Brazos Canal and West Galveston B. | | | Lake Washington Canal, Wash. See Puget | | |
| Caddo Lake, Tex. and La., dam. See Caddo | | | Sound-Lake Washington waterway. | | |
| Lake. | | | Levisa Fork, Big Sandy R., Ky., locks and | | |
| Calaveras R., Cal., to Mormon Chan., San | | | dams. See Big Sandy R. | | |
| Joaquín R. See Mormon Chan. | | | Little Kanawha R., W. Va., locks and dams. | | |
| Canadian Canal, St. Marys R., Ontario, com- | | | See Little Kanawha R. | | |
| merce. See St. Marys Falls Canal. | | | Lockport, Ill., to St. Louis, Mo., and mouth of | | |
| Cape Fear R. above Wilmington, N. C., locks | | | the Mississippi, 14-foot waterway. See Lock- | | |
| and dams. See Cape Fear R. | | | port, Ill. | | |
| Care and maintenance, appropriation for. See | | | Louisville & Portland Canal, Ky. See Ohio R. | | |
| Canals, above. | | | Michigan Lake to Sturgeon B. See Sturgeon | | |
| Cascades Canal, Columbia R., Oreg. See | | | B. & Lake Michigan Canal. | | |
| Columbia R. | | | Minim Cr.-Estherville Canal, S. C. See | | |
| Chicago (Lockport), Ill., to St. Louis, Mo., and | | | Estherville-Minim Cr. Canal. | | |
| the Gulf, 14-foot waterway. See Lockport, | | | Mississippi R., Des Moines Rapids Canal. See | | |
| Ill. | | | Mississippi R. | | |
| Club Cr., Ga., to Plantation Cr. See Club Cr. | | | Mississippi R., Moline, Ill., lock and dam. | | |
| Clubfoot & Harlowe Canal, N. C. See | | | See Mississippi R. | | |
| Newbern-Beaufort waterway. | | | Mississippi R., reservoirs. See Mississippi R. | | |
| Colbert Shoals Canal, Ala. See Tennessee R. | | | Mississippi R., St. Paul to Minneapolis, locks | | |
| Columbia R., Cascades Canal. See Columbia | | | and dams. See Mississippi R. | | |
| R. | | | Mississippi R. to Illinois R. See Illinois & | | |
| Columbia R., The Dalles Rapids to Celilo Falls, | | | Mississippi Canal. | | |
| locks and canal. See Columbia R. | | | Moline H., Ill., lock and dam. See Missis- | | |
| Congaree R., S. C., lock and dam. See Con- | | | sippi R. | | |
| garee R. | | | Monongahela R., W. Va. and Pa., locks and | | |
| | | | dams. See Monongahela R. | | |

District Vol. and
and No. page.

Canals, Locks, Dams, etc.—Continued.

Mormon Chan., San Joaquin R., Cal., to Calaveras R. See Mormon Chan.

Mosquito Cr. Canal, S. C. See Santee R.

Muscle Shoals Canal, Ala. See Tennessee R.

Muskingum R., Ohio, locks and dams. See Muskingum R.

Newark to Kill Van Kull, N. J. See Newark B., N. J.

North Carolina Cut, N. C., waterway via. See Norfolk-Albemarle Sound waterway.

Ohio R., locks and dams. See Ohio R.

Ohio R., Louisville & Portland Canal. See Ohio R.

Operation and care, appropriation for. See Canals, above.

Osage R., Mo., lock and dam. See Osage R.

Ouachita R., Ark. and La., locks and dams. See Ouachita R.

Permanent appropriation for operation and care. See Canals, above.

Plantation Cr., Ga., to Club Cr. See Plantation Cr.

Plaquemine Bayou, La., lock. See Plaquemine Bayou.

Portage Lake canals, Mich. See Keweenaw B.-Lake Superior waterway.

Port Arthur Canal, Tex. See Port Arthur Canal.

Puget Sound-Lake Washington waterway. See Puget Sound-Lake Washington waterway.

Rock R., Ill. See Illinois & Mississippi Canal.

Rough R., Ky., lock and dam. See Rough R.

Sabine-Neches Canal. See Sabine R., Tex.

St. Clair Flats Canal, Mich. See St. Clair Canal and R.

St. Marys Falls Canal, Mich. See St. Marys R., etc.

St. Michael Canal, Alaska. See St. Michael Canal.

Salmon B., Wash., waterway via. See Puget Sound-Lake Washington waterway.

San Joaquin R., Cal., Mormon Chan. to Calaveras R. See Mormon Chan.

Scott Pt., Tennessee R., lock and dam at Hales Bar. See Tennessee R.

Seattle Canal, Wash. See Puget Sound-Lake Washington waterway.

Shishole B., Wash., waterway via. See Puget Sound-Lake Washington waterway.

Sturgeon B. & Lake Michigan Canal, Wis. See Sturgeon B. & Lake Michigan Canal.

Superior Lake to Keweenaw B. See Superior Lake.

Teche Bayou, La., lock and dam. See Teche Bayou.

Tennessee R., canals, locks, and dams. See Tennessee R.

Tombigbee R., Ala., locks and dams. See Tombigbee R.

Trinity R., Tex., locks and dams. See Trinity R.

District Vol. and
and No. page.

Canals, Locks, Dams, etc.—Continued.

Tug Fork, Big Sandy R., W. Va. and Ky., locks and dams. See Big Sandy R.

Turners Cut, N. C., waterway via. See Norfolk-North Carolina Sounds waterway.

Union Lake, Wash., waterway via. See Puget Sound-Lake Washington waterway.

Wabash R., locks and dams. See Wabash R.

Warrior R., Ala., locks and dams. See Warrior R.

Washington, D. C., lock at tidal reservoir, Potomac R. See Potomac R.

Washington Lake to Puget Sound waterway. See Puget Sound-Lake Washington waterway.

Washita (Ouachita) R., Ark. and La., locks and dams. See Ouachita R.

West Galveston B. and Brazos R. Canal, Tex. See Galveston & Brazos Canal and West Galveston B.

White R., Ark., locks and dams. See White R.

Yamhill R., Oreg., lock and dam. See Yamhill R.

Yuba R., Cal., restraining dam. See California Débris Comm.

Canal Waterway, Wash.:

Harbor lines.....ii, 2254

Canapitsit Chan., Mass.. C-25.....i, 107, 112

Appro.....ii, 2288

Canard Frungals Bayou,

La.....S-185.....i, 682

Canarsie B., N. Y..... F-95.....i, 216, 231

F-73-a.....i, 230

Appro.....ii, 2289

Canby, Ft., Wash..... ii, 2018

Candienne Canal, La..... S-424.....i, 684

Candler Cr., Ga..... O-287.....i, 535

Candy Cr., Tenn..... AA-69.....i, 848

Cane Bayou, La..... S-16.....i, 681

S-448.....i, 685

S-499.....i, 685

(See notes, ii, 2804.)

Cane Cr., Ala..... AA-37.....i, 848

AA-50.....i, 848

Cane Cr., S. C..... N-123.....i, 500

Cane Patch Cr., Ga..... O-159.....i, 534

Cane Cr., La..... S-566.....i, 686

Cane R., La..... X-50.....i, 785, 813

Appro.....ii, 2295

Bridges.....ii, 2151

Canes Cr., Ky..... DD-220.....i, 960

Caney Bayou, La..... S-528.....i, 685

Caney Cr., Ky..... DD-112.....i, 960

DD-152.....i, 960

DD-252.....i, 961

Caney Cr., La..... S-773.....i, 687

T-2-i.....i, 717

(See notes, ii, 2805.)

Caney Cr., Tenn..... AA-174.....i, 849

Caney Cr., Tex..... U-46.....i, 735, 765

(See notes, ii, 2805.)

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|------------------------------------|---------------------|-------------------|
| Caney Fork, Ky. | DD-242..... | i, 961 | Cape Fear R., N. C. | L-173-i..... | i, 434 |
| Caney Fork R., Tenn. | AA-263..... | i, 850, 886 | | M-305..... | i, 456, 484 |
| | AA-239..... | i, 878 | (See notes, ii, 2797.) | | |
| (See notes, ii, 2809.) | | | Appro..... | | ii, 2292 |
| Appro..... | | ii, 2296 | Bridges..... | | ii, 2151 |
| Bridges..... | | ii, 2151 | Forts..... | | ii, 1823, 1935 |
| Caney, Ky. | DD-198..... | i, 960 | Harbor lines..... | | ii, 2254 |
| Canisteo R., N. Y. | JJ-687..... | i, 336 | Navigation rules..... | | ii, 2041, 2107 |
| Cannelton, Ind. | (CC)..... | i, 909* | Wrecks..... | | ii, 2265 |
| Cannon. | (HH)..... | i, 1072* | Cape Fear R., N. C. (above | | |
| Cannon R. | (HH)..... | i, 1072* | Fayetteville)..... | M-305-e..... | i, 490 |
| Cannonball. | (GG-2)..... | i, 1038* | Cape Fear R., N. C. (above | | |
| Cannon Ball Cr., N. Dak. | | | Wilmington)..... | M-305-b..... | i, 488 |
| and Mont..... | GG-756..... | i, 1031 | Cape Fear R., N. C. (above | | |
| Cannon Ball R., N. Dak. | (GG-2)..... | i, 1037*, 1038* | Wilmington, locks and | | |
| | GG-779..... | i, 1031 | dams)..... | M-305-c..... | i, 489 |
| (See notes, ii, 2818.) | | | Cape Fear R., N. C. (at and | | |
| Cannon R., Minn. | JJ-26..... | i, 1234 | below Wilmington)..... | M-305-a..... | i, 484 |
| Cannon R., Minn. (reser- | | | Cape Fear R., N. C. (Reeves | | |
| voirs)..... | JJ-26..... | i, 1242 | Pt. to La Grange)..... | M-305-d..... | i, 490 |
| Cannouchee R., Ga. (see | | | Cape Fear R., N. C., to | | |
| Cannouchee)..... | O-120-a..... | i, 549 | Norfolk, Va..... | L-173-h..... | i, 434 |
| Canoe Cr., Pa. | J-869..... | i, 337 | Cape Fear R. to Wacca- | | |
| Canoe Fork, Ky. | DD-98..... | i, 959 | maw R., N. C. (water- | | |
| Canoe Pass, Wash.: | | | way)..... | M-305-f..... | i, 490 |
| Bridges..... | | ii, 2151, 2161 | Cape Flattery to Grays | | |
| Canon Cr., Mont. | GG-655..... | i, 1030 | H., Wash..... | XX-24..... | i, 1655 |
| (See notes, ii, 2817.) | | | Cape Flattery to Port | | |
| Canon Cr., Wyo. | GG-1059..... | i, 1033 | Townsend, Wash..... | XX-39..... | i, 1655 |
| (See notes, ii, 2820.) | | | Cape Florida Chan., Fla. | P-158..... | i, 570 |
| Canonicut Cr., R. I.: | | | Cape Foulweather H., | | |
| Harbor lines..... | | ii, 2254 | Oreg..... | VV-52-b..... | i, 1607 |
| Cannouchee R., Ga. (see | | | Cape Girardeau. | (HH)..... | i, 1072* |
| Cannouchee)..... | O-144..... | i, 534, 549 | (See notes, ii, 2828, 2832.) | | |
| Canton. | (HH)..... | i, 1072* | Capé Girardeau, Mo. | Z..... | i, 841 |
| Canton, Ky. | AA-239..... | i, 878 | Cape Gregory, Oreg. | VV-15-b..... | i, 1599 |
| Canyon Ferry. | (GG-2)..... | i, 1038* | Cape Hatteras, N. C.: | | |
| Cap au Gris. | (HH)..... | i, 1072* | Wrecks..... | | ii, 2265 |
| Cape Ann, Mass. | B-77..... | i, 76 | Cape Henry Light, Va.: | | |
| Cape Canaveral, Fla. | P-107-a..... | i, 585 | Wrecks..... | | ii, 2265 |
| Cape Canaveral H., Fla. | P-110..... | i, 570 | Cape Isld. Cr., N. J.: | | |
| (See notes, ii, 2799.) | | | Bridges..... | | ii, 2151 |
| Cape Charles: | | | Cape Jellison H., Me.: | | |
| Wrecks..... | | ii, 2264 | Bridges..... | | ii, 2151 |
| Cape Charles City H., Va. | L-62..... | i, 411, 414 | Cape Lookout, N. C. | M-259..... | i, 456 |
| (See notes, ii, 2795.) | | | Appro..... | | ii, 2292 |
| Appro..... | | ii, 2291 | Wrecks..... | | ii, 2265 |
| Navigation rules..... | | ii, 2041, 2107 | Cape Lookout, N. C. | | |
| Cape Charles, Va., to | | | (harbor of refuge)..... | M-259-a..... | i, 479 |
| Franklin City, Va. (In- | | | Cape Lookout, Oreg. | VV-59-b..... | i, 1608 |
| ternal waterway)..... | I-79-b..... | i, 327 | Cape May, N. J. | I-28..... | i, 299 |
| Cape Cinque Hommes. | (HH)..... | i, 1072* | Wrecks..... | | ii, 2265 |
| Cape Cod, Mass. | C-2..... | i, 107, 108 | Cape May City, N. J. | | |
| Wrecks..... | | ii, 2265 | (breakwater)..... | I-28..... | i, 304 |
| Cape Cod Ship Canal, | | | Cape May Thoroughfare, | | |
| Mass..... | B-176..... | i, 70, 100 | N. J.: | | |
| Cape Disappointment. | (WW-2)..... | i, 1616* | Bridges..... | | ii, 2230 |
| Cape Disappointment, | | | Cape May to Great B., | | |
| Wash.: | | | N. J..... | I-13-a..... | i, 302 |
| Forts..... | | ii, 2018 | Cape Neddick H., Me. | A-278..... | i, 29 |
| | | | Cape Neddick R., Me.: | | |
| | | | Bridges..... | | ii, 2151 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Cape Porpoise H., Me. | A-274..... | i, 29, 58 | Carrot Cove, Md. | J-548..... | i, 335 |
| Appro. .... | ..... | ii, 2288 | Carrot Isld. Slough, N. C. | M-230-a..... | i, 472 |
| Wrecks..... | ..... | ii, 2265 | Carrs Cr., Md. | J-1212..... | i, 340 |
| Cape Small H., Me. | A-244-a..... | i, 52 | Carrs Fork, Ky. | DD-145..... | i, 960 |
| Capes of Delaware: | | | Carruthersville. | (HH)..... | i, 1072* |
| Wrecks..... | ..... | ii, 2265 | Carsins Run, Md. | J-941..... | i, 338 |
| Cape Split H., Me. | A-24..... | i, 27 | Cart Cr., N. Dak. | KK-174..... | i, 1248 |
| Cape Vincent H., N. Y. | RR-64..... | i, 1493, 1534 | Carter Cove, Va. | K-176..... | i, 374 |
| Appro. .... | ..... | ii, 2299 | Carter Cr., Md. | J-409..... | i, 334 |
| Capiz, P. I. | YY-136..... | i, 1686 | Carter Cr., Mont. | GG-617..... | i, 1029 |
| Captain Cr., Kans.: | | | (See notes, ii, 2817.) | | |
| (See notes, ii, 2823.) | | | Carter Cr., Va. | K-301..... | i, 375 |
| Captina Isld. | (CC)..... | i, 909* | Carters Cr., Miss. | R-98-t..... | i, 647 |
| Captiva Pass, Fla. | P-256..... | i, 571 | Carters Cr., S. C. | N-142..... | i, 500 |
| Cardos R., P. R. | YY-23..... | i, 1685 | Carters Cr., Va. | K-174..... | i, 374, 400 |
| Card Sound, Fla. | P-167..... | i, 570 | Appro. .... | ..... | ii, 2291 |
| Carencro Bayou, La. | S-727..... | i, 687 | Harbor lines..... | ..... | ii, 2254 |
| Carey Cr., Md. | J-241..... | i, 332 | Wrecks..... | ..... | ii, 2265 |
| Carlin Bayou, La. | S-680..... | i, 687, 708 | Carters Mill Cr., N. C. | L-325..... | i, 413 |
| S-705..... | ..... | i, 687 | Carthage Cr., Md. | K-56..... | i, 373 |
| S-708..... | ..... | i, 687 | Carthage, Tenn. | AA-239..... | i, 878 |
| Carlows Isld., Me.: | | | Carthage to Edinburg, | | |
| Bridges..... | ..... | ii, 2216 | Pearl R., Miss..... | R-98-f..... | i, 677 |
| Carlyle Cr., Pa. | H-11..... | i, 271 | Carthage to Jackson, | | |
| Carmans R., N. Y. | F-56..... | i, 215 | Pearl R., Miss..... | R-98-d..... | i, 676 |
| Carmel B., Cal. | TT-4..... | i, 1555 | Caruthersville (HH): | | |
| Carmel R., Cal. | TT-5..... | i, 1555 | (See notes, ii, 2827.) | | |
| Carnahan Cr., Kans. | GG-1251..... | i, 1034 | Carver Cr., Minn. | KK-140..... | i, 1248 |
| (See notes, ii, 2821.) | | | Carvers Cove, Me. | A-124..... | i, 28 |
| Carnerous Slough, Cal. | TT-111..... | i, 1556 | Carvers H., Me. | A-116..... | i, 40 |
| Carolls Isld. (HH): | | | Appro. .... | ..... | ii, 2287 |
| (See notes, ii, 2829.) | | | Carvers H. (Vinalhaven), | | |
| Carondelet Canal, La. | S-135..... | i, 682, 694 | Me..... | A-116..... | i, 28 |
| (See notes, ii, 2805.) | | | Cary Cr., Kans.: | | |
| Appro. .... | ..... | ii, 2294 | (See notes, ii, 2823.) | | |
| Carpenter Run, Pa. | J-724..... | i, 336 | Cascade | (GG-2)..... | i, 1038* |
| Carpenter Cr., S. C. | N-183..... | i, 500 | Cascade R., Wash. | XX-94..... | i, 1655 |
| Carp R., Mich. | OO-54-c..... | i, 1411 | Cascades | (WW-2)..... | i, 1616* |
| PP-27..... | ..... | i, 1419 | (See notes, ii, 2841, 2843.) | | |
| Carquinez Strait, Cal. | TT-65..... | i, 1555 | Cascades Canal, Colum- | | |
| Harbor lines..... | ..... | ii, 2254 | bia R., Oreg. (which see): | | |
| Carrabella R., Fla. | Q-18..... | i, 611 | Navigation rules..... | ..... | ii, 2041, 2107 |
| Carrabelle Bar and H., in- | | | Casco B., Me. | A-243..... | i, 29 |
| cluding East Pass, Fla. | Q-17..... | i, 613 | Bridges..... | ..... | ii, 2151 |
| Appro. .... | ..... | ii, 2293 | Casco Passage, Me. | A-69..... | i, 27 |
| Carrabelle H., Fla. | Q-17..... | i, 611 | Caseville H., Mich. | PP-77..... | i, 1419 |
| Carrabelle R., Fla.: | | | Caseville, Mich. | PP-77-a..... | i, 1439 |
| Wrecks..... | ..... | ii, 2265 | Casey, Brig. Gen. T. L., | | |
| Carris R., N. Y. | F-64..... | i, 215, 229 | Chief of Engineers: | | |
| Carrol, Ft., Md...... | ..... | ii, 1804, 1914 | Forts..... | ..... | ii, 1823 |
| Carroll | (GG-2)..... | i, 1038* | Casey Pass, Fla. | P-272..... | i, 571 |
| Carroll Branch, Md. | J-1005..... | i, 338 | Caseyville | (CC)..... | i, 909* |
| Carroll Cr., Mo. | GG-185..... | i, 1026 | Cashal R., N. C. | L-342..... | i, 414 |
| (See notes, ii, 2814.) | | | Cashie R., N. C. | L-352-b..... | i, 447 |
| Carrolls | (HH)..... | i, 1072* | Cash Isld. | (HH)..... | i, 1072* |
| Carrolls Isld. | (HH)..... | i, 1072* | Cashs Isld. (HH): | | |
| (See notes, ii, 2833.) | | | (See notes, ii, 2827.) | | |
| Carrollton | (HH)..... | i, 1072* | Casin Cr., La. | S-255..... | i, 683 |
| (See notes, ii, 2831.) | | | Casper Cr., Cal. | TT-147..... | i, 1556 |
| Carrollton Chan., Wash. | WW-48..... | i, 1615 | Casper Cr., N. Y. | E-41..... | i, 177 |
| Carron Bayou, La. | S-644..... | i, 686 | Casper Cr., Wyo. | GG-1002..... | i, 1032 |
| | | | (See notes, ii, 2820.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Casper R., Ky.: | | | Cathance R., Me., West | | |
| Bridges..... | | ii, 2151 | Branch..... | A-231..... | i, 29 |
| Cassidy Bayou, Miss..... | X-13..... | i, 785, 792 | Cathead Cr., S. Dak. | GG-793..... | i, 1031 |
| Cassidys Bayou, Miss..... | X-13..... | i, 792 | (See notes, ii, 2818.) | | |
| Cass Lake..... | (HH)..... | i, 1072* | Catherine Cr., N. C. | L-302..... | i, 413 |
| Cass Lake, Minn.: |  |  | ..... | L-330..... | i, 413 |
| Private dams..... | | ii, 2249 | Cathlamet. | (WW-2)..... | i, 1616* |
| Cass R., Mich. | PP-73..... | i, 1419 | Cathlamet B. | (WW-2)..... | i, 1616* |
| Cassville..... | (HH)..... | i, 1072* | Cathlamet Chan., Wash. | WW-59..... | i, 1615 |
| (See notes, ii, 2827, 2828.) | | | Catlin Cr., Ga. | O-275..... | i, 535 |
| Castaing Bayou, La. | S-17..... | i, 689 | Cators Cove, Md. | J-229..... | i, 332 |
| (See notes, ii, 2804.) | | | Cat Pt. Cr., Va. | K-194..... | i, 374 |
| Castiglione Bayou, La. | S-138..... | i, 682 | Cat R., Minn. | KK-112..... | i, 1248 |
| Castine H., Me. | A-95..... | i, 27 | Cat R., Va. | I-86..... | i, 299 |
| Castle Cr., Mo. | GG-219..... | i, 1026 | ..... | I-85-a..... | i, 328 |
| (See notes, ii, 2814.) | | | Appro..... | | ii, 2290 |
| Castle Isld., Mass.: | | | Cats Cr., Ohio. | DD-342..... | i, 961 |
| Forts..... | | ii, 1855 | Catskill Cr., N. Y. | E-61..... | i, 177, 198 |
| Harbor lines..... | | ii, 2254 | Cattall Cr., Md. | J-1194..... | i, 340 |
| Castleman R., Pa. and | | | Cat Tail Cr., Mo. | GG-1502..... | i, 1036 |
| Md..... | FF-16..... | i, 1003 | Cat Tail Cr., N. C. | L-326..... | i, 413 |
| Castle Neck R., Mass. | B-65..... | i, 69 | Cat Tail Cr., N. Dak. | GG-388..... | i, 1028 |
| Castle Pinckney, S. C.: | | | (See notes, ii, 2815.) | | |
| Forts..... | | ii, 1808 | Cattaraugus Cr., N. Y. | RR-11..... | i, 1493, 1501 |
| Castle Ridge Cr., Va. | L-26..... | i, 411 | Appro..... | | ii, 2299 |
| Castle William, N. Y. H. | | | Cattle Cr., S. C. | N-224..... | i, 500 |
| (see New York, N. Y.): | | | Caucus B., Va. | K-289..... | i, 375 |
| Forts..... | | ii, 1806, 1881 | Caulk Cove, Md. | J-344..... | i, 333 |
| Castor Bayou, La. | S-772..... | i, 687 | Cave Branch, Mo. | GG-28..... | i, 1025 |
| ..... | T-2-r..... | i, 717 | Cave Cr., Mo. | GG-1443..... | i, 1036 |
| ..... | X-43..... | i, 785, 812 | (See notes, ii, 2823.) | | |
| (See notes, ii, 2805.) | | | Caw Caw Swamp, S. C. | N-226..... | i, 500 |
| Castro Rocks, Cal.: | | | Caximbas B., Fla. | P-213..... | i, 570 |
| Harbor lines..... | | ii, 2254 | Caximbas Pass, Fla. | P-212..... | i, 570 |
| Caswell, Ft., N. C. | | ii, 1807, 1935 | Cay B., La. | S-337..... | i, 684 |
| Catahoula Bayou, La. | S-397..... | i, 684 | (See notes, ii, 2804.) | | |
| Catahoula Lake, La. | S-640..... | i, 686 | Cayuta Cr., N. Y. | J-660..... | i, 336 |
| Catamount Cr., Kans. | GG-1224..... | i, 1034 | Cazenovia Cr., N. Y. | RR-16..... | i, 1493 |
| Catamount Cr., Mont. | GG-608..... | i, 1029 | Cebu Isld., P. I. | YY-120..... | i, 1686 |
| (See notes, ii, 2817.) | | | Cebu, P. I. | YY-121..... | i, 1686 |
| Catatunk Cr., N. Y. | J-658..... | i, 336 | Cedar B., N. C. | L-253..... | i, 413 |
| Catawissa Cr., Pa. | J-618..... | i, 335 | ..... | M-221..... | i, 455 |
| Catawba R., N. C. | N-120..... | i, 514 | Cedar Bayou. | U-5-a..... | i, 736 |
| Catawba R., S. C. | N-120..... | i, 500 | Cedar Bayou, La. | S-144..... | i, 682 |
| Cat B., La.: | | | Cedar Bayou, Tex. | U-14..... | i, 735, 740 |
| (See notes, ii, 2804.) | | | Appro..... | | ii, 2295 |
| Cat Cove, Md. | J-216..... | i, 332 | Cedar Branch, Md. | J-1113..... | i, 339 |
| Cat Cove, Mass. | B-102..... | i, 69 | Cedar City. | (GG-2)..... | i, 1038* |
| Cat Cr., Md. | K-35..... | i, 373 | Cedar Cr. | (HH)..... | i, 1072* |
| Cat Cr., Mont. | GG-572..... | i, 1029 | Cedar Cr., Conn. | D-73..... | i, 141 |
| (See notes, ii, 2816.) | | | Cedar Cr., Del. | I-71..... | i, 299, 324 |
| Cat Cr., Va. | I-85-a..... | i, 328 | (See notes, ii, 2794.) | | |
| Catching Slough, Oreg. | VV-22..... | i, 1593 | Cedar Cr., Fla. | P-17..... | i, 569 |
| Catfish Cr., Ga. | O-224..... | i, 534 | ..... | P-27..... | i, 569 |
| ..... | O-517..... | i, 537 | ..... | P-31..... | i, 569 |
| Catfish Cr., S. C. | N-41..... | i, 499 | ..... | P-108..... | i, 570 |
| Catfish Lake, La. | S-430..... | i, 684 | Bridges..... | | ii, 2152 |
| ..... | S-750..... | i, 687 | Cedar Cr., Ga. | O-151..... | i, 534 |
| Catfish Pt. | (HH)..... | i, 1072* | ..... | O-181..... | i, 534 |
| Cat Fork, Ky. | DD-217..... | i, 960 | ..... | O-205..... | i, 534 |
| Cathance R., Me. | A-230..... | i, 29, 51 | ..... | O-305..... | i, 535 |
| Appro..... | | ii, 2288 | ..... | O-389..... | i, 536 |
| | | | Cedar Cr., Kans. | GG-1154..... | i, 1034 |
|  |  |  | ..... | GG-1214..... | i, 1034 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---------------------------------------|---------------------|-------------------|
| Cedar Cr., Kans—(Con.) | GG-1225 | i, 1034 | Cedar Straits, Md. | J-40 | i, 331 |
| | GG-1249 | i, 1034 | Cedar Swamp, S. C. | N-30 | i, 499 |
| | GG-1402 | i, 1036 | | N-80 | i, 499 |
| (See notes, ii, 2821, 2822, 2823.) | | | Cello | (WW-2) | i, 1616* |
| Cedar Cr., Ky. | DD-190 | i, 960 | Cello Canal | (WW-2) | i, 1616* |
| Cedar Cr., Md. | J-169 | i, 332 | Cello Falls | (WW-2) | i, 1616* |
| Cedar Cr., Minn. | JJ-51 | i, 1234 | (See notes, ii, 2841, 2843.) | | |
| | KK-79 | i, 1247 | Cello Falls, above | (WW) | |
| Cedar Cr., Mo. | GG-74 | i, 1025 | (See notes, ii, 2843.) | | |
| | GG-1512 | i, 1036 | Celina, Tenn. | AA-239 | i, 878 |
| (See notes, ii, 2813, 2824.) | | | Centennial Isld. | (HH) | i, 1072* |
| Cedar Cr., Mont. | GG-636 | i, 1030 | Center Cr., Nebr. | GG-1298 | i, 1035 |
| | GG-743 | i, 1030 | (See notes, ii, 2822.) | | |
| (See notes, ii, 2817, 2818.) | | | Center H., Me. | A-78 | i, 27 |
| Cedar Cr., Nebr. | GG-959 | i, 1032 | Center H., Brooklyn, Me. | A-78 | i, 37 |
| | GG-970 | i, 1032 | Centerville Cr., Wis. | MM-30-b | i, 1328 |
| (See notes, ii, 2819.) | | | Centerville R., Mass. | C-10 | i, 107 |
| Cedar Cr., N. J. | I-6 | i, 299 | Central Dock | (WW-2) | i, 1616* |
| | I-36 | i, 299 | Centilly Bayou, La. | S-188 | i, 682 |
| Wrecks | | ii, 2265 | (See notes, ii, 2804.) | | |
| Cedar Cr., N. C. | M-152 | i, 455 | Central Division, Engl- neer Dept. | | ii, 2039, 2046 |
| | M-208 | i, 455 | Cerritos Slough, Cal.: | | |
| | M-233 | i, 456 | Bridges | | ii, 2152 |
| Cedar Cr., S. C. | N-121 | i, 500 | Chadwicks Cr., N. C. | M-249 | i, 456 |
| | N-143 | i, 500 | Chaffe Bayou, La. | S-671 | i, 687 |
| | N-149 | i, 500 | Chagavenpuk R., Alaska. | XX-175 | i, 1656 |
| | N-239 | i, 501 | Chagrin R., Ohio | QQ-27 | i, 1461, 1482 |
| Cedar Cr., S. Dak. | GG-359 | i, 1028 | Chain Br. at Little Falls, Va. | K-90 | i, 373 |
| | GG-873 | i, 1032 | Chalaud Bayou, La. | S-332 | i, 683 |
| (See notes, ii, 2815, 2819.) | | | (See notes, ii, 2804.) | | |
| Cedar Cr., Tenn. | AA-128 | i, 849 | Challand Bayou, La.: | | |
| | AA-225 | i, 850 | (See notes, ii, 2804.) | | |
| | AA-257 | i, 850 | Chamberlain | (GG-2) | i, 1038* |
| Cedar Cr., W. Va. | EE-167 | i, 984 | Chamberlain, S. Dak. | (GG-2) | i, 1037* |
| Cedar Cr., Wyo. | GG-1049 | i, 1033 | Chambers Cr., Tenn. and Miss. | AA-32 | i, 848 |
| (See notes, ii, 2820.) | | | Chamler Bayou, Miss. | R-73 | i, 646 |
| Cedar Hammock Cr., Ga. | O-114 | i, 534 | Chamois | (GG-2) | i, 1038* |
| Cedar Hammock, Ga. | O-446 | i, 536 | Champaign Cr., Mont. | GG-459 | i, 1028 |
| Cedar Isld. | (GG-2) | i, 1038* | (See notes, ii, 2816.) | | |
| Cedar Isld. B., N. C. | L-252 | i, 413 | Champaign Lake: | | |
| | M-223 | i, 455 | Forts | | ii, 1998 |
| Cedar Isld. B. (thorough- fare leading from Core Sound into, thence to Neuse R. and Pamlico Sound, N. C.) | M-231-a | i, 472 | Champepelon Cr., Iowa and Minn. | GG-283 | i, 1027 |
| Cedar Key B., Fla. | P-351 | i, 571 | (See notes, ii, 2814.) | | |
| Cedar Keys H., Fla. | P-349 | i, 571, 606 | Champlain R., N. Y. | E-76 | i, 177, 202 |
| (See notes, ii, 2799.) | | | Champlin Cr., N. Y. | F-60 | i, 228 |
| Appro. | | ii, 2293 | Champlins Cr., N. Y. | F-60 | i, 215, 228 |
| Cedar Keys to Clearwater H., Fla. | P-328-b | i, 602 | Chandler R., Alaska. | XX-216 | i, 1656 |
| Cedar Pt. Bayou, Fla. | P-331 | i, 571 | Chandler B., Me. | A-21 | i, 27 |
| Cedar Pt., Conn. | D-79 | i, 168 | Chandler R.: | | |
| Cedar Pond Brook, N. Y. | E-69 | i, 177 | (See notes, ii, 2783.) | | |
| Cedar R., Iowa | JJ-66 | i, 1234 | Chandler R., Me. | A-20 | i, 27 |
| Cedar R., Mich. | MM-8 | i, 1297 | Chandlers B., Me. | A-20 | i, 27, 32 |
| Cedar R. H., Mich. | MM-8 | i, 1299 | Chandeleur Sound, La. | S-159 | i, 682 |
| Appro. | | ii, 2298 | Chaney Cr., La. | S-263 | i, 683 |
| Cedar R., Wash. | XX-77 | i, 1655 | Chaney Cr., N. C. | M-295 | i, 456 |
| Cedar Run, Pa. | J-762 | i, 336 | Chantler Cr., S. Dak. | GG-856 | i, 1031 |
| Cedar Run, Va. | K-102 | i, 373 | (See notes, ii, 2719.) | | |
| | | | Chapel Branch, Md. | J-283 | i, 333 |
| | | | Chapel Cove, Md. | J-232 | i, 332 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|----------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Chapel Cr., Md. | J-254..... | i, 333 | Charleston to Beaufort: | | |
| Chapel Cr., N. C. | M-136..... | i, 455 | Wrecks..... | ii, 2265, 2269 | |
| | M-159..... | i, 455 | Charleston, S. C., Dis- | | |
| Chapelle Cr., S. Dak. | GG-374..... | i, 1028 | trict..... | N (with map)..... | i, 497, 499 |
| (See notes, ii, 2815.) | | | (See notes, ii, 2798.) | | |
| Chapel Pt. H., Md. | K-75-a..... | i, 388 | Appro..... | ii, 2292 | |
| Chaperon Bayou, La.: | | | Charleston, S. C., to | | |
| (See notes, ii, 2804.) | | | Beaufort, S. C. (water- | | |
| Chapmans B., Vt. | E-129..... | i, 178 | way)..... | N-204..... | i, 500 |
| Chapmans Cr., Kans. | GG-1321..... | i, 1035 | Charleston, S. C., to | | |
| (See notes, ii, 2822.) | | | Chesapeake B. (via Dis- | | |
| Chappepeela Cr., La. | S-34..... | i, 681 | mal Swamp Canal, Pas- | | |
| Chaptico B., Md. | K-67..... | i, 373 | quotank R., Croatan, | | |
| Charbonneau Cr., N. | | | Pamlico, and other | | |
| Dak..... | GG-748..... | i, 1031 | sounds to Winyah B.).. | L-173-n..... | i, 438 |
| (See notes, ii, 2818.) | | | Charleston, S. C. (water- | | |
| Charcoal Cr., Vt. | E-125..... | i, 178 | ways from Columbia | | |
| Charenton, La. (canal | | | and Camden to)..... | N-203-b..... | i, 522 |
| connection with Grand | | | Charleston Slough, Cal. | TT-31..... | i, 1555 |
| Lake at)..... | S-642-b..... | i, 707 | Charleston to Orange- | | |
| Charette Cr.: | | | burg, S. C. (waterways). | N-204-b..... | i, 523 |
| (See notes, ii, 2813.) | | | Charleston, Wash.: | | |
| Charette Cr., Mo. | GG-14..... | i, 1025 | Harbor lines..... | ii, 2254 | |
| Charlton R., Iowa and | | | Charlestown Cr., Kans. | GG-1158..... | i, 1034 |
| Mo..... | GG-118..... | i, 1026 | Charlevoix H., Mich. | OO-58..... | i, 1377, 1412 |
| (See notes, ii, 2813.) | | | (See notes, ii, 2838.) | | |
| Charlerol, Pa. | FF-6-a..... | i, 1003 | Appro..... | ii, 2298 | |
| Charles Cr., Ga. | O-122..... | i, 534 | Bridges..... | ii, 2152 | |
| Charles Cr., Md. | J-208..... | i, 332 | Navigation rules..... | ii, 2041, 2107 | |
| Charles Cr., Mont.: | | | Wrecks..... | ii, 2265 | |
| (See notes, ii, 2817.) | | | Charley R., Alaska. | XX-206..... | i, 1656 |
| Charles Cr., N. C. | L-277..... | i, 413 | Charley Cr., W. Va. | EE-56..... | i, 983 |
| Charles H., S. C.: | | | Charlotte H., Fla. | P-258..... | i, 571 |
| Harbor lines..... | ii, 2254 | | P-258-a..... | ii, 594 | |
| Charles R., Mass. | B-123..... | i, 70, 92 | Appro..... | ii, 2293 | |
| Bridges..... | ii, 2152 | | Charlotte H., Fla. (inside | | |
| Dams, locks and..... | ii, 2249 | | Passage to, from Puna- | | |
| Harbor lines..... | ii, 2254 | | tarasa)..... | P-258-c..... | i, 595 |
| Charles Run, Md. | J-1007..... | i, 338 | Charlotte H., Fla. (water- | | |
| Charleston Bar, S. C.: | | | way to St. Johns R.).... | P-258-b..... | i, 595 |
| Wrecks..... | ii, 2265 | | Charlotte H., N. Y. | RR-39..... | i, 1493, 1518 |
| Charleston Cr., Md. | K-70..... | i, 373 | Appro..... | ii, 2299 | |
| Charleston Cr., Kans.: | | | Navigation rules..... | ii, 2041, 2107 | |
| (See notes, ii, 2821.) | | | Charlotte R., Mich. | PP-11..... | i, 1419 |
| Charleston H., S. C. | N-203..... | i, 500, 519 | Charlton, Mo. and Iowa: | | |
| (See notes, ii, 2798.) | | | (See notes, ii, 2813.) | | |
| Appro..... | ii, 2287, 2292 | | Charrette Cr., Mo.: | | |
| Ports..... | ii, 1808, 1823, 1940 | | (See notes, ii, 2813.) | | |
| Wrecks..... | ii, 2265, 2277 | | Chartiers Cr., Pa. | FF-4..... | i, 1003 |
| Charleston H., S. C., and | | | Bridges..... | ii, 2152 | |
| Alligator Cr., opposite | | | Charts, Great Lakes | ii, 2041, 2122 | |
| McClellanville, S. C. (in- | | | Chase Cr., Md. | J-1215..... | i, 340 |
| land waterways be- | | | Chase Garden Cr., Mass. | B-192..... | i, 70 |
| tween)..... | N-202-b..... | i, 518 | Chases Cove, Va. | K-163..... | i, 374 |
| Charleston H. to Santee | | | Chassahowetzka B., Fla. | P-336..... | i, 571 |
| R., including Owendaw | | | Chassahowetzka R., Fla. | P-337..... | i, 571 |
| Cr. (inland waterways). | N-202..... | i, 500 | Chastaing Bayou, La. | S-17..... | i, 689 |
| (See notes, ii, 2798.) | | | Chatham Bar, Mass.: | | |
| Charleston Neck, S. C. | | | Wrecks..... | ii, 2265 | |
| (ship canal across)..... | N-203-c..... | i, 522 | Chatham B., Mass.: | | |
| Charleston, S. C., and | | | Wrecks..... | ii, 2265 | |
| Beaufort, S. C. (inland | | | Chatham Beach, Mass.: | | |
| waterway between)..... | N-204..... | i, 522 | Wrecks..... | ii, 2265 | |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|---|---------------------|-------------------|
| Chatham H., Mass. | B-217..... | i, 70, 103 | Cheboygan R., Mich. | PP-32..... | i, 1419 |
| Appro..... | ..... | ii, 2288 | Bridges..... | ..... | ii, 2153 |
| Wrecks..... | ..... | ii, 2265 | Checking, Index, Reports, | | |
| Chatham New H., Mass. .. | B-219..... | i, 70, 103 | Chief of Engineers, U. S. | | |
| Wrecks..... | ..... | ii, 2265 | Army, 1886-1912. | i, 13, ii, 2779 | |
| Chatham Old H., Mass.: | | | Chedotlothna R., Alaska. XX-178..... | i, 1656 | |
| Wrecks..... | ..... | ii, 2265 | Cheehan R., S. C.: | | |
| Chatham R., Fla. | P-206..... | i, 570 | Bridges..... | ii, 2143, 2153 | |
| Chatham Roads (Old), | | | Cheeseman Cr., Va. | L-87..... | i, 411 |
| Mass.: | | | Cheesquake Cr., N. J. | G-40..... | i, 247, 261 |
| Wrecks..... | ..... | ii, 2265 | (See notes, ii, 2793.) | | |
| Chattahoochee R., Ga. | | | Appro..... | ii, 2290 | |
| and Ala..... | Q-23..... | i, 611 | Bridges..... | ii, 2153 | |
| (See notes, ii, 2800.) | Q-23-b..... | i, 620 | Harbor lines..... | ii, 2254 | |
| Appro..... | ..... | ii, 2293 | Chef Menteur, La. | S-141..... | i, 682 |
| Bridges..... | ..... | ii, 2152 | Chef Menteur Pass, La.: | | |
| Chattahoochee and Flint | | | Bridges..... | ii, 2153 | |
| Rs., Ala., Fla., and Ga. | Q-23..... | i, 618 | Forts..... | ii, 1976 | |
| Q-23-a..... | i, 619 | | Chefunctee R., La. | S-20..... | i, 681, 689 |
| Chattanooga (above and | | | (See notes, ii, 2805.) | | |
| below), Tennessee R.... | AA-18-a..... | i, 856 | Appro..... | ii, 2294 | |
| Chattanooga (above), | | | Chegley Bayou, La. | S-389..... | i, 684 |
| Tennessee R..... | AA-18-e..... | i, 864 | Chehalls R., Wash., | | |
| Chattanooga and Nash- | | | Sloughs: | | |
| ville, Tennessee District: | | | Bridges..... | ii, 2231 | |
| (See notes, ii, 2809.) | | | Chehalls R., Wash. | XX-16..... | i, 1655, 1661 |
| Appro..... | ..... | ii, 2296 | XX-13-b..... | i, 1660 | |
| Chattanooga (below), | | | Appro..... | ii, 2301 | |
| Tennessee R..... | AA-18-b..... | i, 858 | Bridges..... | ii, 2153 | |
| Chattanooga Cr., Tenn. | | | Harbor lines..... | ii, 2254 | |
| and Ga..... | AA-63..... | i, 848 | Chehaw R., S. C. | N-249..... | i, 501 |
| Chattanooga, Tenn. | AA-18..... | i, 855 | Wrecks..... | ii, 2265 | |
| Chattanooga, Tenn., Dis- | | | Chelan Rock. | (WW-2)..... | i, 1616* |
| trict. | AA..... | i, 843 | Chelsea Cr., Mass. | B-118..... | i, 70, 90 |
| Chattanooga to Elverton, | | | Bridges..... | ii, 2153 | |
| Tennessee R..... | AA-18-d..... | i, 862 | Harbor lines..... | ii, 2254 | |
| Chattooga R.: | | | Chelsea R., Mass. | B-111..... | i, 70 |
| (See notes, ii, 2800.) | | | B-118..... | i, 70 | |
| Chattooga R., Ga. and | | | B-118..... | i, 90 | |
| S. C. | O-19..... | i, 533 | (See notes, ii, 2785.) | | |
| Chattooga R., Ala. and | | | Chemung R., N. Y. | J-661..... | i, 336 |
| Ga. | Q-57..... | i, 611 | Chenal a Bout Rond and | | |
| Chauga R., S. C. | O-14..... | i, 533 | Middle Chan, Mich. | PP-95..... | i, 1420 |
| Chaumont B., N. Y. | RR-62..... | i, 1493 | Chenango R., N. Y. | J-656..... | i, 336 |
| Chaumont R., N. Y.: | | | Chena R., Alaska. | XX-204..... | i, 1656 |
| Bridges..... | ..... | ii, 2152 | Chenaults. | (CC)..... | i, 909* |
| Chautauqua Cr., N. Y. .. | RR-7..... | i, 1493 | Chene Bayou, La. | S-498..... | i, 685 |
| Chautauqua Lake, N. Y. | FF-20..... | i, 1015 | S-624..... | i, 686 | |
| Cheat R., Pa. and W. Va. | FF-6-a..... | i, 1003 | S-732..... | i, 687 | |
| FF-14..... | i, 1003 | | S-779..... | i, 687 | |
| Bridges..... | ..... | ii, 2153 | Chene Blanc Bayou, La. | S-113..... | i, 682 |
| Cheat R., W. Va. | FF-14..... | i, 1012 | Chenier B., La. | S-344..... | i, 684 |
| Appro..... | ..... | ii, 2297 | Chenier Pass, La. | S-222..... | i, 683 |
| Cheboygan and Petos- | | | Cheoah R., N. C. | AA-99..... | i, 849 |
| key, Mich. (Inland | | | (See notes, ii, 2809.) | | |
| route)..... | OO-62-b..... | i, 1414 | Cher Ami Canal, La. | S-422..... | i, 684 |
| Cheboygan H., Mich. | PP-32-a..... | i, 1419, 1432 | Cherokee. | (HH)..... | i, 1072* |
| Appro..... | PP-31..... | i, 1419, 1431 | Cherokee Cr., Ky. | DD-219..... | i, 960 |
|  | ..... | ii, 2299 | Cherokee Cr., S. C. | N-164..... | i, 500 |
| | | | Cherokee Crossing (HH): | | |
| | | | (See notes, ii, 2831.) | | |
| | | | Cherokee R., Ga. | O-42..... | i, 533 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|-------------------------------------|----------------------|-------------------|
| Cherry Cr., Colo. | GG-1106..... | i, 1033 | Chesapeake to Delaware | | |
| (See notes, ii, 2820.) | | | Bs., Del. and Md.: * | | |
| Cherry Cr., Minn. | KK-165..... | i, 1248 | Appro..... | ii, 2291 | |
| Cherry Cr., Mont. | GG-414..... | i, 1028 | Chesconnesser Cr., Va. | L-85..... | i, 411, 417 |
| (See notes, ii, 2817.) | GG-637..... | i, 1030 | Chesley Isld. | (HH)..... | i, 1072* |
| Cherry Cr., S. Dak. | GG-818..... | i, 1031 | (See notes, ii, 2833.) | | |
| (See notes, ii, 2818.) | GG-824..... | i, 1031 | Chesmina R., Alaska | XX-137..... | i, 1656 |
| Cherry Cr., Wyo. | GG-1014..... | i, 1033 | Chessy Cr., S. C. | N-246..... | i, 501 |
| Cherry R., W. Va. | EE-118..... | i, 984 | Chest Cr., Pa. | J-810..... | i, 337 |
| Cherry Run, Pa. | J-833..... | i, 337 | Chester | (HH)..... | i, 1072* |
| Cherrystone Cr., Va. | L-64-a..... | i, 415 | Chester Cr., Conn. | D-38..... | i, 141 |
| Cherrystone Inlet, Va. | L-64..... | i, 411 | Chester Cr., Pa. | I-57-a..... | i, 314 |
| Cherrytree Cove, Md. | J-1244..... | i, 340 | Appro..... | ii, 2290 | |
| Cherry Winck Cr., La. | S-815..... | i, 688 | Bridges..... | ii, 2153, 2230 | |
| Chesapeake and Albe- | | | Harbor lines..... | ii, 2254 | |
| marle Canal | L-173-l..... | i, 436 | Wrecks..... | ii, 2265 | |
| Chesapeake and Albe- | | | Chester H., Pa. | H-3-k..... | i, 284 |
| marle Canal, N. C. | L-251..... | i, 413 | Chester, Ill. (HH): | | |
| L-261..... | i, 413 | | (See notes, ii, 2833.) | | |
| Chesapeake and Albe- | | | Chester R., Md. | J-413..... | i, 334, 355 |
| marle Canal, Va. | L-188..... | i, 412 | (See notes, ii, 2795.) | | |
| L-243..... | i, 413 | | Appro..... | ii, 2291 | |
| Chesapeake and Delaware | | | Chester R., Pa. | I-57..... | i, 299, 314 |
| Canal | ii, 2041, 2106 | | Chestnut Cr., Va. | EE-100..... | i, 984 |
| Appro..... | ii, 2290 | | Cheston Cr., Md. | J-1269..... | i, 340 |
| Chesapeake and Dela- | | | Chestue Cr., Tenn. | AA-74..... | i, 848 |
| ware Canal, Del. and | | | Chetco Cove, Oreg. | VV-4..... | i, 1593 |
| Md. | I-60..... | i, 299, 317 | Chetco R., Oreg. | VV-5..... | i, 1593, 1595 |
| Chesapeake and Ohio | | | Chevreuil Bayou, La. | S-384..... | i, 684, 698 |
| Canal | K-46-p..... | i, 386 | (See notes, ii, 2804.) | | |
| Chesapeake B., Eastern | | | Bridges..... | ii, 2153 | |
| Shore | L..... | i, 411 | Cheyenne R., S. Dak. | GG-823..... | i, 1061 |
| Chesapeake B., Md. | J-1081-a..... | i, 365 | (See notes, ii, 2818.) | | |
| K-1..... | i, 373 | | Chicacomico R., Md. | J-141..... | i, 332 |
| Appro..... | ii, 2291 | | Chicago H., Ill. | (HH)..... | i, 1072* |
| Forts..... | ii, 1823 | | NN-14..... | i, 1349, 1356 | |
| Navigation rules..... | ii, 2041, 2107 | | (See notes, ii, 2837.) | | |
| Wrecks..... | ii, 2265 | | Appro..... | ii, 2298 | |
| Chesapeake B., Md. and | | | Harbor lines..... | ii, 2254 | |
| Va. | J-1..... | i, 331 | Chicago, Ill., District | NN(with map)i, 1347 | |
| Chesapeake B., Md., Bat- | | | 1349 | | |
| tery Isld. | J-556-e..... | i, 365 | (See notes, ii, 2836.) | | |
| Chesapeake B., Md. | | | Appro..... | ii, 2298 | |
| (headwaters of)..... | J-556-g..... | i, 365 | Chicago Drainage Canal | ii, 2041, 2106 | |
| Chesapeake B. to Charles- | | | Great Lakes regulation..... | ii, 2041, 2124 | |
| ton, S. C. (via Dismal | | | Chicago R., Ill. | NN-15..... | i, 1349, 1359 |
| Swamp Canal, Pasquo- | | | (See notes, ii, 2837.) | | |
| tank R., Croatan, Pam- | | | Bridges..... | ii, 2153, 2154, 2155 | |
| lico, and other sounds | | | Harbor lines..... | ii, 2254 | |
| to Winyah B.) | L-173-n..... | i, 438 | Wrecks..... | ii, 2265 | |
| Chesapeake B. to Lake | | | Chicago Sanitary and | | |
| Ontario | J-1-a..... | i, 340 | Ship Canal, Ill. | NN-16..... | i, 1349 |
| Chesapeake B., Va. | L-59..... | i, 411 | Chl Charas, La. | S-313..... | i, 683 |
| Chesapeake B., Western | | | Chickahominy R., Va. | L-118..... | i, 412, 424 |
| Shore | L..... | i, 411 | Appro..... | ii, 2291 | |
| Chesapeake Cr., N. Y.: | | | Chickamauga Cr., Tenn. | | |
| Harbor lines..... | ii, 2254 | | and Ga. | AA-64..... | i, 848 |
| Chesapeake Division, En- | | | Chickasahay R., Miss. | R-66..... | i, 646, 668 |
| gineer Dept. | ii, 2039, 2046 | | (See notes, ii, 2803.) | | |
| Chesapeake to Delaware | | | Bridges..... | ii, 2155 | |
| (Bs., Del. and Md. (ship | | | Chickasaw | (HH)..... | i, 1072* |
| canal surveys) | J-535..... | i, 335, 361 | Chickasaw Cr., Ala. | R-44..... | i, 646, 663 |
| | | | Bridges..... | ii, 2155 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------|---------------------|-------------------|-----------------------------|---------------------|-------------------|
| Chickasaw Cr., Ga..... | O-37..... | i, 533 | Chippewa R. | (HH)..... | i, 1072* |
| Chickasaw R., Miss.: | | | Chippewa R. at Yellow | | |
| Appro..... | | ii, 2294 | Banks, Wis..... | KK-30-b..... | i, 1250 |
| Chicken Bayou, La..... | S-654..... | i, 686 | Chippewa R., E. Branch, | | |
| Chicken Cr., Ga..... | O-403..... | i, 536 | Wis..... | KK-39..... | i, 1247 |
| Chicod Cr., N. C..... | M-88..... | i, 454 | Chippewa R., including | | |
| Chicomuxen Cr., Md..... | K-79..... | i, 373, 389 | Yellow Banks, Wis..... | KK-30-c..... | i, 1251 |
| Chicone Cr., Md..... | J-132..... | i, 332 | Chippewa R., Minn..... | KK-149..... | i, 1248 |
| Chicopee R., Conn..... | D-32..... | i, 141 | Chippewa R., W. Branch, | | |
| Chicot Bayou, La..... | S-595..... | i, 686 | Wis..... | KK-40..... | i, 1247 |
| | S-693..... | i, 687 | Chippewa R., Wis..... | KK-30..... | i, 1247, 1249 |
| Chilton R., N. Y..... | J-664..... | i, 336 | | KK-30-a..... | i, 1249 |
| Chief of Engineers, U. S. | | | Appro..... | | ii, 2297 |
| Army: | | | Bridges..... | | ii, 2155 |
| List of..... | | ii, 2039, 2043 | Chippoak Cr., Va..... | L-156..... | i, 412 |
| Reports..... | | i, 16; ii, viii | Chiquesalunga Cr., Pa..... | J-578..... | i, 335 |
| Index to reports..... | | i, 13 | Chistochina R., Alaska..... | XX-142..... | i, 1656 |
| Childs R., Mass..... | C-22..... | i, 107 | Chitanana R., Alaska..... | XX-195..... | i, 1656 |
| Chillisquaque Cr., Pa..... | J-716..... | i, 336 | Chitina R., Alaska..... | XX-128..... | i, 1656 |
| Chimikim R., Wash..... | XX-46..... | i, 1655 | Bridges..... | | ii, 2156 |
| Chimney Branch, Md..... | J-1122..... | i, 339 | Choates Cr., La.: | | |
| Chimney Rock..... | (HH)..... | i, 1072* | (See notes, ii, 2805.) | | |
| China Basin, Cal.: | | | Chocolate Bayou, La..... | S-614..... | i, 686 |
| Harbor lines..... | | ii, 2254 | | U-5-a..... | i, 736 |
| Chincheba Bayou, La..... | S-19..... | i, 681 | Chocolate Bayou, Tex..... | U-34..... | i, 735, 755 |
| Chincoteague B. to Dela- | | | Appro..... | | ii, 2295 |
| ware B., Del. (Inland | | | Bridges..... | | ii, 2144, 2156 |
| waterway between)..... | I-79-a..... | i, 326 | Choconut Cr., Pa. and | | |
| Appro..... | | ii, 2290 | N. Y..... | J-651..... | i, 336 |
| Bridges..... | | ii, 2155 | Chocowinty Cr., N. C..... | M-91..... | i, 454 |
| Chincoteague B., Va..... | I-79..... | i, 299 | Choctaw..... | (HH)..... | i, 1072* |
| Wrecks..... | | ii, 2266 | Choctaw Bayou, La..... | S-519..... | i, 685 |
| Chincoteague Inlet, Va..... | I-78..... | i, 299, 326 | | S-525..... | i, 685 |
| Chincoteague Inlet, Va. | | | | S-561..... | i, 686 |
| (breakwater)..... | I-78-a..... | i, 326 | | X-31..... | i, 785 |
| Chincoteague Inlet, Va., | | | | X-20..... | i, 785 |
| to Delaware line | | | Bridges..... | | ii, 2156 |
| through Worcester Co., | | | Choctawhatchee B., Fla..... | Q-31..... | i, 611 |
| Md. and Va. (canal)..... | I-80-a..... | i, 328 | (See notes, ii, 2800.) | | |
| Appro..... | | ii, 2290 | Appro..... | | ii, 2293 |
| Chincoteague Lighthouse, | | | Choctawhatchee B., In- | | |
| Va.: | | | cluding Santa Rosa | | |
| Wrecks..... | | ii, 2266 | Sound Chan., Fla..... | Q-31..... | i, 624 |
| Chincoteague, Va.: | | | Choctawhatchee R. and | | |
| Wrecks..... | | ii, 2265 | B., Fla., to St. Andrews | | |
| Chinkapin Cr., N. C..... | L-333..... | i, 413 | B..... | Q-30..... | i, 611 |
| Chinkapin Run, Md..... | J-1076..... | i, 339 | Choctawhatchee R. and | | |
| Chinook R..... | (WW-2)..... | i, 1616* | B., Fla., to St. Andrews | | |
| Chinook R., Wash..... | WW-70..... | i, 1615 | B., Fla. (canal)..... | Q-30..... | i, 624 |
| Bridges..... | | ii, 2155 | Choctawhatchee R., Fla. | | |
| Forts..... | | ii, 2020 | and Ala..... | O-2-i..... | i, 547 |
| Chinholm Cr., Va..... | L-110..... | i, 412 | | Q-32..... | i, 611, 625 |
| Chipola R., Fla..... | Q-21..... | i, 616 | (See notes, ii, 2801.) | | |
| Appro..... | | ii, 2293 | Appro..... | | ii, 2293 |
| Bridges..... | | ii, 2155 | Bridges..... | | ii, 2156, 2166 |
| Chipola R. (lower)..... | Q-21-a..... | i, 616 | Dams, private..... | | ii, 2249 |
| Chipola R. (lower), Fla..... | Q-21-c..... | i, 618 | Chokalska B., Fla..... | P-208..... | i, 570 |
| Chipola R. (lower and up- | | | Chokalska Pass, Fla..... | P-207..... | i, 570 |
| per), Fla..... | Q-24..... | i, 611 | Chokalska R., Fla..... | P-209..... | i, 570 |
| Chipola R. (upper), Fla..... | Q-21-b..... | i, 617 | Chopawamsic Cr., Va..... | K-106..... | i, 374 |
| | Q-21-c..... | i, 618 | Bridges..... | | ii, 2156 |
| Chippewa B., N. Y..... | R.R-69..... | i, 1493 | Chopwamsic B., Va..... | K-106..... | i, 393 |
| Chippewa Cr., Ohio..... | DD-386..... | i, 962 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Chopin Chute, La. | S-521..... | i, 685 | City Isld., N. Y.: | | |
| Choptank R., Md. | J-252..... | i, 333, 349 | Bridges..... | | ii, 2156 |
| Appro..... | ii, 2291 | | City Pt.: | | |
| Bridges..... | ii, 2156 | | Harbor lines..... | | ii, 2254 |
| Wrecks..... | ii, 2266 | | City West H., Ind. | NN-22-c..... | i, 1368 |
| Choptank (Little) R., Md.: | | | Civilian Assistants, Engi- | | |
| Wrecks..... | ii, 2266 | | neer Troops..... | ii, 2039, 2059 | |
| Choteau Cr., S. Dak. | GG-353..... | i, 1027 | Clackamas Rapids. | WW-30-c..... | i, 1645 |
| (See notes, ii, 2815.) | | | Clackamas R., Ore. | WW-40..... | i, 1615, 1649 |
| Choteau Isld. | (HH)..... | i, 1072* | Claborn H., Md. | J-363..... | i, 333, 354 |
| Choupique Bayou, La. | S-857..... | i, 688 | Appro..... | ii, 2291 | |
| (See notes, ii, 2804.) | | | Clallam B., Wash. | XX-39-c..... | i, 1663 |
| Chowan R., N. C. | L-298..... | i, 413, 443 | Clam Cove, Me. | A-144..... | i, 28 |
| Christiana R., Del. | I-58..... | i, 299, 314 | Clam Cr., Ga. | O-449..... | i, 536 |
| Bridges..... | ii, 2156 | | Clam Pass, Fla. | P-220..... | i, 570 |
| Harbor lines..... | ii, 2254 | | Clam R., Mich. | OO-38..... | i, 1377 |
| Navigation rules..... | ii, 2041, 2107 | | Clam R., Wis. | KK-52..... | i, 1247 |
| Wrecks..... | ii, 2266 | | Clapboard Cr., Fla. | P-13..... | i, 569 |
| Christmas Camp Lake, | | | Claps Swamp, S. C. | N-88..... | i, 499 |
| La..... | S-169..... | i, 682 | Clarendon. | (HH)..... | i, 1072* |
| Christmas Cove, Me. | A-187..... | i, 28 | Clarendon, Ark. | Y-23-h..... | i, 832 |
| Chesley. | (HH)..... | i, 1072* | Clarendon R., Ark.: | | |
| Chub Cr., Minn. | JJ-27..... | i, 1234 | (See notes, ii, 2808.) | | |
| Chuckatuck Cr., Va. | L-164..... | i, 412, 428 | Clarion Cr., Pa. | FF-29..... | i, 1003 |
| Chugwater Cr., Wyo. | GG-1072..... | i, 1033 | Clarion R., Pa. | FF-20..... | i, 1015 |
| (See notes, ii, 2820.) | | | FF-29..... | i, 1020 | |
| Chulitna R., Alaska. | XX-157..... | i, 1656 | Clark Cr., Ky. and Tenn. | AA-19..... | i, 848 |
| XX-173..... | i, 1656 | | (See notes, ii, 2809.) | | |
| Church Cr., Md. | J-238..... | i, 332 | Clark Cr., N. Dak. | GG-752..... | i, 1031 |
| J-487..... | i, 334 | | (See notes, ii, 2809, 2818.) | | |
| J-955..... | i, 338 | | Clark Cr., Pa. | J-597..... | i, 335 |
| J-1249..... | i, 340 | | Clark Cr., S. C. | N-73..... | i, 499 |
| Church Cr., Va. | L-71..... | i, 411 | N-61-a..... | i, 508 | |
| Churches Cove, R. I.: | | | Appro..... | ii, 2292 | |
| Appro..... | ii, 2288 | | Clarke R. (see Lewis and | | |
| Church Flats: | | | Clarke R.) | (WW-2)..... | i, 1617* |
| Wrecks..... | ii, 2266 | | Bridges..... | ii, 2156 | |
| Churchills. | (GG-2)..... | i, 1038* | Clarke R., Ore. (see Lewis | | |
| Churchs. | (HH)..... | i, 1072* | and Clarke R.) | WW-5..... | i, 1615 |
| Churchs Cove H., R. I. | C-62..... | i, 107 | WW-3-a..... | i, 1640 | |
| Churchs Cove H., R. I. | | | Clarks Cove, Me. | A-61..... | i, 27 |
| (breakwater)..... | C-62..... | i, 119 | Clarks Fork, Mont. and | | |
| Churn Cr., Md. | J-507..... | i, 334 | Wyo. | GG-672..... | i, 1030 |
| Cimarron R., Okla. | Y-17..... | i, 818 | Clark R., Ky.: | | |
| Cincinnati Landing (HH): | | | (See notes, ii, 2809.) | | |
| (See notes, ii, 2827.) | | | Clarks Branch, Mo. | GG-37..... | i, 1025 |
| Cincinnati, Ohio. | (CC)..... | i, 909* | Clarks Cr., Kans. | GG-1371..... | i, 1035 |
| (HH)..... | i, 1072* | | (See notes, ii, 2823.) | | |
| Harbor lines..... | ii, 2254 | | Clark Cr., Va.: | | |
| Cincinnati, Ohio, Ohio | | | (See notes, ii, 2809.) | | |
| R. | DD-490..... | i, 963 | Clarks Cove, Me. | A-150..... | i, 28 |
| Cincinnati, Ohio, 1st Dis- | | | A-191..... | i, 28 | |
| trict. | CC (with map)..... | i, 905 | Clarks Cr., Mo. | GG-1524..... | i, 1037 |
| 909 | | | (See notes, ii, 2824.) | | |
| (See notes, ii, 2810.) | | | Clarks Cr., N. C. | M-123..... | i, 455 |
| Appro..... | ii, 2296 | | Clarks Cr., S. C. | N-73..... | i, 509 |
| Cincinnati, Ohio, 2d Dis- | | | Clarks Fork. | (WW-2)..... | i, 1616* |
| trict. | DD (with map)..... | i, 957 | Clarks Fork, Mo. | GG-1442..... | i, 1036 |
| 959 | | | Clarks Fork, Mo. and | | |
| Appro..... | ii, 2296 | | Wyo.: | | |
| Cinque Hommes. | (HH)..... | i, 1072* | (See notes, ii, 2823.) | | |
| Citico Cr., Tenn. | AA-96..... | i, 849 | Clarks Fork, Mont. and | | |
| Citizens Bluff. | (HH)..... | i, 1072* | Idaho. | XX-111..... | i, 1656 |
| | | | (See notes, ii, 2817.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------|---------------------|-------------------|------------------------------------|---------------------|-------------------|
| Clarks Pt., Mass.: | | | Clear Lake, Cal. | UU-62-a | i, 1589 |
| Forts. | ii | 1805, 1866 | Clearwater H., Fla. | P-323 | i, 571 |
| Clarks R., S. O. | N-73 | i, 509 | | P-323-a | i, 602 |
| Clarksville. | (HH) | i, 1072* | Appro. | ii | 2293 |
| Clarksville, Tenn. | AA-239 | i, 878 | Wrecks. | ii | 2266 |
| Clatskanie Cr., Oreg.: | | | Clearwater H., Fla., Big | | |
| (See notes, ii, 2844.) | | | Pass. | P-322 | i, 571 |
| Appro. | ii | 2300 | Clearwater H., Fla., Little | | |
| Bridges. | ii | 2156 | Pass. | P-321 | i, 571 |
| Clatskanie R. | (WW-2) | i, 1616* | Clearwater H., Fla., to | | |
| Clatskanie R., Oreg. | WW-20 | i, 1615, 1641 | Cedar Keys. | P-323-b | i, 602 |
| Clatsop Spit. | (WW-2) | i, 1616* | Clearwater R. | (WW-2) | i, 1616* |
| Clay Cr., Kans.: | | | Clearwater R., Idaho. | VV-93 | i, 1594 |
| (See notes, ii, 2822.) | | | | VV-94 | i, 1612 |
| Clay Cr., S. Dak.: | | | Appro. | ii | 2300 |
| (See notes, ii, 2815.) | | | Bridges. | ii | 2156, 2157 |
| Clay Cr., Tenn. | AA-238 | i, 850 | Dams, private. | ii | 2249 |
| Clay Isld. Cr., Md. | J-138 | i, 332 | Clearwater R., Idaho, | | |
| Claylick Cr., Ky. | AA-321 | i, 850 | Middle Fork. | VV-95 | i, 1594 |
| Clay Pit Brook, Mass. | B-15 | i, 69 | Clearwater R., Minn. | KK-128 | i, 1243 |
| Clay Pit Cr., N. J. | G-51 | i, 247 | | KK-199 | i, 1243 |
| Claysville. | (GG-2) | i, 1033* | Clearwater R., North | | |
| (See notes, ii, 2824.) | | | Fork, Idaho. | VV-96 | i, 1594 |
| Clayton. | (HH) | i, 1072* | Clearwater R., South | | |
| Clayton H., N. Y. | RR-65 | i, 1493, 1535 | Fork, Idaho. | VV-94 | i, 1594 |
| Clear Branch, Mo. | GG-208 | i, 1026 | Clement Bayou, La. | T-2-11 | 717 |
| Clear Cr., Colo. | GG-1081 | i, 1033 | (See notes, ii, 2805.) | | |
| | GG-1089 | i, 1033 | Clements Cr., Md. | J-1232 | i, 340 |
| (See notes, ii, 2820.) | | | Cleveland H., Ohio. | QQ-25 | i, 1461, 1478 |
| Clear Cr., Kans. | GG-1324 | i, 1035 | Appro. | ii | 2299 |
| | GG-1403 | i, 1036 | Harbor lines. | ii | 2254 |
| (See notes, ii, 2821, 2822, | | | Navigation rules. | ii | 2041, 2107 |
| 2823.) | | | Wrecks. | ii | 2266 |
| Clear Cr., Ky. | DD-20 | i, 959 | Cleveland, Ohio, District. | QQ(with map) | i, 1459 |
| | DD-156 | i, 960 | | | i, 1461 |
| | DD-187 | i, 960 | Appro. | ii | 2299 |
| Clear Cr., La. | S-834 | i, 688 | Cleveland, Ohio (old river | | |
| Clear Cr., Mo. | GG-26 | i, 1025 | bed). | QQ-26 | i, 1481 |
| | GG-29 | i, 1025 | Cliffs Bight, Md. | J-463 | i, 334 |
| | GG-184 | i, 1026 | Cliffle Cr., Mo. | GG-1542 | i, 1037 |
| (See notes, ii, 2813, 2814, | | | Clifton Chan. | (WW-2) | i, 1616* |
| 2823.) | | | Clifton Chan., Oreg. | WW-15 | i, 1615 |
| Clear Cr., Mont. | GG-449 | i, 1028 | Clinch, Ft. | ii | 1802, 1948 |
| | GG-633 | i, 1030 | Clinch R., Tenn. | AA-18 | i, 855 |
| (See notes, ii, 2817.) | | | Clinch R., Tenn. and Va. | AA-157 | i, 849, 875 |
| Clear Cr., Nebr. | GG-1113 | i, 1033 | Appro. | ii | 2296 |
| Clear Cr., Ohio. | DD-479 | i, 962 | Bridges. | ii | 2157 |
| Clear Cr., Pa. | J-785 | i, 337 | Dams, private. | ii | 2249 |
| | J-883 | i, 337 | Clinton. | (HH) | i, 1072* |
| Clear Cr., Tenn. | AA-178 | i, 849 | Clinton H., Conn. | D-44 | i, 141, 154 |
| Clear Cr., Tex. | U-27 | i, 735, 745 | (See notes, ii, 2790.) | | |
| Appro. | ii | 2295 | Appro. | ii | 2289 |
| Bridges. | ii | 2156 | Clinton R., Mich. | PP-103 | i, 1420, 1451 |
| Wrecks. | ii | 2266 | Appro. | ii | 2299 |
| Clear Cr., Wyo. | GG-726 | i, 1030 | Wrecks. | ii | 2266 |
| (See notes, ii, 2818.) | | | Cloquet R., Minn. | LL-20 | i, 1265 |
| Clearfield Cr., Pa. | J-811 | i, 337 | Close Bayou, La. | S-546 | i, 686 |
| Clear Fork, Ky. and | | | Cloud Cr., Tenn. | AA-143 | i, 849 |
| Tenn. | AA-276 | i, 850 | Clover Cr., Pa. | J-873 | i, 337 |
| Clear Fork, Ohio. | DD-375 | i, 962 | Cloverdale Cr., Va. | K-144 | i, 374 |
| | DD-413 | i, 962 | Clover Fork, Ky. | AA-277 | i, 850 |
| Clear Fork, W. Va. | DD-311 | i, 961 | | DD-124 | i, 960 |
| | EE-37 | i, 983 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|----------------------|-------------------|--|---------------------|-------------------|
| Cloyds Cr., Tenn. | AA-107..... | i, 849 | Codorus Cr., Pa. | J-914..... | i, 338 |
| Clubbs Cr., Ga. | O-439..... | i, 536 | Coe Cr., Kans. | GG-1369..... | i, 1035 |
| Club Cr., Ga. | O-439-a..... | i, 558 | Coenties Reef, N. Y. | E-17..... | i, 184 |
| Appro..... | ii, 2293 | | Coeur D'Alene Lake and R., Idaho. | XX-108-a..... | i, 1676 |
| Clubfoot Cr., N. C. | M-194..... | i, 455 | Coeur de Alene R., Idaho. | XX-109..... | i, 1656 |
| Clubfoot R. | M-357-f..... | i, 477 | Coeyman Cr., N. Y. | E-56..... | i, 177 |
| Appro..... | ii, 2292 | | Coffee Cr., Kans.: (See notes, ii, 2823.) | | |
| Clusters Isld. | (CC)..... | i, 909* | Coffee Cr., Mo. | GG-1409..... | i, 1036 |
| Coal Bank Slough, Ore. | VV-20..... | i, 1593 | Coffee Cr., S. Dak. | GG-339..... | i, 1027 |
| Bridges..... | ii, 2157 | | Coffee Pot Bayou, Fla. | P-313..... | i, 571 |
| Coal Camp Cr., Mo. | GG-1464..... | i, 1036 | Cognevichs Pass, La. | S-223..... | i, 683 |
| Coal Cr., Colo. | GG-1107..... | i, 1033 | Cohabanosse Bayou, La. | S-388..... | i, 684 |
| (See notes, ii, 2820.) | | | Cohansey Cr., N. J. | I-38..... | i, 306 |
| Coal Cr., Kans. | GG-1213..... | i, 1034 | Appro..... | ii, 2290 | |
| (See notes, ii, 2821, 2823.) | | | Bridges..... | ii, 2157 | |
| Coal Cr., Ky. | DD-62..... | i, 959 | Wrecks..... | ii, 2266 | |
| Coal Cr. Slough, Wash. | WW-56..... | i, 1615 | Cohansey R., N. J. | I-38..... | i, 299, 306 |
| Bridges..... | ii, 2157 | | Cohasset H., Mass. | B-150..... | i, 70, 95 |
| Coal Foot, Alaska: Roads..... | ii, 2041, 2117 | | (See notes, ii, 2785.) | | |
| Coal R., W. Va. | EE-68..... | i, 983, 994 | Appro..... | ii, 2288 | |
| Coal R., W. Va. (head- waters) | EE, 70..... | i, 983 | Cohasset Narrows, Mass. | C-38..... | i, 107 |
| Coamo R., P. R. | YY-11..... | i, 1685 | Bridges..... | ii, 2157 | |
| Coanlock B., N. C. (see Coinlock) | L-173-l..... | i, 436 | Coinlock B., N. C. (see Coanlock) | L-249..... | i, 413 |
| Coan R., Va. | K-129..... | i, 374, 397 | Colbert Shoals Canal, Ala. (see Tennessee R.) | AA-35..... | i, 848 |
| Coast and Geodetic Sur- vey: Index, checking..... | i, 13 | | AA-18..... | i, 855 | |
| Coast Artillery: Equipment..... | ii, 1814, 2041, 2133 | | Colbert Shoals Canal, Tennessee R. (operat- ing and care) | AA-18-f..... | i, 867 |
| Coasters Isld. H., R. I. | C-66..... | i, 107, 121 | Colbourn Cr., Md. | J-55..... | i, 331 |
| (See notes, ii, 2786, 2787.) | | | Cold Camp Cr., N. C. | N-32..... | i, 499 |
| Appro..... | ii, 2288 | | Cold Spring B. and Lloyds H., N. Y. (channel be- tween) | F-15-a..... | i, 219 |
| Cobb Cr., Va. | K-245..... | i, 375 | Cold Spring H., N. Y. | F-13..... | i, 215, 219 |
| Cobbler Brook, Mass. | B-6..... | i, 69 | Cold Spring Inlet, N. J. | I-27..... | i, 299, 304 |
| Cobbs Isld., Va.: Wrecks..... | ii, 2266 | | Appro..... | ii, 2290 | |
| Cobesseeconte Canal, Me. | A-226-a..... | i, 51 | Wrecks..... | ii, 2266 | |
| Cobham Cr., Va. | L-158..... | i, 412 | Cold Stream, Pa. | J-818..... | i, 337 |
| Cobosseecontee Stream, Me. | A-226..... | i, 29 | Coldwater Cr., Ga. | O-26..... | i, 533 |
| Cobscook B., Me. | A-5..... | i, 27 | Coldwater Cr., Mo. | GG-1556..... | i, 1037 |
| Appro..... | ii, 2287 | | (See notes, ii, 2824.) | | |
| Cobscook B., Me. (near Fall Isld.) | A-5..... | i, 31 | Coldwater Cr., Nebr. | GG-987..... | i, 1032 |
| Cobscook R., Me. | A-8..... | i, 27 | Coldwater Fork, Ky. | DD-295..... | i, 961 |
| Coburn Cr., La. | R-98-e..... | i, 647 | Coldwater R., Miss. | X-11..... | i, 785 |
| Cocalco Cr., Pa. | J-573..... | i, 335 | X-10..... | i, 789 | |
| Cocheco R., N. H. | A-284..... | i, 29, 61 | X-10-b..... | i, 790 | |
| Appro..... | ii, 2288 | | X-10-c..... | i, 791 | |
| Cockeys Cr., Md. | J-1192..... | i, 340 | (See notes, ii, 2807.) | | |
| Cockle Pt. Cr., Va. | L-39..... | i, 411 | Appro..... | ii, 2295 | |
| Cockpit Pt., Va. (ice har- bor) | K-104-a..... | i, 392 | Bridges..... | ii, 2157 | |
| Cockrells Cr., Va. | K-138..... | i, 374 | Coldwater R. (mouth) to Batesville, Miss. | X-10-d..... | i, 791 |
| Cockspur Isld., Ga.: Forts..... | ii, 1949 | | Cole Camp Cr., Mo.: (See notes, ii, 2824.) | | |
| Cocodrie Bayou, La. | S-592..... | i, 686, 705 | Cole Cr., Kans.: (See notes, ii, 2823.) | | |
| Cocolums Cr., Pa. | J-857..... | i, 337 | Cole Cr., Md. | K-38..... | i, 373 |
| Cod Cr., Md. | J-952..... | i, 338 | Cole Cr., Mo. | GG-43..... | i, 1025 |
| Cod H., Va. | J-194..... | i, 332 | GG-106..... | i, 1026 | |
| | | | GG-1538..... | i, 1037 | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

2893

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|----------------------------|-----------------------------------|----------------------------|-------------------|
| Coles B., N. Y. | E-96..... | i, 178 | Columbia R.: | | |
| Coles Cr., Pa. | J-706..... | i, 336 | (See notes, ii, 2841, 2842, | | |
| Coles Cr., La. | S-844..... | i, 688 | 2845.) | | |
| Coles Cr., Mo.: | | | Appro..... | ii, 2287 | |
| (See notes, ii, 2824.) | | | Forts..... | ii, 1796, 1809, 1823, 2018 | |
| Coles R., Mass. | C-76..... | i, 107 | Columbia R., above | | |
| Bridges..... | | ii, 2157 | Snake R. | XX-106..... | i, 1676 |
| Colgate Cr., Md. | J-1088..... | i, 339 | Columbia R. and New | | |
| Wrecks..... | | ii, 2266 | York H. | (WW-2)..... | i, 1617* |
| College, Army War: | | | Columbia R. and Willam- | | |
| Buildings, D. C..... | | ii, 2039, 2066 | ette R. | WW-30-a..... | i, 1642 |
| College Cr., Mo. | GG-12..... | i, 1025 | Columbia R. (lower) | (WW-2)..... | i, 1616* |
| College Cr., Va. | L-113..... | i, 412 | Columbia R. (mouth) | (WW-2)..... | i, 1617* |
| (See notes, ii, 2795.) | | | (See notes, ii, 2842.) | | |
| College Pt., N. Y.: | | | Columbia R., Oreg. and | | |
| Harbor lines..... | | ii, 2254 | Wash. | VV-76..... | i, 1593 |
| Collicon Bayou, La. | S-740..... | i, 687 | | WW-2..... | i, 1615 |
| Collicon Lake, La. | S-738..... | i, 687 | Columbia R., Oreg. and | | |
| Collins Cr., Minn. | JJ-38..... | i, 1234 | Wash. (tributaries be- | | |
| Collins Cove, Mass. | B-69..... | i, 69 | low mouth of Willam- | | |
| Collins Fork, Ky. | DD-40..... | i, 959 | ette R.) (dredging | | |
| Collins Gut, Md. | J-92..... | i, 331 | plant) | WW-41-a..... | i, 1649 |
| Collins R., Tenn. | AA-264..... | i, 850 | (See notes, ii, 2844.) | | |
| Colly Cr., Ky. | DD-136..... | i, 960 | Columbia R., Oreg., | | |
| Columbia, South Ameri- | | | Wash., and Idaho. | (WW-2)..... | i, 1616* |
| ca: | | | Appro..... | ii, 2300 | |
| Index, Isthmian Canal | | | Bridges..... | ii, 2157 | |
| reports..... | | ii, 2357 | Harbor lines..... | ii, 2254 | |
| Colon: | | | Navigation rules..... | ii, 2041, 2107 | |
| Forts..... | | ii, 1823 | Wrecks..... | ii, 2266 | |
| Colonels Cr., S. C. | N-137..... | i, 500 | Columbia R. to Willapa | | |
| Colonial Beach, West- | | | B., Oreg. | XX-2-a..... | i, 1657 |
| moreland Co., Va. | K-113-a..... | i, 374, 394 | Columbia R. tributaries .. | WW-41..... | i, 1615 |
| Colorado: | | | (See notes, ii, 2843.) | | |
| Field service..... | | ii, 2039, 2047 | Columbia R. (upper) | (WW-2)..... | i, 1616* |
| Colorado and Wyoming | | | (See notes, ii, 2843.) | | |
| (arid regions and reser- | | | Columbia R., Wash., Ida- | | |
| voirs) | GG-1025-a..... | i, 1061 | ho, and Mont. | XX-106..... | i, 1656 |
| Colorado and Wyoming: | | | Columbia, S. C. (above); | | |
| Arid regions, appro..... | | ii, 2297 | Broad and Saluda Rs. | N-147-b..... | i, 517 |
| Colorado Cr., Colo. | GG-1032..... | i, 1033 | Columbia Slough | (WW-2)..... | i, 1616* |
| Colorado, Department of: | | | Columbia Slough, Oreg. .. | WW-41..... | i, 1615 |
| Work in the field..... | | ii, 2040, 2086 | Bridges..... | | ii, 2157-2158 |
| Colorado R., Ariz., Cal., | | | Columbia to Granby, | | |
| and Nev. | SS-1..... | i, 1543 | Congaree R. | N-141-b..... | i, 516 |
| (See notes, ii, 2839.) | | | Columbus | (HH)..... | i, 1072* |
| Appro..... | | ii, 2300 | Columbus, Ft., N. Y. | | ii, 1806, 1881 |
| Bridges..... | | ii, 2157 | Columbus, Miss. (above); | | |
| Dams, private..... | | ii, 2249 | Tombigbee R. | R-23-g..... | i, 656 |
| Colorado R., Tex. | U-48..... | i, 735, 766 | Columbus, Miss., to Ful- | | |
| Appro..... | | ii, 2295 | ton; Tombigbee R. | R-23-f..... | i, 656 |
| Columbia and Camden, | | | Columbus to Demopolis, | | |
| waterways to Charles- | | | Ala. and Miss.; Tom- | | |
| ton, S. C. | N-203-b..... | i, 522 | bigbee R. | R-23-e..... | i, 655 |
| Columbia City | (WW-2)..... | i, 1616* | Columbus to Walkers | | |
| Columbia, Department of | | | Br., Miss.; Tombigbee | | |
| the: | | | R. | R-23-h..... | i, 657 |
| Field service..... | | ii, 2039, 2040, 2047, 2086 | Colyell Bayou, La. | S-64..... | i, 681 |
| Columbia Falls | (WW-2)..... | i, 1616* | Comal R., Tex. | U-63..... | i, 735 |
| Columbia Falls, Me., | | | Comanche | (HH)..... | i, 1072* |
| Pleasant R. | A-26..... | i, 33 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|----------------------------|-------------------|
| Combahee R., S. C. | N-248..... | i, 501, 527 | Conecuh R., Fla. and Ala.: | | |
| Combination Br. | (GG-2)..... | i, 1038* | Appro..... | ii, 2293 | |
| Comite R., La. | S-87..... | i, 682 | Conemaugh and Kiskiminetas R., Pa. | FF-21-a..... | i, 1020 |
| Commegy Bight, Md. | J-461..... | i, 334 | Conemaugh R., Pa. | FF-24..... | i, 1003 |
| Commegy Cr., Md. | J-462..... | i, 334 | Conesota Cr., Pa. | J-567..... | i, 335 |
| Commencement B., Wash.: | | | Conestoga Cr., Pa. | J-569..... | i, 335 |
| Bridges..... | ii, 2158 | | Conetoe Cr., N. C. | M-84..... | i, 454 |
| Harbor lines..... | ii, 2254 | | Conewago Cr., Pa. | J-582..... | i, 335 |
| Commerce | i, 21 | | J-908..... | i, 337 | |
| Commerce Isld. | (HH)..... | i, 1072* | Conewango Cr., Pa. and N. Y. | FF-33..... | i, 1003 |
| Commerce, Mo. | (HH)..... | i, 1072* | FF-20..... | i, 1015 | |
| Commissary Cr., Ga. | O-310..... | i, 535 | J-581..... | i, 335 | |
| Commissions. | ii, 2041, 2108 | | Coney Cr., Pa. | | |
| California Débris Comm..... | i, 1580; ii, 2108 | | Coney Isld. Chan., N. Y. | | |
| International Navigation Congresses..... | ii, 2041, 2110 | | H., N. Y..... | F-105-e..... | i, 238 |
| National Waterways Comm..... | ii, 2286 | | Coney Isld. Cr., N. Y. | F-103..... | i, 216, 233 |
| Mississippi R. Comm..... | i, 1142; ii, 2108 | | Bridges..... | ii, 2158 | |
| Missouri R. Comm..... | i, 1049; ii, 2108 | | Coney Isld., N. Y.: | | |
| Common Cr., Pa. | H-14..... | i, 271 | Harbor lines..... | ii, 2254 | |
| Common Flats, Mass.: | | | Confederate Cr., Mont. | GG-536..... | i, 1029 |
| Wrecks..... | ii, 2266 | | (See notes, ii, 2816.) | | |
| Communipaw: | | | Congaree Cr., S. C. | N-194..... | i, 500 |
| Harbor lines..... | ii, 2254 | | Congaree R., S. C. | N-141..... | i, 500, 515 |
| Common Sage Cr., Wyo. | GG-1021..... | i, 1033 | N-141-a..... | i, 515 | |
| Company Canal, La.: | | | Appro..... | ii, 2292 | |
| Bridges..... | ii, 2158 | | Bridges..... | ii, 2158 | |
| Company Canal No. 1. | S-367..... | i, 684 | Congaree R., S. C., Ger- vals Street Br., Colum- bia, to Granby. | N-141-b..... | i, 516 |
| Company Canal No. 1, La. | S-300..... | i, 683 | Congaree R., S. C. (locks and dams on). | N-141-c..... | i, 517 |
| Company Canal No. 2, La. | S-395..... | i, 684 | Congress: | | |
| S-422..... | i, 684 | | Index, authorization of..... | i, 7, 9 | |
| S-424..... | i, 684 | | Sessions of..... | ii, 2781 | |
| S-431..... | i, 684 | | Congresses, International Navigation: | | |
| Compass Run, Md. | J-1021..... | i, 338 | Appro..... | ii, 2041, 2110, 2283, 2286 | |
| Compass, variation, Great Lakes | ii, 2041, 2141 | | Congresses of the United States | ii, 2781 | |
| Compton Cr., N. J. | G-47..... | i, 247 | Conlio Cr., N. C. | L-393..... | i, 414 |
| G-46..... | i, 263 | | Conline Cr., N. C. | L-356..... | i, 414 |
| Appro..... | ii, 2290 | | Conlot Cr., N. C. | L-357..... | i, 414 |
| Harbor lines..... | ii, 2254 | | Conneaut H., Ohio. | QQ-33..... | i, 1461, 1488 |
| Comrade Cr., La. | S-811..... | i, 688 | Appro..... | ii, 2299 | |
| Comstock Cr., Tenn. | AA-68..... | i, 848 | Navigation rules..... | ii, 2041, 2107 | |
| Conanicut Isld., R. I. | C-97..... | i, 108, 132 | Wrecks..... | ii, 2266 | |
| Forts..... | ii, 1866 | | Conneaut Cr., Ohio: | | |
| Conasauga Cr., Tenn. | AA-73..... | i, 848 | Bridges..... | ii, 2158 | |
| Conch Hole Cr., N. Y. | F-83..... | i, 216 | Conneaut R., Ohio. | QQ-34..... | i, 1461 |
| Concho R., Tex. | U-40..... | i, 735 | Connecticut: | | |
| Concordia | (HH)..... | i, 1072* | Forts..... | ii, 1796, 1802, 1816, 1874 | |
| Concord R., Mass. | B-44..... | i, 69 | Connecticut R. above Hartford, Conn. | D-23-c..... | i, 152 |
| Concrete mixing plant, Ist. | ii, 2356 | | Connecticut R. below Hartford, Conn. | D-23-b..... | i, 150 |
| Condado B., P. R.: | | | Connecticut R., Conn. and Mass. | D-23..... | i, 141, 149 |
| Bridges..... | ii, 2158 | | D-23-a..... | i, 149 | |
| Conduit Road, D. C. | ii, 2040, 2076 | | Appro..... | ii, 2289 | |
| Conecuh and Escambia Rs., Fla. and Ala. | Q-43..... | i, 611, 630 | Bridges..... | ii, 2158 | |
| Q-43-c..... | i, 631 | | Wrecks..... | ii, 2266 | |
| Conecuh R. | Q-44..... | i, 611 | (See notes, ii, 2789.) | | |
| Conecuh R., Ala. | Q-43-b..... | i, 631 | | | |
| Bridges..... | ii, 2158 | | | | |
| Conecuh R., Fla.: | | | | | |
| (See notes, ii, 2801.) | | | | | |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|------------------|------------------------------|--|------------------|----------------|
| Connecticut R., Conn. | | | Cook Bayou, La. | S-327..... | i, 683 |
| (mouth)..... | D-24..... | i, 153 | Cook Pt. Cove, Md. | J-253..... | i, 333 |
| Connection Slough, Cal. | UU-28..... | i, 1577 | Cook Run, Pa. | J-774..... | i, 336 |
| Connedogulnet Cr., Pa. | J-902..... | i, 337 | Cooks Anchorage, Hawaii. | YY-38..... | i, 1685 |
| Connegan R., Ga. | O-216..... | i, 534 | Cooks Branch, Md. | J-1123..... | i, 339 |
| Conner Bayou, La.: | | | Cooks Cr., Ga. | O-373..... | i, 535 |
| Bridge..... | | ii, 2144 | Coolbranch Run, Md. | J-933..... | i, 338 |
| Conner Cr., Kans. | GG-1175..... | i, 1034 | Cools Cr., La. | S-42..... | i, 681 |
| (See notes, ii, 2821.) | | | Cool Spring Cove, Md. | J-1214..... | i, 340 |
| Conners Cr., Mich. | PP-108..... | i, 1420 | Coon (HH) | | i, 1072* |
| Conners Pt., Minn.: | | | Coon Cr., Kans. | GG-1395..... | i, 1036 |
| Harbor lines..... | | ii, 2254 | (See notes, ii, 2822.) | | |
| Conners Pt., Wis.: | | | Coon Cr., Ky. | DD-88..... | i, 959 |
| Harbor lines..... | | ii, 2254 | | DD-285..... | i, 961 |
| Connesauga R., Ga. | Q-56..... | i, 611 | Coon Cr., Minn. | KK-63..... | i, 1247 |
| Connolly Cove, Md. | J-317..... | i, 333 | Coon Cr., Mo. | GG-1500..... | i, 1036 |
| Connoquenessing Cr., Pa. | FF-39..... | i, 1003 | (See notes, ii, 2824.) | | |
| Conoby Cr., N. C. | L-397..... | i, 414, 449 | Coon Isld. | (HH)..... | i, 1072* |
| Conoconneque | (CC)..... | i, 909* | | (WW-2)..... | i, 1617* |
| Conoconneque Cr., Ky. | DD-210..... | i, 960 | Coon Isld. Slough. | (WW-2)..... | i, 1616* |
| Conotton Cr., Ohio. | DD-371..... | i, 962 | Coon Run Bar. | (CC)..... | i, 909* |
| Conowingo Cr., Md. and Pa. | J-563..... | i, 335 | Cooper Branch, Md. | J-1111..... | i, 339 |
| | (HH)..... | i, 1072* | Cooper Cr., Md. | J-974..... | i, 338 |
| Conradis | | | Cooper Cr., N. J. | I-51..... | i, 312 |
| Conscience B., N. Y. | F-22..... | i, 215 | Appro..... | | ii, 2290 |
| Constable Hook, N. J. | E-28-c..... | i, 195 | Bridges..... | | ii, 2158 |
| Constable Pt., N. Y.: | | | Wrecks..... | | ii, 2266 |
| Harbor lines..... | | ii, 2254 | Cooper Cr., S. C.: | | |
| Constance Bayou, La. | S-743..... | i, 687 | Appro..... | | ii, 2292 |
| Constitution, Ft., N. H. | | ii, 1805, 1851 | Harbor lines..... | | ii, 2254 |
| Constructions, Engineering: | | | Wrecks..... | | ii, 2266 |
| Plates or views..... | | i, 13; ii, 2625 | Cooper Cr., W. Va. | EE-151..... | i, 984 |
| Contentula Cr., N. C. (see Moccasin Cr.) | M-172..... | i, 455, 468 | Cooper Pt., N. J.: | | |
| (See notes, ii, 2797.) | | | Harbor lines..... | | ii, 2254 |
| Appro..... | | ii, 2292 | Cooper R. near Charleston, S. C. | N-216-b..... | i, 525 |
| Bridges..... | | ii, 2158, 2199 | Cooper R., N. J. | I-51..... | i, 299, 312 |
| Contents: | | | Cooper R., S. C. | N-205..... | i, 500, 523 |
| Index..... | | See fronts of Vols. I and II | Cooper R., S. C., Eastern Branch. | N-209..... | i, 500 |
| Contingencies: | | | Cooper R., S. C., Western Branch. | N-211..... | i, 500 |
| Appro..... | | ii, 2283 | Coopers Cr., La. | S-36..... | i, 681 |
| Ports..... | | ii, 1809 | Coopers Cr., N. C. | I-269..... | i, 413 |
| Philippine Islds..... | | ii, 2039, 2042 | Coopers R., Ga. | O-420..... | i, 536 |
| Contoocook R., N. H. | B-32..... | i, 69 | Cooper Swamp, S. C. | N-232..... | i, 500 |
| Contraband Bayou, La. | S-804..... | i, 688 | Coosa and Tennessee Rs. | | |
| Contractors: | | | (canal to connect)..... | A-18-h..... | i, 868 |
| List of, river and harbor works..... | | ii, 2307 | Coosa R. | (CC)..... | i, 909* |
| Contracts | | | Coosa R., Ala. and Ga. | Q-52..... | i, 611, 635 |
| Forts..... | | ii, 1797 | | Q-52-b..... | i, 636 |
| Contrary Cr., Ky. | DD-175..... | i, 960 | (See notes, ii, 2802.) | | |
| Contrary Cr., Mo.: | | | Appro..... | | ii, 2296 |
| (See notes, ii, 2824.) | | | Bridges..... | | ii, 2158 |
| Convent | (HH)..... | i, 1072* | Dams, private..... | | ii, 2249 |
| Convent Bayou, La. | S-361..... | i, 684 | Coosa R., Ala. and Ga. | | |
| Conway Bayou, Ala. | R-17..... | i, 646 | (operation and care of canals)..... | Q-52-e..... | i, 640 |
| Conway Bayou, La. | S-117..... | i, 682 | Coosa R., between Rome, Ga., and East Tennessee, Virginia & Georgia | | |
| | T-2-h..... | i, 717 | R. R. br. | Q-52-c..... | i, 638 |
| Conway, Mich.: | | | | | |
| Logs, floating of..... | | ii, 2041, 2109 | | | |
| Conways Bayou, La.: | | | | | |
| (See notes, ii, 2805.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Coosa R., Ga., between Wetumpka and East Tennessee, Virginia & Georgia R. R. br..... | Q-52-d..... | i, 639 | Corea H., Gouldsboro, Me..... | A-39-a..... | i, 34 |
| Coosa R. ("Transporta- tion Routes to Sea- board")..... | AA-18-k..... | i, 589 | Core Cr., N. C..... | M-177..... | i, 455 |
| Coosawattee R., Ga..... | Q-54-a..... | i, 641 | | M-268..... | i, 456, 480 |
| | Q-55..... | i, 611 | Core Sound, N. C..... | M-228..... | i, 456, 471 |
| (See notes, ii, 2802.) | | | (See notes, ii, 2797.) | | |
| Appro..... | | ii, 2293 | Core Sound, thorough- fare leading from, into Cedar Isld. B., thence to Neuse R. and Pam- lico Sound, N. C..... | M-231-a..... | i, 472 |
| Bridges..... | | ii, 2159, 2212 | Core Sound to Newport R., N. C..... | M-226-b..... | i, 471 |
| Coosawhatchie R., S. C..... | N-264..... | i, 501 | Corkers Cr., Md..... | J-9..... | i, 331 |
| Coosaw R., S. C..... | N-257..... | i, 501 | Corkscrew Slough, Cal..... | TT-25..... | i, 1555 |
| Coosaw R., Whale Branch, S. C.: | | | | TT-27..... | i, 1555 |
| Bridges..... | | ii, 2158 | Corlears B., N. Y..... | E-91..... | i, 177 |
| Coos B. and H., Oreg..... | VV-16..... | i, 1599 | Corlears Kill, N. Y..... | E-60..... | i, 177 |
| | VV-16-b..... | i, 1600 | Cornay R., La..... | X-40..... | i, 811 |
| Appro..... | | ii, 2300 | Corn Cr., S. Dak..... | GG-888..... | i, 1032 |
| Harbor lines..... | | ii, 2254 | (See notes, ii, 2819.) | | |
| Coos B., Oreg..... | VV-16..... | i, 1593 | Cornelius Cr., Va..... | L-142..... | i, 412 |
| Harbor lines..... | | ii, 2254 | Cornells Cr. and Landing to Jamaica B., N. Y. (water connection)..... | F-91..... | i, 231 |
| Coos B., Oreg. (dredging). VV-16-a..... | | i, 1599 | Cornells Cr., N. Y..... | F-91..... | i, 216 |
| Cooskie Cr., Cal..... | TT-166..... | i, 1556 | Corney Bayou, La..... | X-40..... | i, 811 |
| Coos R., Oreg..... | VV-23..... | i, 1593, 1602 | Appro..... | | ii, 2295 |
| Appro..... | | ii, 2300 | Bridges..... | | ii, 2159 |
| Coos R., Oreg., North Fork..... | VV-24..... | i, 1593 | Cornfield Cr., Ga..... | O-110..... | i, 534 |
| Coos R., Oreg., South Fork..... | VV-25..... | i, 1593 | Cornfield Cr., Md..... | J-1185..... | i, 340 |
| Copalls R., Wash..... | XX-25..... | i, 1655 | Cornice..... | (HH)..... | i, 1072* |
| Copano B., Tex..... | U-65..... | i, 735 | Cornie Bayou, Ark. and La..... | X-41..... | i, 785 |
| Cope Branch, Ky..... | DD-100..... | i, 959 | Cornie R., La..... | X-40..... | i, 811 |
| Copelands Bend..... | (GG-2)..... | i, 1038* | Cornish Cr., Va..... | K-128..... | i, 374 |
| Copperas Cr..... | (HH)..... | i, 1072* | Cornucopia H., Wis..... | LL-28-b..... | i, 1282 |
| Copperas Mine Fork, W. Va..... | EE-18..... | i, 983 | (See notes, ii, 2836.) | | |
| Copper H., Mich..... | LL-38..... | i, 1265, 1288 | Corona..... | (HH)..... | i, 1072* |
| Copper R., Alaska..... | XX-126..... | i, 1656 | (See notes, ii, 2831.) | | |
| Bridges..... | | ii, 2159 | Coronado, Cal.: | | |
| Cog d'Inde Bayou, Ala..... | R-58..... | i, 646 | Harbor lines..... | | ii, 2254 |
| Coquille City to Myrtle Pt., Oreg., Coquille R.... | VV-12-b..... | i, 1598 | Corpse Cr., Ga..... | O-447..... | i, 536 |
| Coquille R., Oreg..... | VV-12..... | i, 1593, 1596 | Corps of Engineers: | | |
| | VV-12-a..... | i, 1596 | Increase of..... | | ii, 2039, 2058 |
| Appro..... | | ii, 2300 | Laws affecting..... | | ii, 2329 |
| Logs, floating of..... | | ii, 2041, 2109 | List of Chiefs..... | | ii, 2039, 2043 |
| Coquille R., Oreg., Co- quille City to Myrtle Pt. | VV-12-b..... | i, 1598 | Corpus Christi B., Tex.... | U-68..... | i, 735 |
| Coquille R., Oreg. (en- trance)..... | VV-11..... | i, 1593 | Corpus Christi Chan., Tex.: | | |
| Coquille R., Oreg., North Fork..... | VV-13..... | i, 1593 | Bridges..... | | ii, 2159 |
| Coral B., P. I..... | YY-146..... | i, 1686 | Corpus Christi H..... | U-2-b..... | i, 735 |
| Coral Cr., Fla..... | P-265..... | i, 571 | Corpus Christi, Tex..... | U-68-a..... | i, 773 |
| Corbins Cr., Va..... | K-190..... | i, 374 | Appro..... | | ii, 2295 |
| Cordella Slough, Cal..... | TT-101..... | i, 1555 | Corpus Christi, Tex., to Aransas Pass (including Turtle Cove Chan.)..... | U-68-b..... | i, 773 |
| Bridges..... | | ii, 2159, 2214 | Corral Cr., Kans..... | GG-1168..... | i, 1034 |
| Cordova..... | (HH)..... | i, 1072* | (See notes, ii, 2821.) | | |
| Cordova B., Alaska: | | | | | |
| Harbor lines..... | | ii, 2254 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Corral Cr., N. Dak. and Mont. | GG-757 | i, 1031 | Coughers Cr., Va. | K-140 | i, 374 |
| Corrotoman R., Va. | K-177 | i, 374 | Coulee Cr., Mont. | GG-442 | i, 1028 |
| Corsica Cr., Md. | J-433 | i, 357 | (See notes, ii, 2815.) | | |
| Corsica R., Md. | J-433 | i, 334, 357 | Coulee Madagale, La. | S-386 | i, 684 |
| Appro. | | ii, 2291 | Coulson Pond, Md. | J-157 | i, 332 |
| Corsica Shoal, Mich. | PP-87 | i, 1419, 1444 | Coulton Cr., La. | S-68 | i, 681 |
| Corsons Inlet, N. J. | I-23 | i, 299 | Counell Bluffs | (GG-2) | i, 1038* |
| Corsons Sound, N. J. | I-23-a | i, 304 | Courtableau Bayou, La. | S-585 | i, 686, 704 |
| Corte Madera Cr., Cal. | TT-128 | i, 1556 | (See notes, ii, 2805.) | | |
| Bridges | | ii, 2159 | Appro. | | ii, 2294 |
| Corvallis City, Oreg. | WW-30-c | i, 1645 | Bridges | | ii, 2144, 2159 |
| Cory Cr., Pa. | J-675 | i, 336 | Courthouse Cr., Va. | L-136 | i, 412 |
| COSBY, SPENCER (Lt. Col.): | | | Courts Cr., N. C. | M-199 | i, 455 |
| Fortification index | | i, 9 | Courville Bayou, La. | S-572 | i, 686 |
| Coscob, Conn.: | | | Couteau Bayou, La. | S-558 | i, 686 |
| (See notes, ii, 2792.) | | | Cove Cr., Pa. | J-882 | i, 337 |
| Appro. | | ii, 2289 | | J-900 | i, 337 |
| Bridges | | ii, 2159 | Cove Cr., S. C. | N-162 | i, 500 |
| Cos Cob H., Conn. | D-95 | i, 141 | Cove Cr., Tenn. | AA-155 | i, 849 |
| Coscob H., Conn. | D-95 | i, 172 | | AA-171 | i, 849 |
| Coscob R., Conn.: | | | Cove H., Conn. | D-91 | i, 141, 171 |
| Bridges | | ii, 2159 | Covert Cr., Kans.: | | |
| Coshoke R., N. C. | L-343 | i, 414 | (See notes, ii, 2822.) | | |
| Cosmopolis, Wash.: | | | Covey Cr., Md. | J-251 | i, 333 |
| Harbor lines | | ii, 2254 | Covington | (CC) | i, 909* |
| Cosna R., Alaska | XX-196 | i, 1656 | Covington Cove, Md. | J-388 | i, 334 |
| Cosumnes R., Cal. | UU-50 | i, 1577 | Cowanesque R., Pa. | J-670 | i, 336 |
| Cotabato, P. I. | YY-162 | i, 1686 | Cowards Gully, La. | S-850 | i, 688 |
| Cotaco Cr., Ala. | AA-48 | i, 848 | Cow Bayou, La. | S-538 | i, 685 |
| Cotonier Bayou, La. | S-531 | i, 685 | | T-2-kk | i, 717 |
| Cottage City H., Mass. | C-28 | i, 107, 113 | Cow Bayou, Tex.: | | |
| Cottage Isld. | (HH) | i, 1072* | (See notes, ii, 2806.) | | |
| Cottells Cr., Mass. | B-7 | i, 69 | Bridges | | ii, 2159 |
| Cotton Cr., Ga. | O-360 | i, 535 | Cow Cr., Kans. | GG-1328 | i, 1035 |
| Cottonwood | (CC) | i, 909* | (See notes, ii, 2822.) | | |
| | (HH) | i, 1072* | Cow Cr., Ky. | DD-53 | i, 959 |
| Cottonwood Branch, Mo. | GG-173 | i, 1026 | | DD-177 | i, 960 |
| Cottonwood Cr., Mont. | GG-429 | i, 1028 | Cow Cr., La.: | | |
| | GG-478 | i, 1028 | (See notes, ii, 2805.) | | |
| | GG-539 | i, 1029 | Cow Cr., Md. | J-136 | i, 332 |
| | GG-720 | i, 1030 | Cow Cr., Mass. | B-185 | i, 70 |
| | GG-761 | i, 1031 | Cow Cr., Mo. | GG-53 | i, 1025 |
| Cottonwood Cr., Mont., and Canada, Nebr., N. Dak., S. Dak., Wyo.: | | | Cow Cr., Mont. | GG-470 | i, 1028 |
| (See notes, ii, 2815, 2816, 2817, 2818, 2819, 2820.) | | | (See notes, ii, 2816.) | | |
| Cottonwood Cr., Nebr. | GG-972 | i, 1032 | Cow Cr., Tex.: | | |
| | GG-1119 | i, 1033 | (See notes, ii, 2806.) | | |
| Cottonwood Cr., N. Dak. | GG-319 | i, 1027 | Cow Cr., W. Va. | EE-19 | i, 983 |
| Cottonwood Cr., S. Dak. | GG-848 | i, 1031 | Cow Cr., Wyo. | GG-1024 | i, 1033 |
| | GG-866 | i, 1031 | (See notes, ii, 2820.) | | |
| Cottonwood Cr., Wyo. | GG-683 | i, 1030 | Cowman R., Wash. | WW-50 | i, 1615 |
| | GG-1011 | i, 1033 | Cowen Cr., Alaska | XX-222 | i, 1657 |
| | GG-1056 | i, 1033 | Cowen Run, Md. | J-997 | i, 338 |
| Cottonwood Isld. | (HH) | i, 1072* | Cowesett B., R. I. | C-91 | i, 107, 131 |
| Cottonwood Rocks | (WW-2) | i, 1617* | Cow Face Cut, Ga. | O-335 | i, 535 |
| Cotuit H., Mass. | C-13 | i, 107, 110 | Cowhead Bayou, La. | S-547 | i, 686 |
| Cotuit R., Mass. | C-12 | i, 107 | Cowhead Cut, Ga. | O-85 | i, 533, 548 |
| Couba Bayou, La. | S-368 | i, 684 | Cow Head R., Ga. | O-85 | i, 548 |
| Couchan Bayou, La. | S-136 | i, 682 | Appro. | | ii, 2293 |
| | | | Cow Horn Cr., Minn. | KK-97 | i, 1248 |
| | | | Cow Isld. | (GG-2) | i, 1038* |
| | | | Cow Isld. Batteries, Me.: | | |
| | | | Forts | | ii, 1841 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|--|---------------------|-------------------|
| Cowles Cr., Ohio | QQ-30-b | i, 1485 | Crater Lake National Park | ii, 2040, 2096 | |
| Cowlitz R. | (WW-2) | i, 1617* | Crats | (HH) | i, 1072* |
| Cowlitz R., Wash. | WW-49 | i, 1615, 1650 | Cravens Cr., Mo. | GG-175 | i, 1026 |
| (See notes, ii, 2844.) | | | (See notes, ii, 2814.) | | |
| Appro. | | ii, 2300 | Craven Thoroughfare, N. | | |
| Bridges | | ii, 2159 | J.: | | |
| Cowpen | (HH) | i, 1072 | Bridges | ii, 2159, 2184 | |
| Cowpen Bayou, La. | S-788 | i, 688 | Crawfish Cr. | (CC) | i, 909* |
| Cowpen Cr., La. | S-845 | i, 688 | Crawford | (HH) | i, 1072* |
| Cowsegan Narrows, Me. | A-205 | i, 28 | Crawford Co., Ark. | Y-2-c | i, 820 |
| Cox B., La. | S-194 | i, 682 | Crawford Co. Levee (front | | |
| Cox Cr., Md. | J-403 | i, 334 | of), Arkansas R., Ark. | Y-2-k | i, 825 |
| | J-1165 | i, 339 | Crawley Cr., W. Va. | EE-15 | i, 983 |
| Coxsack Cr., N. Y. | E-58 | i, 177 | Crazy Woman Fork, Wyo. | GG-27 | i, 1080 |
| Coxsack to New Balti- | | | (See notes, ii, 2818.) | | |
| more, N. Y. | E-28-e | i, 196 | Creek Brook, Mass. | B-8 | i, 69 |
| Coxs Cr., Md. | J-1273 | i, 340 | Creel B., N. Dak. | KK-186-a | i, 1259 |
| Coyles Bayou, La. | S-554 | i, 686 | Creitz Cr., Pa. | J-918 | i, 338 |
| Coyote Cr., Cal.: | | | Cremona Cr., Md. | K-31 | i, 373 |
| Bridges | | ii, 2159, 2242 | Creole B., La. | S-405 | i, 684 |
| Coyote Cr., Colo. | GG-1034 | i, 1033 | Creole Canal, La. | S-792 | i, 688 |
| Coyote Hill Slough, Cal. | TT-47 | i, 1555 | Crescent City, Cal. | TT-206 | i, 1572 |
| Coyote R., Cal. | TT-38 | i, 1555 | (See notes, ii, 2840.) | | |
| Crab Alley B., Md. | J-401 | i, 334 | Crescent City H., Cal. | TT-206 | i, 1556 |
| Crab Alley Cr., Md. | J-402 | i, 334 | Cressy Cr., Tenn. | AA-131 | i, 849 |
| Crabapple Cr., Mo. | GG-166 | i, 1026 | Crescent Lake, Fla. | P-72 | i, 569 |
| Crab Cr., Ala. | R-18 | i, 646 | Creux Bayou, La. | S-511 | i, 685 |
| Crab Cr., Md. | J-1248 | i, 340 | Creve Coeur Cr., Mo.: | | |
| Crab Isid. | (HH) | i, 1072* | (See notes, ii, 2824.) | | |
| Crabtree Coulee | (WW-2) | i, 1617* | Criehaven H., Me. | A-118 | i, 28 |
| Cracraft | (HH) | i, 1072* | Cripple Cr., Va. | EE-92 | i, 983 |
| Craddock Cr., Va. | L-75 | i, 411 | Crisfield H., Md. | J-46 | i, 331, 342 |
| Craghead Branch, Mo. | GG-57 | i, 1025 | Appro. | | ii, 2291 |
| Craghead Cr., Mo. | GG-69 | i, 1025 | Harbor lines | | ii, 2254 |
| (See notes, ii, 2813.) | | | Wrecks | | ii, 2266 |
| Craig | (GG-2) | i, 1038* | Cristobal, Colon: | | |
| Craig Cr., Kans. | GG-1216 | i, 1034 | Wreck | | ii, 2041, 2116 |
| (See notes, ii, 2821.) | | | Croatian Sound, N. C. | L-173-n | i, 438 |
| Craighead | (HH) | i, 1072* | | M-22-b | i, 459 |
| Craigs Bar | (CC) | i, 909* | | M-23 | i, 454 |
| Craigs Cr., Md. | J-520 | i, 335 | Appro. | | ii, 2292 |
| Crain Cr., Mont. | GG-629 | i, 1030 | Crockery Cr., Mich. | OO-34 | i, 1377 |
| (See notes, ii, 2817.) | | | Crockett Cr., Tenn. | AA-142 | i, 849 |
| Crains | (HH) | i, 1072* | Crocketts Cove, Me. | A-121 | i, 28 |
| Crampton, Md.: | | | Crocketts Cr., Mo. | GG-189 | i, 1026 |
| (See notes, ii, 2795.) | | | Crocodile Bayou, La. | S-378 | i, 684 |
| Cranberry Branch, Md. | J-1135 | i, 339 | Crocodile Canal, La. | S-377 | i, 684 |
| Cranberry Inlet, N. J. | I-3 | i, 299, 300 | Crocondunez | (GG-2) | i, 1038* |
| Appro. | | ii, 2290 | Crocus Cr., Ky. | AA-287 | i, 850 |
| Cranberry Pond, N. Y. | RR-35 | i, 1493 | Croma Kill, N. J. | G-10 | i, 247 |
| Cranberry R., W. Va. | EE-119 | i, 984 | Crooked Bayou, Miss. | R-72 | i, 646 |
| Cranberry Run, Md. | J-956 | i, 338 | Crooked Cr., Ark. | Y-43 | i, 818 |
| Crane Cove, Md. | J-59 | i, 331 | Crooked Cr., Ga. | O-300 | i, 535 |
| Crane Cr., Fla. | P-120 | i, 570 | | O-377 | i, 536 |
| | P-128 | i, 570 | Crooked Cr., Iowa | GG-248 | i, 1027 |
| Crane Cr., Ky. | DD-33 | i, 959 | (See notes, ii, 2814.) | | |
| Crane Cr., S. C. | N-148 | i, 500 | Crooked Cr., S. C. | N-43 | i, 499 |
| Crane Cr., W. Va. | DD-310 | i, 961 | Crooked Cr., Kans. | GG-1268 | i, 1035 |
| Crane R., Mass. | B-96 | i, 69, 81 | (See notes, ii, 2821, 2822.) | | |
| (See notes, ii, 2784.) | | | Crooked Cr., La. | S-276 | i, 683 |
| Cranes Nest R., Va. | DD-263 | i, 961 | Crooked Cr., Minn. | KK-168 | i, 1248 |
| Cranes Cr., Va. | K-141 | i, 374, 397 | Crooked Cr., Mont. | GG-570 | i, 1029 |
| Craney Cr., Va. | J-411 | i, 334 | | GG-653 | i, 1030 |

(See notes, ii, 2816, 2817.)

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|---------------------|-------------------|
| Crooked Cr., N. C. | M-55..... | i, 454 | Crow Cr., Mont. and Wyo. | GG-738..... | i, 1030 |
| Crooked Cr., N. Dak.: (See notes, ii, 2818.) | | | Crow Cr., S. Dak. | GG-867..... | i, 1028 |
| Crooked Cr., Ohio | DD-353..... | i, 962 | | GG-833..... | i, 1031 |
| Crooked Cr., Pa. | J-671..... | i, 336 | (See notes, ii, 2815.) | | |
| | J-874..... | i, 337 | Crow Cr., S. Dak. and Wyo.: (See notes, ii, 2818.) | | |
| | FF-26..... | i, 1003 | Crowders Cr., S. C. | N-131..... | i, 500 |
| Crooked Cr., Va. | EE-101..... | i, 984 | Crow or Soldier Cr., S. Dak. | GG-372..... | i, 1028 |
| Crooked Lake, Mich. | PP-36..... | i, 1419 | Crow Rock Cr., Mont.: (See notes, ii, 2817.) | | |
| Crooked Lake, Minn. and Canada | KK-233..... | i, 1249 | Crows Pond, Mass. | B-215..... | i, 70 |
| Crooked Rapids | (HH)..... | i, 1072* | Crow R. | (HH)..... | i, 1072* |
| Crooked R. | WW-68-a..... | i, 1652 | Crow R., Minn. | KK-131..... | i, 1248 |
| (See notes, ii, 2841.) | | | Crow R., Minn., North Branch | KK-132..... | i, 1248 |
| Crooked R., Fla. | Q-14..... | i, 611, 613 | Crow R., Minn., South Branch | KK-133..... | i, 1248 |
| (See notes, ii, 2800.) | | | Crow Rock Cr., Mont. | GG-612..... | i, 1029 |
| Crooked R., Ga. | O-508..... | i, 536 | Crows Branch, Mo. | GG-213..... | i, 1026 |
| Crooked R., Mass. | C-44..... | i, 107 | Crow Shoals, Delaware B. | H-23-c..... | i, 293 |
| Crooked R., Mich. | PP-36..... | i, 1419 | Crow Wing | (HH)..... | i, 1072* |
| Crooked R., Minn. | KK-58..... | i, 1247 | Crow Wing R. | (HH)..... | i, 1072* |
| Crooked R., Mo. | GG-169..... | i, 1026 | Crow Wing R., Minn. | KK-103..... | i, 1248 |
| (See notes, ii, 2814.) | | | Dams, private..... | | ii, 2249 |
| Crooked Slough | (HH)..... | i, 1072* | Crum Cr., Pa.: Bridges..... | | ii, 2150, 2161 |
| Crook Horn Thorough- fare, N. J.: Bridges..... | | ii, 2159 | Crum Elbow Cr., N. Y. | E-43..... | i, 177 |
| Crook Landing | (HH)..... | i, 1072* | Crumpton, Md.: (See notes, ii, 2795.) | | |
| Crooks Cr., Wyo. | GG-1010..... | i, 1033 | Crum R., Pa. | I-55..... | i, 299, 314 |
| Crookston (above); Red R. of the North | KK-170-c..... | i, 1258 | Crutchfield | (HH)..... | i, 1072* |
| Cross Bayou, La. | S-621..... | i, 686 | Cry Bayou, Miss. | S-289..... | i, 683 |
| Cross Cr., Fla. | P-37..... | i, 569 | Crystal B., Fla. | P-340..... | i, 571 |
| Cross Cr., Kans. | GG-1236..... | i, 1034 | Crystal City | (HH)..... | i, 1072* |
| (See notes, ii, 2821.) | | | Crystal Cove, Mass. | B-115..... | i, 70 |
| Cross Cr., Va. | L-5..... | i, 411 | Bridges..... | | ii, 2159 |
| Cross Fork, Pa. | J-772..... | i, 336 | Crystal Cr., Kans. and Nebr. | GG-1307..... | i, 1035 |
| Crosierdoer Cr., Md. | J-315..... | i, 333 | (See notes, ii, 2822.) | | |
| Cross Lake | (HH)..... | i, 1072* | Crystal Cr., Ky. | DD-173..... | i, 960 |
| Cross Rip Lightship, Mass.: Wrecks..... | | ii, 2266 | Crystal R., Fla. | P-341..... | i, 571, 604 |
| Cross R., Me. | A-203..... | i, 28 | Appro..... | | ii, 2293 |
| Cross Slough, Cal. | TT-88..... | i, 1555 | Crystal Spring Cr., Wyo.: (See notes, ii, 2817.) | | |
| Cross Village H., Mich. (harbor of refuge)..... | OO-63..... | i, 1377 | Cub Cr., Mo. | GG-1460..... | i, 1036 |
| | OO-63..... | i, 1415 | Cub Cr., Va. | L-370..... | i, 414 |
| Crosswick Cr., N. J. | H-6..... | i, 271 | Cubits Gap | (HH)..... | i, 1072* |
| Croton R., N. Y. | E-32..... | i, 177 | Cubits Gap, La. | S-245..... | i, 683 |
| Crowberry Cr., Md. | J-272..... | i, 333 | Cubitt Cr., Va. | K-134..... | i, 374 |
| Crow Coulee | (GG-2)..... | i, 1038* | Cuckold Cr., Md. | K-40..... | i, 373 |
| Crow Cr., Colo. and Wyo. (See notes, ii, 2820.) | GG-1084..... | i, 1033 | | K-72..... | i, 373 |
| Crow Cr., Kans. | GG-1199..... | i, 1034 | Cuckolds Cr., S. C. | N-250..... | i, 501 |
| (See notes, ii, 2821.) | | | Culvre Isld. | (HH)..... | i, 1072* |
| Crow Cr., Kans. and Nebr. | GG-1306..... | i, 1035 | Culvre R. | (HH)..... | i, 1072* |
| Crow Cr., Mo. | GG-58..... | i, 1025 | Culvre R., Mo. | JJ-81..... | i, 1234, 1243 |
| (See notes, ii, 2813.) | | | Appro..... | | ii, 2297 |
| Crow Cr., Mont. | GG-510..... | i, 1029 | Culebra Isld., P. R., Great H. | YY-5-a..... | i, 1687 |
| (See notes, ii, 2816, 2818.) | GG-555..... | i, 1029 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|------------------------------------|---------------------|-------------------|
| Culebrinas R., P. R. | YY-22..... | i, 1685 | Currituck Sound, N. C. | L-221..... | i, 413 |
| Culotches B., Ark. | Y-27..... | i, 818 | Currituck Sound (Nor- | | |
| Cullum | (CC)..... | i, 909* | folk H., Va., to Alber- | | |
| Cullum Bar | (CC)..... | i, 909* | marie Sound, N. C., | | |
| Cullums Ripple | (CC)..... | i, 909* | via)..... | L-173-l..... | i, 426 |
| Cumberland B., N. Y. | E-87..... | i, 177 | Curry Cr., Fla.: | | |
| Cumberland Dam | (CC)..... | i, 909* | Bridges..... | ii, 2160, 2231 | |
| Cumberland R., Ga. | O-502..... | i, 536 | Curry Run, Pa. | J-808..... | i, 337 |
| Cumberland R., Ky. and | | | Curtis | (HH)..... | i, 1072* |
| Tenn | AA-239..... | i, 850, 878 | Curtis B., Md. | J-1153..... | i, 339 |
| | AA-239-b..... | i, 879 | Harbor lines..... | ii, 2254 | |
| | BB-5..... | i, 891 | Curtis Cr., Ga. | O-107..... | i, 533 |
| | (CC)..... | i, 909* | Curtis Cr., Md. | J-1156..... | i, 339 |
| (See notes, ii, 2809.) | | | Curtis Pt. (HH): | | |
| Appro. | ii, 2296 | | (See notes, ii, 2827.) | | |
| Bridges | ii, 2159, 2160 | | Cush Cr., Pa. | J-809..... | i, 337 |
| Navigation rules | ii, 2041, 2107 | | Cushing Cr., Cal. | TT-204..... | i, 1556 |
| Wrecks | ii, 2266 | | Cushing Cr., Pa. | J-760..... | i, 336 |
| Cumberland R., Ky., | | | Custer Cr., Mont. | GG-638..... | i, 1030 |
| South Fork | AA-275..... | i, 887 | (See notes, ii, 2817.) | | |
| Cumberland R., Ky. | | | Customhouse Bayou, La. | S-233..... | i, 683 |
| (mouth) | AA-322..... | i, 850 | Cut Bank Cr., Mont. | GG-482..... | i, 1028 |
| Cumberland Sound, Fla. | | | (See notes, ii, 2816.) | | |
| and Ga. | O-501-b..... | i, 562 | Cutler Bayou, La. | S-350..... | i, 684 |
| | O-501-c..... | i, 562 | Cutler, Me. | A-10..... | i, 27 |
| (See notes, ii, 2799.) | | | Cutnaptico Cr., Md. | J-93..... | i, 331 |
| Appro. | ii, 2293 | | Cutmeat Cr., S. Dak.: | | |
| Forts | ii, 1948 | | (See notes, ii, 2819.) | | |
| Wrecks | ii, 2266 | | Cutoff Bayou, La. | S-238..... | i, 683 |
| Cumberland Sound, Ga. | O-501..... | i, 536 | Cut-off Cr., Va. | L-51..... | i, 411 |
| Cumberland Sound to | | | Cut Off, Fla. | O-521..... | i, 537 |
| St. Johns R. (water- | | | Cut Off, Ga. | O-495..... | i, 536 |
| way) | P-2..... | i, 569 | Cut Off Slough, Cal. | TT-90..... | i, 1555 |
| Cumberland Sound to | | | | TT-92..... | i, 1555 |
| St. Simons Sound, Ga. | | | Cutoff Slough, Wash. | WW-55..... | i, 1615 |
| (inside passage) | O-501-a..... | i, 561 | Cut R., Mass. | B-162..... | i, 70 |
| Cummings Cr., Md. | J-349..... | i, 333 | Cutshn Cr., Ky. | DD-87..... | i, 959 |
| Cummings Cr., Nebr. | GG-952..... | i, 1032 | Cuttyhunk Isld., Mass.: | | |
| Cunningham Cr., Ohio. ... | QQ-30..... | i, 1461 | Wrecks..... | ii, 2266 | |
| | QQ-30-a..... | i, 1485 | Cuttyhunk Pond, Mass.: | | |
| Appro. | ii, 2299 | | Wrecks..... | ii, 2266 | |
| Cunningham Slough | (WW-2)..... | i, 1617* | Cuyahoga R., Ohio. | QQ-26..... | i, 1461, 1481 |
| Cunningham Slough, | | | Bridges..... | ii, 2160 | |
| Oreg. | WW-28..... | i, 1615 | Cypremort Bayou, La. ... | S-697..... | i, 687 |
| Cundys H., Me. | A-248..... | i, 29 | (See notes, ii, 2804.) | | |
| Curger Chan., Va. | L-22..... | i, 411 | Cypress Bayou, La. | S-14..... | i, 681 |
| Curles Swamp Cr., Va. ... | L-140..... | i, 412 | | S-101..... | i, 682 |
| Curlew Cr., Fla. | P-326..... | i, 571 | | S-810..... | i, 688 |
| Curlew Cr., N. Dak. | GG-776..... | i, 1031 | Cypress Bayou, La. and | | |
| (See notes, ii, 2818.) | | | Tex. | T-19..... | i, 717, 730 |
| Currant Bayou, La. | S-578..... | i, 686 | (See notes, ii, 2806, 2807.) | | |
| (See notes, ii, 2804.) | | | Appro. | ii, 2294 | |
| Currituck Cr., Va. | L-77..... | i, 411 | Cypress Branch, Md. | J-452..... | i, 334 |
| Current Bayou, La.: | | | Cypress Cr. | (HH)..... | i, 1072* |
| (See notes, ii, 2804.) | | | Cypress Cr., Ala. and | | |
| Current R., Ark. and Mo. | Y-29..... | i, 818, 835 | Tenn. | AA-216..... | i, 850 |
| (See notes, ii, 2808.) | | | Cypress Cr., Ga. | O-140..... | i, 534 |
| Appro. | ii, 2295 | | | O-263..... | i, 535 |
| Bridges | ii, 2160 | | Cypress Cr., Ind. | BB-22..... | i, 891 |
| Currioman B., Va. | K-117..... | i, 374, 395 | Cypress Cr., La. | S-770..... | i, 687 |
| (See notes, ii, 2795.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|--|---------------------|-------------------|
| Cyprus Cr., La. | T-2-p..... | i, 717 | Cypress Cr., Va. | L-161..... | i, 412 |
| | T-2-k..... | i, 717 | Bridges..... | | ii, 2160 |
| (See notes, ii, 2806.) | | | Wrecks..... | | ii, 2266 |
| Cypress Cr., Md. | J-1195..... | i, 340 | Cypress Isld. Coulee, La. | S-725..... | i, 687 |
| Cypress Cr., Tenn. | AA-24..... | i, 848 | Cypress Isld. Pass, La. | S-612..... | i, 686 |
| Cypress Cr., Tex.: | | | Cypress Lake, Ga. | O-476..... | i, 536 |
| (See notes, ii, 2806.) | | | Cyprien B., La. | S-320..... | i, 638 |
| | | | | | |
| Dabob B., Wash. | XX-48-a..... | i, 1664 | Daniel Cr., Ky. | DD-287..... | i, 961 |
| Dadina R., Alaska. | XX-138..... | i, 1656 | Daniels Cr., Ala. | R-26..... | i, 646 |
| Dadys Cr., Minn. | JJ-43..... | i, 1234 | Daniels Mill Cr., Ga. | O-336..... | i, 535 |
| Dagtilil R., Alaska: | | | Daniels Pt. | (HH)..... | i, 1073* |
| (See notes, ii, 2845.) | | | Dan R., Va. and N. C. | L-378..... | i, 414, 448 |
| Dagtilu R., Alaska. | XX-234..... | i, 1657 | (See notes, ii, 2797.) | | |
| Dakli R., Alaska. | XX-232..... | i, 1657 | Appro..... | | ii, 2291 |
| Dakota. | (GG-2)..... | i, 1038* | Danube (The) | (HH)..... | i, 1073* |
| | (HH)..... | i, 1072* | Danvers R., Mass. | B-93..... | i, 69 |
| Dakota Cr., Minn. | JJ-53..... | i, 1234 | Bridges..... | | ii, 2161 |
| Dakota R., N. Dak. and | | | Dapitan, P. I. | YY-173..... | i, 1686 |
| S. Dak. | GG-301..... | i, 1027 | D'Arbonne Bayou, La. | S-584..... | i, 686 |
| | GG-301-a..... | i, 1060 | | X-40..... | i, 785, 811 |
| (See notes, ii, 2815, 2824.) | | | Appro..... | | ii, 2295 |
| Dakota (State) | (HH)..... | i, 1072* | Bridges..... | | ii, 2161 |
| (See notes, ii, 2827.) | | | Darby Cr., Ohio. | DD-468..... | i, 962 |
| Field service..... | | ii, 2039, 2048 | Darby Cr., Pa. | H-22..... | i, 271 |
| Dalecarlia Receiving Res- | | | | I-54..... | i, 313 |
| ervoir, D. C. | | ii, 2040, 2084 | Bridges..... | | ii, 2161, 2230 |
| Dallas. | (HH)..... | i, 1072* | Darby R., Pa. | I-54..... | i, 299, 313 |
| Dallas City to Oquawka (HH): | | | Darbys Coulee, La. | S-723..... | i, 687 |
| (See notes, ii, 2827.) | | | Darbys Cr., N. C. | L-324..... | i, 413 |
| Dallas Cr., Tenn. | AA-184..... | i, 840 | Dardanelle, Ark. | Y-2-c..... | i, 820 |
| Dallas, Tex., District. | T (with map)..... | i, 715, 717 | Dardenne Isld. | (HH)..... | i, 1073* |
| (See notes, ii, 2805.) | | | Dargman Cr., Va. | K-226..... | i, 374 |
| Appro..... | | ii, 2294 | Darien H., Conn. | D-88..... | i, 141, 171 |
| Dalles-Cello Canal, Oreg.: | | | (See notes, ii, 2788.) | | |
| (See notes, ii, 2841.) | | | Darien H., Ga. | O-229..... | i, 534, 550 |
| Dalles Rapids. | (WW-2)..... | i, 1617* | | O-229-a..... | i, 550 |
| Dalles, The (WW): | | | | O-229-c..... | i, 551 |
| (See notes, ii, 2841.) | | | Appro..... | | ii, 2293 |
| Dall R., Alaska. | XX-219..... | i, 1657 | Forts..... | | ii, 1948 |
| Damariscotta H., Me. | A-192..... | i, 28 | Navigation rules..... | | ii, 2041, 2107 |
| Damariscotta Lake, Me.: | | | Wrecks..... | | ii, 2266 |
| Bridges..... | | ii, 2161 | Darien R., Conn. | D-87..... | i, 141 |
| Damariscotta R., Me. | A-186..... | i, 28, 47 | Darien R., Ga. | O-229..... | i, 534 |
| Appro..... | | ii, 2287 | Bridges..... | | ii, 2161 |
| Dames Quarter Cr., Md. | J-83..... | i, 331 | Dark Cr., Ga. | O-207..... | i, 534 |
| Damnation Cr., Cal. | TT-202..... | i, 1556 | Dark Cr., Mo. | GG-125..... | i, 1026 |
| Damrell Cr., La. | T-2-w..... | i, 717 | (See notes, ii, 2813.) | | |
| (See notes, ii, 2805.) | | | Dark H., Me. | A-112..... | i, 28 |
| Dams. | | ii, 2041, 2109 | Dark Head Cr., Md. | J-1060..... | i, 339 |
| Danby. | (HH)..... | i, 1073* | Darling Bayou, La. | S-73..... | i, 681 |
| Dancing Cr., Va. | K-244..... | i, 375 | Darnells Pt. | (HH)..... | i, 1073 |
| | | | Darr Branch, Mo. | GG-152..... | i, 1026 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Dasol B., P. I. | YY-103..... | i, 1686 | Dead R., Ga. | O-217..... | i, 534 |
| Data, Index, Reports, | | | | O-271..... | i, 535 |
| Chief of Engineers: | | | Dead R., Mich. | LL-53..... | i, 1265 |
| Arrangement..... | | i, 14 | Dead Run, Md. | J-1106..... | i, 339 |
| Checking..... | | i, 13 | DEAKYNE, MAJ. H. (Lt. | | |
| Daugherty Cr., Md. | J-53..... | i, 331 | Col.): | | |
| Dauphin Isld.: | | | Index, Reports, Chief of | | |
| Forts..... | | ii, 1972 | Engineers..... | | i, 10, 13 |
| Dauphin Isld. B., Ala. | R-54..... | i, 646 | Deal Isld., Md. | J-79..... | i, 343 |
| Dauphins. | (GG-2)..... | i, 1038* | | J-80..... | i, 343 |
| Dauphins Rapids. | (GG-2)..... | i, 1038* | Appro..... | | ii, 2291 |
| Davenport. | (HH)..... | i, 1073* | Wrecks..... | | ii, 2266 |
| Davenport Cr., Fla. | P-244..... | i, 571 | Dean Br., Minn. | KK-101..... | i, 1248 |
| Davenport H., Iowa: | | | Dean Cr., Ga. | O-211..... | i, 534 |
| Harbor lines..... | | ii, 2254 | Dean Cr., Mont. | GG-594..... | i, 1029 |
| Davidson Cr., Tenn. | AA-162..... | i, 849 | (See notes, ii, 2817.) | | |
| Davidson, Gen.: | | | Dean Cr., S. C. | N-238..... | i, 501 |
| Monument..... | | ii, 2040, 2091 | Dean Isld. | (HH)..... | i, 1073* |
| Davis. | (CC)..... | i, 909* | Deapolis. | (GG-2)..... | i, 1038* |
| Davis B., Miss. | R-76..... | i, 646 | Dearborn R., Mont. | GG-504..... | i, 1029 |
| Davis Branch, Md. | J-1146..... | i, 339 | (See notes, ii, 2816.) | | |
| Davis Branch, Mo. | GG-39..... | i, 1025 | Débris Commission, Cali- | | |
| Davis Cove, Me. | A-159..... | i, 28 | fornia | | ii, 2041, 2108 |
| Davis Cr., Kans.: | | | Debs Inlet, N. Y. | F-70..... | i, 215 |
| (See notes, ii, 2823.) | | | De Cade Bayou, La. | S-482..... | i, 685 |
| Davis Cr., Md. | J-233..... | i, 332 | Decatur. | (GG-2)..... | i, 1038* |
| | J-477..... | i, 334 | Decatur, Ala. | AA-18..... | i, 855 |
| Davis Cr., Mo. | GG-1482..... | i, 1036 | Deception Bayou, Tex.: | | |
| (See notes, ii, 2823.) | | | (See notes, ii, 2806.) | | |
| Davis Cr., Tex.: | | | Deception Pass, Wash.: | | |
| (See notes, ii, 2806.) | | | Bridges..... | | ii, 2161 |
| Davis Cr., Va. | K-283..... | i, 375 | Deckers Cove, Me.: | | |
| Davis Cr., W. Va. | EE-72..... | i, 983 | Bridges..... | | ii, 2161 |
| Davis Isld. | (CC)..... | i, 909* | Deckers Cr., W. Va. | FF-6-a..... | i, 1003 |
| Davis Isld. Dam, Pa. (see | | | | FF-13-a..... | i, 1012 |
| Ohio R.): | | | De Claise Bayou, La. | S-541..... | i, 685 |
| Harbor lines..... | | ii, 2254 | (See notes, ii, 2804.) | | |
| Navigation rules..... | | ii, 2041, 2107 | Deep B. and Swan Quar- | | |
| Davis Slough, Wash.: | | | ter B., N. C. (waterway). | M-37..... | i, 459 |
| Bridges..... | | ii, 2161 | Deep B., N. C. | M-39..... | i, 454 |
| Davis Strait, Me.: | | | Appro..... | | ii, 2292 |
| Wrecks..... | | ii, 2266 | Deep B., N. C.-Swan | | |
| Dawho R., S. C. | N-220..... | i, 500 | Quarter B. (waterway).. | M-37..... | i, 454 |
| Dawson Branch, Md. | J-276..... | i, 333 | Deep Bayou, La.: | | |
| Dawson Cr., La. | S-105..... | i, 682 | (See notes, ii, 2805.) | | |
| Dawsons Cr., N. C. | M-160..... | i, 455 | Deep Branch, N. C. | L-259..... | i, 413 |
| Dawson Lake, Miss. | X-16..... | i, 785 | Deep Brook, Mass. | B-42..... | i, 69 |
| Day Isld. Waterway, | | | Deep Cove, Md. | J-480..... | i, 334 |
| Wash.: | | | Deep Cr. Branch, Eliza- | | |
| Bridges..... | | ii, 2161, 2245 | beth R., Va. | L-181..... | i, 439 |
| Dead Cr., Ga. | O-183..... | i, 534 | Deep Cr., Del. | J-123..... | i, 332 |
| Dead Cr., N. C. | L-329..... | i, 413 | Deep Cr., Fla. | P-34..... | i, 569 |
| Dead Horse Cr., S. Dak. | GG-832..... | i, 1031 | | P-69..... | i, 569 |
| (See notes, ii, 2818.) | | | | P-74..... | i, 569 |
| Dead Horse Inlet, N. Y. | F-100..... | i, 216 | Deep Cr., Ga. | O-139..... | i, 534 |
| Dead Mans Bar. | (HH)..... | i, 1073* | Deep Cr., Iowa. | GG-270..... | i, 1027 |
| Deadmans B., Fla. | P-364..... | i, 572 | (See notes, ii, 2814.) | | |
| Deadmans Bayou, La. | S-239..... | i, 683 | Deep Cr., Kans. | GG-1373..... | i, 1035 |
| Deadmans Isld., Cal.: | | | (See notes, ii, 2823.) | | |
| Harbor lines..... | | ii, 2254 | Deep Cr., Md. | J-292..... | i, 333 |
| Dead R., Fla. | P-45..... | i, 569 | | J-1069..... | i, 339 |
| Bridges..... | | ii, 2161 | | J-1200..... | i, 340 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|---------------------------------------|---------------------|------------------------|
| Deep Cr., Mont. | GG-534..... | i, 1029 | Deer Cr., Nebr. | GG-922..... | i, 1032 |
| (See notes, ii, 2816.) | | | | GG-1129..... | i, 1034 |
| Deep Cr., N. C. | L-284..... | i, 413 | (See notes, ii, 2819.) | | |
| | L-391..... | i, 414 | Deer Cr., N. C. | M-284..... | i, 456 |
| | M-4..... | i, 454, 457 | Deer Cr., Ohio. | DD-472..... | i, 962 |
| | M-132..... | i, 455 | Deer Cr., Pa. | J-801..... | i, 337 |
| | M-253..... | i, 456 | Deer Cr., Wyo. | GG-1062..... | i, 1033 |
| | M-273..... | i, 456 | (See notes, ii, 2820.) | | |
| | N-52..... | i, 499 | Deer Isld. Slough. | (WW-2)..... | i, 1617* |
| Deep Cr., N. Dak. | GG-764..... | i, 1031 | Deer Isld. Slough, Oreg. | WW-24..... | i, 1615 |
| (See notes, ii, 2818.) | | | Deer Isld. Thoroughfare, | | |
| Deep Cr., Pa. | J-608..... | i, 335 | Me. | A-85..... | i, 27. |
| | J-784..... | i, 337 | (See notes, ii, 2783.) | | |
| | J-922..... | i, 338 | Wrecks..... | | ii, 2266 |
| Deep Cr., Va. | K-185..... | i, 374 | Deer Lake. | (HH)..... | i, 107 * |
| | K-208..... | i, 374 | Deer Park. | (HH)..... | i, 1073* |
| | K-263..... | i, 375 | Deer R., Ala. | R-50..... | i, 646 |
| | L-107..... | i, 412 | Deer R., Minn. | KK-88..... | i, 1248 |
| | L-181..... | i, 412 | Deertail R., Wis. | KK-35..... | i, 1247 |
| Deep R. | (WW-2)..... | i, 1617* | Defeated Cr., Ky. | DD-129..... | i, 900 |
| (See notes, ii, 2841.) | | | Defeated Cr., Tenn. | AA-299..... | i, 850 |
| Deep R., Conn. | D-39..... | i, 141 | Defenses: | | |
| Deep R., Mont. | GG-543..... | i, 1029 | Floating defenses, harbors..... | | ii, 1824 |
| (See notes, ii, 2816.) | | | Lake frontiers..... | | ii, 1818 |
| Deep R., N. C. | M-318..... | i, 456 | Operations, in general..... | | ii, 1826 |
| Deep R., N. C., Reeves Pt. | | | Order of completion..... | | ii, 1824 |
| to La Grange. | M-305-d..... | i, 490 | Ports..... | | ii, 1818 |
| Deep R., Wash. | WW-68..... | i, 1615 | Seacoasts, supplies..... | | ii, 1813, 1814 |
| | WW-68-b..... | i, 1652 | Security..... | | ii, 1824 |
| Bridges..... | | ii, 2161 | Surveys..... | | ii, 2279 |
| Deep R., Wash., includ- | | | De Gruys Bayou, La. | S-394..... | i, 684 |
| ing Skamokawa and | | | Delamars Cr., N. C. | M-202..... | i, 455 |
| Crooked Rs. | WW-68-a..... | i, 1652 | Delano Cove, Me. | A-162..... | i, 28 |
| Deep Run. | (CC)..... | i, 909* | De Laroche Cr., Ga. | O-507..... | i, 536 |
| Deep Run, Md. | J-1095..... | i, 339 | Delaware: | | |
| | J-1128..... | i, 339 | Forts..... | | ii, 1816 |
| | J-1149..... | i, 339 | Delaware and Chesapeake | | |
| Deep (The), Va. | L-27..... | i, 411 | Canal, Del. and Md. | | ii, 2041, 2106 |
| Deep Swamp Branch, N. | | | | I-60..... | i, 317 |
| C. | L-336..... | i, 413 | | J-535..... | i, 335 |
| Deepwater Cr., Mo.: | | | Delaware and Raritan | | |
| (See notes, ii, 2824.) | | | Canal, N. J. | G-36-a..... | i, 260 |
| Deep-water H. at Harbor | | | Delaware B., Del. and | | |
| Isld., Aransas Pass, Tex. | U-67-b..... | i, 772 | N. J. | H-2..... | i, 271 |
| Deepwater Slough, Cal. | 1T-29..... | i, 1555 | | H-23-c..... | i, 293 |
| Deep Waterways, U. S. | | | | H-23-c..... | i, 293 |
| Board on: | | | | I-29..... | i, 299 |
| Great Lakes to Atlantic..... | | ii, 2041, 2124 | (See notes, ii, 2794.) | | |
| Deer Cr., Colo. | GG-1091..... | i, 1033 | Bridges..... | | ii, 2155, 2161 |
| (See notes, ii, 2820.) | | | Forts..... | | ii, 1802, 1823 |
| Deer Cr., Fla. | P-22..... | i, 569 | Wrecks..... | | i, 281; ii, 2266, 2267 |
| Deer Cr., Ga. | O-374..... | i, 535 | Delaware B., Del. (harbor | | |
| Deer Cr., Kans. | GG-1391..... | i, 1036 | of refuge). | H-23-d..... | i, 293 |
| (See notes, ii, 2821, 2822, | GG-1396..... | i, 1036 | Delaware B., Del. (ice har- | | |
| 2823.) | | | bor at head of). | H-3-f..... | i, 281 |
| Deer Cr., Md. | J-924..... | i, 338 | Delaware B., Del., Lewes, | | |
| Deer Cr., Miss. | X-23..... | i, 785, 794 | Pier. | H-23-b..... | i, 292 |
| Deer Cr., Mo. | GG-1497..... | i, 1036 | Delaware B. to Chin- | | |
| (See notes, ii, 2824.) | GG-1514..... | i, 1036 | coteague B. (inland | | |
| Deer Cr., Mont.: | | | waterway between). | I-79-a..... | i, 36 |
| (See notes, ii, 2817.) | | | | I-80-a..... | i, 328 |
| | | | Appro..... | | ii, 2290 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------|-------------------------------------|---------------------|-------------------|
| Delaware B. to Rehoboth | | | Des Allemands Bayou, | | |
| B., Del. (Inland water- | | | La | S-374..... | i, 684 |
| way)..... | I-76-a..... | i, 325 | Bridges..... | ..... | ii, 2144, 2161 |
| Delaware Break'r, Del..... | H-23..... | i, 271, 290 | Des Amoreaux Bayou, | | |
| | H-23-a..... | i, 290 | La | S-400..... | i, 684 |
| Appro..... | ..... | ii, 2290 | Des Cannes Bayou, La..... | S-759..... | i, 687 |
| Forts..... | ..... | ii, 1903 | Deschutes R., Wash..... | (WW-2)..... | i, 1617* |
| Wrecks..... | ..... | i, 281; ii, 2267 | Bridges..... | ..... | ii, 2161 |
| Delaware City, Del.: | | | Des Chutes R., Oreg..... | VV-80..... | i, 1593 |
| Forts..... | ..... | ii, 1903 | Des Chutes R., Wash..... | XX-63..... | i, 1655 |
| Delaware Cr., Tex.: | | | Des Familles Bayou, La..... | S-362..... | i, 684 |
| (See notes, ii, 2805.) | | | Des Glaises Bayou, La..... | S-573..... | i, 686, 703 |
| Delaware, Fort, Del..... | ..... | ii, 1802, 1903 | (HH)..... | ..... | i, 1071* |
| Delaware R., N. Y., Pa., | | | (See notes, ii, 2804.) | | |
| N. J., and Del..... | H-3..... | i, 271 | Bridges..... | ..... | ii, 2161 |
| (See notes, ii, 2794.) | | | Des Illettes, Bay, La.: | | |
| Appro..... | ..... | ii, 2290 | (See notes, ii, 2804.) | | |
| Bridges..... | ..... | ii, 2161 | Des Moines..... | (HH)..... | i, 1073* |
| Forts..... | ..... | ii, 1796, 1903 | (See notes, ii, 2827.) | | |
| Harbor lines..... | ..... | ii, 2254 | Des Moines Rapids..... | (HH)..... | i, 1073* |
| Navigation rules..... | ..... | ii, 2041, 2107 | (See notes, ii, 2833.) | | |
| Wrecks..... | ..... | ii, 2264, 2267 | Des Moines Rapids Ca- | | |
| Delaware to Chesapeake | | | nal, Ill.: | | |
| (Bays) (ship canal sur- | | | Bridges..... | ..... | ii, 2161 |
| veys)..... | J-535-a..... | i, 361 | Navigation rules..... | ..... | ii, 2041, 2107 |
| Delaware to Sharptown | | | Des Moines R..... | (HH)..... | i, 1073* |
| Canal, N. J..... | I-43-a..... | i, 309 | Des Moines R., Iowa, Wis. | JJ-68..... | i, 1234 |
| Delaware Run, Pa..... | J-719..... | i, 336 | Des Moines R., Iowa..... | JJ-68..... | i, 1243 |
| Delcambre Canal, La..... | S-713..... | i, 687 | JJ-68-b..... | ..... | i, 1243 |
| Delegal Cr., Ga..... | O-109..... | i, 534 | Appro..... | ..... | ii, 2297 |
| De la Platta R., P. R..... | YY-27..... | i, 1685 | De Soto..... | (HH)..... | i, 1073* |
| Delph Cr., Md..... | J-944..... | i, 338 | De Soto Bayou, Fla..... | P-311..... | i, 571 |
| Delphi, Ind..... | BB-23..... | i, 598 | Des Ourse Bayou, La..... | S-544..... | i, 686 |
| De Large Bayou, La..... | S-471..... | i, 685 | Bridges..... | ..... | ii, 2161 |
| Delta Pt..... | (HH)..... | i, 1073* | Des Peres..... | (HH)..... | i, 1073* |
| Delta R., Alaska..... | XX-200..... | i, 1656 | Des Plaines R..... | (HH)..... | i, 1073* |
| Delta (The)..... | (HH)..... | i, 1073* | Des Plaines R., Ill..... | JJ-9..... | i, 1234 |
| (See notes, ii, 2831.) | | | NN-1-c..... | ..... | i, 1353 |
| De Mar Bayou, La..... | S-433..... | i, 684 | NN-7..... | ..... | i, 1349 |
| Demassville..... | (WW-2)..... | i, 1617* | Des Saules Bayou, La..... | S-372..... | i, 684 |
| Demerits Cr., Ga..... | O-173..... | i, 534 | Detour Passage, Mich..... | PP-22..... | i, 1419 |
| Demopolis, Ala. (See Tom- | | | Detroit H., Wis..... | MM-23-a..... | i, 1317 |
| bigbee R.) | | | Detroit, Mich.: | | |
| Denmark Isld..... | (HH)..... | i, 1073* | Bridges..... | ..... | ii, 2162 |
| Dennis Cr., Md..... | J-115..... | i, 332 | Forts..... | ..... | ii, 1796, 1992 |
| Dennis Cr., N. J..... | I-31..... | i, 299, 305 | Harbor lines..... | ..... | ii, 2254 |
| Appro..... | ..... | ii, 2290 | Great Lakes survey..... | ..... | ii, 2041, 2123 |
| Wrecks..... | ..... | ii, 2267, 2277 | Detroit, Mich., and Ft. | | |
| Dennys R., Dennyville, | | | Leavenworth, Kans.: | | |
| Me..... | A-7..... | i, 27 | Longitude..... | ..... | ii, 2041, 2122 |
| Densfords Crossing..... | (HH)..... | i, 1073* | Detroit, Mich., District.... | PP(with map)..... | i, 1417 |
| Dent Run, Pa..... | J-789..... | i, 337 | (See notes, ii, 2838.) | | 1419 |
| Dennyville, Me..... | A-7..... | i, 27 | Appropriations..... | ..... | ii, 2299 |
| Denver, Colo.: | | | Detroit R., Mich..... | PP-105..... | i, 1420, 1452 |
| Surveys, latitude and longitude.... | ..... | ii, 2041, 2122 | PP-109..... | ..... | i, 1420 |
| Departments: | | | PP-105-a..... | ..... | i, 1452 |
| Work in the field..... | ..... | ii, 2040, 2086 | (See notes, ii, 2838.) | | |
| Depere H., Wis..... | MM-15-c..... | i, 1315 | Appro..... | ..... | ii, 2287, 2299 |
| Depots, Engineer..... | ..... | ii, 2039, 2045, 2046 | Bridges..... | ..... | ii, 2162 |
| (See Estimates.) | | | Great Lakes, regulation..... | ..... | ii, 2041, 2124 |
| Depot Slough, Oreg..... | VV-50..... | i, 1593 | Navigation rules..... | ..... | ii, 2041, 2107 |
| Derrick Boats, llt..... | ..... | ii, 2341 | Wrecks..... | ..... | ii, 2267 |
| Des Acadens Bayou, La..... | S-118..... | i, 682 | | | |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | District and No. | Vol. and page. |
|-------------------------------------|------------------|----------------|---|--|
| Devleu Bayou, Ark..... | Y-26..... | i, 818 | Dismal Swamp Canal, N. C. and Va..... | L-271.....i, 413 L-173-p.....i, 439 L-182.....i, 412 L-173-n.....i, 438 |
| Devil or Rattlesnake Cr., Mont..... | GG-601..... | i, 1029 | (See notes, ii, 2796.) | |
| Devil R., Mich..... | PP-51..... | i, 1419 | Dismal Swamp Canal, Va. (waterway connecting with sounds of N. C.)..... | L-173-o.....i, 438 |
| Devils B., La..... | S-427..... | i, 684 | District of Columbia: | |
| Devils Bend..... | (WW-2)..... | i, 1617* | Bridges..... | ii, 2039, 2060, 2062, 2063, 2064, 2065 |
| Devils Bend Rapids (WW): | | | Buildings..... | ii, 2039, 2040, 2065, 2066, 2067, 2072 |
| (See notes, ii, 2843.) | | | Fishways..... | ii, 2040, 2071 |
| Devils Cr., La..... | S-812..... | i, 688 | Fortes..... | ii, 1802, 1816 |
| Devils Fork, W. Va..... | EE-29..... | i, 983 | Harbor lines..... | ii, 2254, 2255 |
| Devils Gut, N. C..... | L-395..... | i, 414 | Lots..... | ii, 2039, 2069 |
| Devils Isld..... | (HH)..... | i, 1073* | Memorials..... | ii, 2040, 2069 |
| Devils Lake, N. Dak..... | KK-186-a..... | i, 1259 | Monuments..... | ii, 2040, 2070 |
| Devils R., Tex..... | U-75..... | i, 735 | Parks..... | ii, 2040, 2070, 2071 |
| Devil Track R., Minn..... | LL-8..... | i, 1265 | Reservations..... | ii, 2040, 2075 |
| Dewatto R., Wash..... | XX-61..... | i, 1655 | Reservoirs..... | ii, 2040, 2084, 2085 |
| Deweese Cr., Wyo..... | GG-1017..... | i, 1033 | Roads..... | ii, 2040, 2075, 2076 |
| (See notes, ii, 2820.) | | | Statutes..... | ii, 2040, 2076 |
| De West Bayou, La..... | S-474..... | i, 685 | Telegraphs and telephones..... | ii, 2040, 2077 |
| De Witt..... | (GG-2)..... | i, 1038* | Water supply..... | ii, 2040, 2077, 2080, 2081, 2082, 2083, 2084, 2085 |
| Dexter H., N. Y..... | RR-59-b..... | i, 1533 | Wharves..... | ii, 2040, 2086 |
| Diamond Bluff..... | (HH)..... | i, 1073* | Districts, Engineering or Waterway: | |
| Diamond Crossing..... | (WW-2)..... | i, 1617* | (See i, 19, and frontis-piece map.) | |
| Diamond Fork, Ga..... | O-45..... | i, 533 | Appro., summary of..... | ii, 2279, 2287, 2302 |
| Diamond H., Hawaii..... | YY-44..... | i, 1685 | Dredging or floating plant..... | ii, 2337 |
| Diamond Isld..... | (HH)..... | i, 1073* | Limits, notes..... | i, 11; ii, 2782 |
| Diamond Reef, N. Y..... | E-17..... | i, 184 | Proofs of this Index, review..... | ii, 2779 |
| Dascond Cr., Va..... | L-126..... | i, 412 | Ditch Cr., N. C..... | M-129.....i, 455 |
| Dick Branch, Ga..... | O-484..... | i, 536 | Ditchers Cove, Md..... | J-424.....i, 334 |
| Dick Branch, Md..... | J-991..... | i, 338 | Divide Cr., Iowa..... | GG-249.....i, 1027 |
| Dickkeys Isld..... | (HH)..... | i, 1073* | Dividing Cr., Md..... | J-33.....i, 331 J-390.....i, 334 J-1196.....i, 340 J-316.....i, 352 |
| Dickkeys Isld. to Ohio R. (HH): | | | Dividing Cr., N. J..... | I-34.....i, 299, 306 |
| (See notes, ii, 2827.) | | | Bridges..... | ii, 2162 |
| Dickinson B., Md..... | J-313..... | i, 333 | Wrecks..... | ii, 2267 |
| Dickinson Bayou, Tex..... | U-28..... | i, 735, 746 | Dividing Cr., Va..... | K-146.....i, 374 |
| Appro..... | ii, 2295 | | Division Cr., N. J..... | G-8.....i, 247 |
| Bridges..... | ii, 2162 | | Divisions, Engineer: | |
| Dickinsons Cr., Ga..... | O-177..... | i, 534 | See ii, 2046, and frontis-piece map, and ii, 2039. | |
| Dicks Br., Mo.: | | | See Districts, above. | |
| (See notes, ii, 2814.) | | | Dix Cr., Ky..... | DD-10.....i, 959 |
| Dicks Cr., Mo..... | GG-217..... | i, 1026 | Dixon Branch, La..... | S-94.....i, 682 |
| Dicky R., Wash..... | XX-36..... | i, 1655 | Dixon Cr., Md..... | J-328.....i, 333 |
| Dielasac B., P. I..... | YY-90..... | i, 1686 | Dixon Cr., Tenn..... | AA-300.....i, 850 |
| Difficult Cr., Va..... | L-377..... | i, 414 | Dixon Quarry..... | (HH).....i, 1073* |
| Diggins Cr., N. C..... | L-394..... | i, 414 | Dixons Cr., N. C..... | M-119.....i, 455 |
| Digollorin B., P. I..... | YY-89..... | i, 1686 | Doboy Bar, Ga..... | O-229-b.....i, 550 |
| Dillard Cr., N. C..... | L-300..... | i, 413 | O-229-c.....i, 551 | |
| Dillon Cr., Mo..... | GG-235..... | i, 1027 | Doboy Sound, Ga..... | O-210.....i, 534 |
| (See notes, ii, 2814.) | | | Doboy to Sapelo, Ga. (inside route)..... | O-210-a.....i, 549 |
| D'Inde Bayou, La..... | S-856..... | i, 688 | | |
| Dingalan B., P. I..... | YY-92..... | i, 1686 | | |
| Dingus Run, W. Va..... | EE-45..... | i, 983 | | |
| Dippingpond Run, Md..... | J-1096..... | i, 339 | | |
| Dips Cr., N. C..... | M-50..... | i, 454 | | |
| Disappointment Slough, Cal..... | UU-42..... | i, 1577 | | |
| Discharge, Great Lakes..... | ii, 2041, 2132 | | | |
| Dismal Cr., Va..... | DD-277..... | i, 961 | | |
| Dismal R., Nebr.: | | | | |
| (See notes, ii, 2820.) | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Docewallips R., Wash. | XX-49..... | i, 1655 | Doodletown Bight or Cr., N. Y.: | | |
| Dock Cr., Mass. | B-179..... | i, 70 | Bridges..... | | ii, 2162 |
| Dockery Cr., Va. | L-386..... | i, 414 | Doolans Slough. (HH)..... | | i, 1073* |
| Doctors Bayou, La. | S-662..... | i, 686 | Dorcheat Bayou, La. | X-48..... | i, 813 |
| Doctors Cr., N. J. | H-7..... | i, 271 | Dorchester B., Mass. | B-132..... | i, 70, 92 |
| Doctors Lake, Fla. | P-29..... | i, 569 | (See notes, ii, 275.) | | |
| Doctors Pass, Fla. | P-219..... | i, 570 | Appro..... | | ii, 2288 |
| Documents, Congressional. | | | Wrecks..... | | ii, 2267 |
| (Reference in this Index.....) | | ii, 2782.) | Dorchester Pt., Mass.: | | |
| Dodds Isld. (GG-2)..... | | i, 1038* | Harbor lines..... | | ii, 2254 |
| Dodge City, Kans. | Y-2-c..... | i, 820 | Dorsey Cr., Md. | J-1236..... | i, 340 |
| Doe Cr., Tenn. | AA-29..... | i, 848 | Double Bayou. (HH)..... | | i, 1073* |
| | AA-267..... | i, 850 | Double Bayou, La. | S-126..... | i, 682 |
| Doe Lake, Ga. | O-474..... | i, 536 | | S-241..... | i, 683 |
| Doe Run, Pa. | J-858..... | i, 337 | Double Bayou, Tex. | U-9..... | i, 735, 738 |
| Doe R., Tenn. | AA-134..... | i, 849 | Appro..... | | ii, 2295 |
| Dog and Fowl Rs., Ala.: | | | Double Br. Branch, Md. | J-18..... | i, 331 |
| Bridges..... | | ii, 2162 | Double Cr., N. J. | I-8..... | i, 299, 301 |
| Dog Cr., Kans. | GG-1385..... | i, 1035 | Appro..... | | ii, 2290 |
| (See notes, ii, 2822.) | GG-1397..... | i, 1036 | Dough Cr., N. C. | M-21..... | i, 454 |
| Dog Cr., Mo. | GG-1501..... | i, 1036 | Dougherty Branch, Mo. | GG-194..... | i, 1026 |
| (See notes, ii, 2824.) | | | Dougherty Slough, Oreg. | VV-65..... | i, 1593 |
| Dog Cr., Mont. | GG-506..... | i, 1029 | Doughty Fork, Ohio. | DD-398..... | i, 962 |
| (See notes, ii, 2816.) | GG-566..... | i, 1029 | Douglas Cr., Colo. | GG-1100..... | i, 1033 |
| Dog Ear Cr., S. Dak. | GG-898..... | i, 1032 | (See notes, ii, 2820.) | | |
| (See notes, ii, 2819.) | | | Douglas Cr., N. Dak. | GG-401..... | i, 1028 |
| Dog Isld., Ala.: | | | (See notes, ii, 2815.) | | |
| Bridges..... | | ii, 2162 | Douglas Cr., Wyo. | GG-1046..... | i, 1033 |
| Dog Isld., Fla.: | | | Doullut Canal, La. | S-328..... | i, 683 |
| Harbor lines..... | | ii, 2254 | Doulluts Canal, La. | S-302..... | i, 683 |
| Dog Isld. H., Fla. | Q-16..... | i, 611, 613 | Dover Cr., Ga. | O-463..... | i, 536 |
| Dog Keys Pass, Miss. | R-85..... | i, 646 | Dover, Tenn. | AA-239..... | i, 878 |
| Dog R. (above mouth of), | | | Doves Cr., Md. | J-973..... | i, 338 |
| Pascagoula R., Miss. | R-63-d..... | i, 667 | Dovetail Cr., Mont. | GG-571..... | i, 1029 |
| Dog R., Ala. | R-49..... | i, 646 | (See notes, ii, 2816.) | | |
| Dog R., Ala. and Miss. | R-65..... | i, 646 | Downer Cr., Kans. | GG-1331..... | i, 1035 |
| Dog R., Miss.: | | | (See notes, ii, 2822.) | | |
| Bridges..... | | ii, 2162 | Downings Pt. (GG-2)..... | | i, 1038* |
| Dogtooth. (HH)..... | | i, 1073* | Dowaglac R., Mich. | OO-11..... | i, 1377 |
| Dogtooth Cr., N. Dak. | GG-780..... | i, 1031 | Doxies Cr., Mo. | GG-120..... | i, 1026 |
| (See notes, ii, 2818.) | | | (See notes, ii, 2813.) | | |
| Dogue Cr., Va. | K-94..... | i, 373 | Doyles Bayou, La. | S-98..... | i, 682 |
| | K-201..... | i, 374 | Drainage: | | |
| Dogwood Branch, Md. | J-541..... | i, 335 | Great Lakes..... | | ii, 2041, 2132 |
| Dogwood Run, Md. | J-1114..... | i, 339 | Drainage Canal, Chicago, | | |
| D'Olives B., Ala. | R-10..... | i, 646 | Ill..... | | ii, 2041, 2106 |
| Dollar Bayou, La. | S-655..... | i, 686 | Drainage Canal, La. | S-484..... | i, 685 |
| Dollibers Cove, Mass. | B-106..... | i, 70 | Drakes B., Cal. | TT-132..... | i, 1556, 1568 |
| Dolphins | | ii, 2041, 2109 | Drakes Cr., La. | S-825..... | i, 688 |
| Domingos Cr., Cal. | TT-169..... | i, 1556 | Drakes Fork, Ohio. | DD-426..... | i, 962 |
| Dona B., Fla. | P-273..... | i, 571 | Draughans Bayou, La. | S-88..... | i, 682 |
| Donaldsonville. (HH)..... | | i, 1073* | Drawbridges | | ii, 2041, 2105 |
| Donaldsonville, La., to the Rio Grande, Tex. (In- land waterway), via Ver- million B., La., etc. | S-696-a..... | i, 709 | Dredges | | ii, 2337 |
| | S-696-b..... | i, 709 | Appro..... | | ii, 2279 |
| | U-38-g..... | i, 759 | Dredges, Bucket; list. | | ii, 2340 |
| Appro..... | | ii, 2294 | Dredges, Dipper; list. | | ii, 2339 |
| Donegal Cr., Pa. | J-580..... | i, 335 | Dredges, Hydraulic Pipe Line; list. | | ii, 2338 |
| Donigan Branch, Ky. | DD-60..... | i, 959 | Dredges, Seagolng Hop- per; list. | | ii, 2337 |
| Doodletown Bight, N. Y. | E-68..... | i, 177 | Drennon Cr., Ky. | DD-5..... | i, 959 |
| | | | Dresbach. (HH)..... | | i, 1073* |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Dresser Canal, La. | S-425..... | i, 684 | Duckabush R., Wash. | XX-50..... | i, 1655 |
| (See notes, ii, 2804.) | S-430..... | i, 684 | Duck Cr. | (HH)..... | i, 1073* |
| Drews Prairie. | (HH)..... | i, 1073* | Duck Cr., Del. | I-65..... | i, 296 |
| Driftwood Branch, Pa. | J-782..... | i, 337 | ..... | I-63..... | i, 318 |
| Drill Boats, Hst...... | ..... | ii, 2344 | Duck Cr., Kans. | GG-1227..... | i, 1034 |
| Driscoll Slough, Oreg. | WW-16..... | i, 1615 | (See notes, ii, 2821.) | | |
| Driscolls Slough. | (WW-2)..... | i, 1617* | Duck Cr., Mass. | B-204..... | i, 70 |
| Drowning Cr., Ky. | DD-19..... | i, 959 | Duck Cr., Mont. | GG-535..... | i, 1029 |
| Drum B., La. | S-167..... | i, 682 | (See notes, ii, 2816.) | | |
| Drum B., Va. | J-4..... | i, 331 | Duck Cr., N. J. | H-9..... | i, 271 |
| Drum Cr., N. C. | M-128..... | i, 455 | Duck Cr., N. C. | M-72..... | i, 454 |
| Drum Inlet, N. C. | M-226-a..... | i, 471 | ..... | M-169..... | i, 455 |
| Drummonds Cr. | P-18..... | i, 569 | Duck Cr., Ohio. | DD-340..... | i, 961 |
| Drummore B., Me. | A-237..... | i, 29 | Duck Cr., S. C. | N-105..... | i, 499 |
| (See notes, ii, 2783.) | | | Duck Cr., Wis.: | | |
| Drum Pt. Cove, Md. | J-67..... | i, 331 | Bridges..... | ..... | ii, 2162 |
| Drum Pt. Cr., Va. | L-175..... | i, 412 | Duck H., Mass. | B-206..... | i, 70 |
| Drury Run, Pa. | J-769..... | i, 336 | Duck Isld. H., Conn. | D-41..... | i, 141, 153 |
| Drurys Landing. | (HH)..... | i, 1073* | (See notes, ii, 2790.) | | |
| Dry Auglaise Cr., Mo.: | | | Appro..... | ..... | ii, 2289 |
| (See notes, ii, 2824.) | | | Duck Pt. Cove, Md. | J-204..... | i, 332 |
| Dry Cr., Ala. | AA-49..... | i, 848 | Duck R., Conn. | D-27..... | i, 141 |
| Dry Cr., Colo. | GG-1088..... | i, 1033 | Bridges..... | ..... | ii, 2162 |
| (See notes, ii, 2820.) | | | Duck R., Tenn. | AA-227..... | i, 850, 877 |
| Dry Cr., Ga. | O-130..... | i, 534 | ..... | AA-18..... | i, 855 |
| ..... | O-135..... | i, 534 | Appro..... | ..... | ii, 2296 |
| ..... | O-150..... | i, 534 | Bridges..... | ..... | ii, 2162 |
| Dry Cr., Iowa. | GG-279..... | i, 1027 | Duck Slough, Cal. | TT-95..... | i, 1555 |
| Dry Cr., Kans. | GG-1282..... | i, 1035 | Duck Trap H., Me. | A-140..... | i, 28, 42 |
| ..... | GG-1286..... | i, 1035 | ..... | A-141..... | i, 42 |
| Dry Cr., La. | S-280..... | i, 683 | Duffs Bar. | (CC)..... | i, 909* |
| ..... | S-831..... | i, 688 | Duffy Cr., Md. | J-519..... | i, 335 |
| Dry Cr., Ohio. | DD-418..... | i, 962 | Dugdemona Bayou, La. .. | X-44..... | i, 812 |
| Dry Cr., S. Dak. | GG-341..... | i, 1027 | Dugdemona R., La. | X-44..... | i, 785, 812 |
| (See notes, ii, 2815, 2819.) | GG-874..... | i, 1032 | Duherts Cr., Ga. | O-133..... | i, 534 |
| Dry Cr., S. Dak., North | | | Duhuy Bayou, La. | S-187..... | i, 682 |
| and South Branches... | GG-342..... | i, 1027 | Dukeharts Cr., Md. | K-64..... | i, 873 |
| ..... | GG-343..... | i, 1027 | Dulac Bayou, La. | S-468..... | i, 685 |
| Dry Cr., Wash. | XX-60..... | i, 1655 | Dulaney Valley Branch, | | |
| Dry Cr., W. Va. | EE-111..... | i, 984 | Md. | J-999..... | i, 338 |
| Dry Fork, Ky. | DD-138..... | i, 960 | Duluth Canal, Minn.: | | |
| Dry Fork, Mo. | GG-15..... | i, 1025 | Bridges..... | ..... | ii, 2162 |
| ..... | GG-182..... | i, 1026 | Duluth H., Minn. | LL-18-b..... | i, 1272 |
| Dry Fork of Loutre R., | | | Bridges..... | ..... | ii, 2163 |
| Mo. | GG-44..... | i, 1025 | Compass variations..... | ..... | ii, 2041, 2121 |
| Dry Fork, Loutre, Mo.: | | | Harbor lines..... | ..... | ii, 2254-2255 |
| (See notes, ii, 2813.) | | | Wrecks..... | ..... | ii, 2267 |
| Dry Fork, W. Va. and Va. | DD-305..... | i, 961 | Duluth, Minn., Distriet... | LL(with map)..... | i, 1263, 1265 |
| Dry Fork, Wyo.: | | | (See notes, ii, 2835.) | | |
| (See notes, ii, 2819.) | | | Appro..... | ..... | ii, 2298 |
| Dry Run, S. Dak. | GG-312..... | i, 1027 | Duluth-Superior R., | | |
| Dry Straits, Alaska. | XX-122-a..... | i, 1679 | Min. and Wis. | LL-18..... | i, 1265, 1271 |
| Dry Tortugas, Fla.: |  |  | ..... | LL-18-g..... | i, 1276 |
| Forts..... | ..... | ii, 1955 | (See notes, ii, 2835, 2836.) | | |
| Dry Wood Cr., Mo. and | | | Appro..... | ..... | ii, 2298 |
| Kans. | GG-1492..... | i, 1036 | Bridges..... | ..... | ii, 2163 |
| (See notes, ii, 2824.) | | | Harbor lines..... | ..... | ii, 2255 |
| Dubignons Cr., Ga. | O-448..... | i, 536 | Navigation rules..... | ..... | ii, 2041, 2107 |
| Du Bols Cr., Mo. | GG-1548..... | i, 1037 | Dumaguete, P. I. | YY-129..... | i, 1686 |
| (See notes, ii, 2824.) | | | Dumangillas B., P. I. | YY-166..... | i, 1686 |
| Dubuque. | (HH)..... | i, 1073* | Dumanjug, P. I. | YY-125..... | i, 1686 |
| (See notes, ii, 2827.) | | | Dumbolne. | (HH)..... | i, 1073* |
| | | | Dumfoundling B., Fla. ... | P-161..... | i, 570 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|--------------------------------|---------------------|---------------------|
| Dumplings Battery, R. I.: | | | Dupont, Ft., N. J. | | ii, 1903 |
| Forts..... | | ii, 1866 | Dupre Bayou, La. | S-148..... | i, 682 |
| Dunbars Cr., Ga. | O-430..... | i, 536 | Dupuyer Cr., Mont. | GG-487..... | i, 1028 |
| Dunbars Cut, Ga. | O-404..... | i, 536 | Durbin Cr., Md. | J-490..... | i, 334 |
| Duncan Cr., Mo. | (GG-1518)..... | i, 1037* | Durell Cr., Pa. | J-689..... | i, 336 |
| Duncan Cr., N. C. | M-210..... | i, 455 | Durhams Cr., N. C. | M-99..... | i, 455, 464 |
| Duncan Cr., Wis. | KK-41..... | i, 1247 | Bridges..... | | ii, 2163 |
| Duncan, Fort, Tex. | | ii, 1808 | Durhams Estuary, N. C. | N-99..... | i, 464 |
| Duncan Rock, Strait of | | | Dutch Bayou, La. | S-120..... | i, 682 |
| Juan de Fuca, Wash. | XX-39-a..... | i, 1663 | Dutch Isld., E. I.: | | |
| Duncan Slough, Oreg. | VV-39..... | i, 1593 | Forts..... | | ii, 1807, 1866 |
| Duncans Run, Ohio | DD-434..... | i, 962 | Wrecks..... | | ii, 2267 |
| Dun Cove, Md. | J-352..... | i, 333 | Dutch Kills Cr., N. Y.: | | |
| Dundee. | (GG-2)..... | i, 1038* | Bridges..... | | ii, 2163 |
| Dundee Cr., Md. | J-1053..... | i, 339 | Harbor lines..... | | ii, 2255 |
| Dung Cr., Md. | J-111..... | i, 332 | Dutch Kills, N. Y. | F-113..... | i, 216 |
| Dungeness R., Wash. | XX-45..... | i, 1655 | Dutchman Cr., S. C. | N-133..... | i, 500 |
| Dunkard Cr., Pa. and W. | | | Dutchman Isld. | (HH)..... | i, 1073* |
| Va. | FF-8..... | i, 1003 | Dutchmans Cr., N. C. | M-326..... | i, 456 |
| Dunkirk H., N. Y. | RR-9..... | i, 1493, 1498 | Dutch Slough, Cal. | UU-7..... | i, 1577 |
| Appro. | | ii, 2299 | Duvall Cr., Md. | J-1245..... | i, 340 |
| Dunlap Cr., Ohio | DD-362..... | i, 962 | Duvals Cr., Md. | J-1209..... | i, 340 |
| Dunlap Cr., Mont.: | | | Duwamish Head, Wash.: | | |
| (See notes, ii, 2817.) | | | Harbor lines..... | | ii, 2255 |
| Dunlaps Cr., Mo. | GG-64..... | i, 1025 | Duwamish R., Wash. | XX-73..... | i, 1655, 1671 |
| Dunleith. | (HH)..... | i, 1073* | Bridges..... | | ii, 2163, 2165-2166 |
| Dunloup Cr., W. Va. | EE-79..... | i, 983 | Wrecks..... | | ii, 2267 |
| Dunn Barr Bayou, La. | S-314..... | i, 683 | Duxbury B., Mass. | B-161..... | i, 70 |
| Dunning Cr., Pa. | J-877..... | i, 337 | Duxbury Beach, Mass.: | | |
| Dunnock Slough, Md. | J-224..... | i, 332 | Appro. | | ii, 2288 |
| Dunns Cr., Fla. | P-16..... | i, 569 | Duxbury Beach and H., | | |
| Bridges | P-71..... | i, 569 | Mass. | B-160..... | i, 70, 96 |
| ..... |  | ii, 2163 | Dyer Cr., Va. | K-261..... | i, 375 |
| Dunn Spring Cr., Mo. | GG-1549..... | i, 1037 | Dyers B., Me. | A-32..... | i, 27 |
| (See notes, ii, 2824.) | | | Dyers Branch, Mo. | GG-59..... | i, 1025 |
| Du Page R., Ill. | JJ-10..... | i, 1234 | Dyers H., Me. | A-34..... | i, 27 |
| | NN-8..... | i, 1349 | Dyes Cr., Ga. | O-252..... | i, 535 |
| Dupline Cr., Ga. | O-213..... | i, 534 | Dymers Cr., Va. | K-158..... | i, 374, 398 |
| Dupont Bayou, La. | S-143..... | i, 682 | Appro. | | ii, 2291 |
| | S-348..... | i, 684 | | | |

E.

| | | | | | |
|-----------------------------------|-------------|----------------|---------------------------------|-------------|----------|
| Eads projects: | | | Eagle H., Wash.: | | |
| Appro. | | ii, 2279, 2282 | Harbor lines..... | | ii, 2255 |
| Eagle Cr., Ky. | DD-192..... | i, 960 | Eagle H., Wis.: | | |
| Eagle Cr., Nebr. | GG-931..... | i, 1032 | Wrecks..... | | ii, 2267 |
| Eagle Cr., Ohio. | DD-486..... | i, 963 | Eagle Nest Cr., S. Dak.: | | |
| Eagle Cr., Mont. | GG-473..... | i, 1028 | (See notes, ii, 2819.) | | |
| (See notes, ii, 2816.) | | | Eagles Nest Cr., S. Dak. | GG-890..... | i, 1032 |
| Eagle Cr., Nebr.: | | | Eagle Pt. | (HH)..... | i, 1073* |
| (See notes, ii, 2819.) | | | Eagle R., Wis. | KK-22..... | i, 1247 |
| Eagle Cr., Tenn. | AA-26..... | i, 848 | Eajardo R., P. R. | YY-5..... | i, 1685 |
| Eagle Cr., Wash. | XX-53..... | i, 1655 | Earle Cove, Md. | J-427..... | i, 334 |
| Eagle Feather Cr., S. Dak. | GG-791..... | i, 1031 | ..... | J-438..... | i, 334 |
| (See notes, ii, 2818.) | | | Earle Cr., Md. | J-437..... | i, 334 |
| Eagle H., Mich. | LL-36..... | i, 1265 | Easer Branch, Md. | K-55..... | i, 373 |
| ..... | LL-36..... | i, 1286 | East B. | (HH)..... | i, 1073* |
| Appro. | | ii, 2298 | East B. Bayou, Tex. | U-8..... | i, 735 |
| | | | Appro. | | ii, 2295 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| East B. Bayou, Tex., in- cluding channel across Hannas Reef. | U-8 | i, 737 | Eastern Division, Engi- neer Department. | ii, 2039, 2046 | |
| East B., Fla. | Q-39 | i, 611 | Eastern R., Me. | A-224 | i, 28 |
| East B., Fla. and Ala. | Q-41 | i, 630 | East Fork, Alaska. | XX-217 | i, 1656 |
| Appro. | | ii, 2293 | East Fork, Canadian R., Colo. | GG-1042 | i, 1033 |
| East B., La. | S-231 | i, 683 | (See notes, ii, 2820.) | | |
| | S-659 | i, 686 | East Fork, Iowa and Mo. | GG-140 | i, 1026 |
| East Boothbay H., Me. | A-194 | i, 28, 47 | East Fork, La. | S-78 | i, 681 |
| East Boston Chan., Mass. | B-117 | i, 70, 89 | East Fork, Md. | J-465 | i, 334 |
| (See notes, ii, 2785.) | | | East Fork, Miss., Tom- bigbee R. | R-34 | i, 646 |
| East Bottoms. | (GG-2) | i, 1038* | East Fork, Mo. | GG-121 | i, 1026 |
| East Branch, Md. | J-967 | i, 338 | | GG-164 | i, 1026 |
| | J-1130 | i, 339 | | GG-170 | i, 1026 |
| East Br., Kans.: | | | | GG-181 | i, 1026 |
| (See notes, ii, 2823.) | | | (See notes, ii, 2813, 2814.) | | |
| East Branch, Mont. | GG-417 | i, 1028 | East Fork, Mo. and Iowa: | | |
| | GG-615 | i, 1029 | (See notes, ii, 2813, 2814.) | | |
| (See notes, ii, 2817.) | | | East Fork, Mont. | GG-413 | i, 1028 |
| East Br., Mont. and Can- ada: | | | | GG-677 | i, 1030 |
| (See notes, ii, 2815.) | | | | GG-708 | i, 1030 |
| East Branch, N. Dak. | GG-394 | i, 1028 | | GG-741 | i, 1030 |
| (See notes, ii, 2815.) | | | (See notes, ii, 2815, 2817, 2818.) | | |
| East Branch, Olentangy R., Ohio. | DD-459 | i, 962 | East Fork, Mont. and Wyo.: | | |
| East Branch, Pa. | J-560 | i, 335 | (See notes, ii, 2816.) | | |
| | J-632 | i, 335 | East Fork, Ohio. | DD-348 | i, 961 |
| | J-642 | i, 335 | | DD-475 | i, 962 |
| | J-708 | i, 336 | East Fork, Pa. | J-777 | i, 336 |
| | J-916 | i, 338 | East Fork, S. Dak. | GG-296 | i, 1027 |
| East Branch, Stamford H., Conn. | D-93 | i, 141 | (See notes, ii, 2814.) | | |
| East Chester B., N. Y.: | | | East Fork, Twelve Pole Cr., W. Va. | EE-6 | i, 983 |
| Bridges. | | ii, 2164 | East Gallatin R., Mont.: | | |
| Wrecks. | | ii, 2287 | (See notes, ii, 2816.) | | |
| East Chester Cr., N. Y. | E-15 | i, 177, 182 | East Galveston B., Tex. | U-6 | i, 735 |
| Appro. | | ii, 2289 | East Galveston B. to Port Arthur, Tex. (Inland waterway). | U-7 | i, 735 |
| Harbor lines. | | ii, 2255 | Easthams Cr., N. C. | M-118 | i, 455 |
| East Cote Blanche R., La. | S-674 | i, 687 | East Haven R., Conn. | D-55 | i, 141, 156 |
| East Cr., N. J.: | | | Bridges. | | ii, 2164 |
| Wrecks. | | ii, 2277 | East Hog Branch, La. | S-60 | i, 681 |
| East Cr., Vt. | E-104 | i, 178 | East Hoquiam R., Wash. | XX-21 | i, 1655 |
| | E-106 | i, 178 | East Lake, N. C. | M-16 | i, 454 |
| East Dennis, Mass. | B-194 | i, 70, 100 | Eastlake Slough, Cal. | TT-173 | i, 1556 |
| Appro. | | ii, 2288 | East Liverpool, Ohio: | | |
| East, Department of the: | | | Harbor lines. | | ii, 2255 |
| Work in the field. | | ii, 2040, 2086 | East Lynne Cr., Va. | L-365 | i, 414 |
| East Dubuque. | (HH) | i, 1073* | East Machias R., Me. | A-15 | i, 27 |
| East Elm Cr., S. Dak. | GG-829 | i, 1031 | (See notes, ii, 2783.) | | |
| (See notes, ii, 2818.) | | | Bridges. | | ii, 2164 |
| Eastern B., Md. | J-359 | i, 333 | East Mission Cr., Kans.: | | |
| Eastern Branch, Potomac R., D. C. (see Potomac R.) | K-46-c | i, 378 | (See notes, ii, 2821.) | | |
| Eastern Branch, Lynn- haven R., Va. | L-211 | i, 412 | East Missouri Cr., Kans. | GG-1183 | i, 1034 |
| Eastern Branch, Me. | A-168 | i, 28 | Eastmost R., N. C. | L-351 | i, 414 |
| Eastern Branch, Va. | K-175 | i, 374 | East Neebish Chan., Mich. | PP-15 | i, 1419 |
| | K-179 | i, 374 | East Nishnabotna R., Iowa. | GG-246 | i, 1027 |
| | L-193 | i, 412 | (See notes, ii, 2814.) | | |
| Eastern Chan., Me. | A-102 | i, 28 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|----------------------------------|---------------------|----------------------|
| East Nodaway R., Iowa... | GG-237 | i, 1027 | Eau Claire R., Wis. | KK-9 | i, 1247 |
| (See notes, ii, 2814.) | | | | KK-31 | i, 1247 |
| Easton, Pa.: | | | | KK-55 | i, 1247 |
| (See notes, ii, 2794.) | | | Ebenecook H., Me. | A-201 | i, 28 |
| Easton Pt. H., Md. | J-323-a | i, 354 | Ebenezer Cr., Ga. | Q-74 | i, 533 |
| East Pascagoula R., Miss.: | | | Ebey Slough, Wash. | XX-84 | i, 1655 |
| Bridges | | ii, 2164 | Ebeys Slough, Wash.: | | |
| East Pass, Fla. | P-353 | i, 571 | Bridges | | ii, 2164 |
| | Q-17 | i, 613 | Echo B. H., N. Y. | E-11 | i, 177, 181 |
| Appro. | | ii, 2293 | | E-11-a | i, 182 |
| East Pass, La. | R-98-hh | i, 647 | Appro. | | ii, 2289 |
| | R-109 | i, 647 | Eckeeconree Cr., Ga. | O-379 | i, 536 |
| East Pearl R., Miss. | R-97 | i, 646 | Eckichy Chan., Va. | L-37 | i, 411 |
| Bridges | | ii, 2164 | Econlockhatchee R., Fla. | P-64 | i, 569 |
| East Penobscot B., Me. | A-90 | i, 27 | Economy | (OC) | i, 909* |
| Eastport | (GG-2) | i, 1038* | Ecorse, Mich.: | | |
| Eastport H., Me., Friar | | | Harbor lines | | ii, 2255 |
| Roads | A-4 | i, 27 | Ecorse R., Mich. | PP-111 | i, 1420 |
| Eastport, Mich. (near) | OO-55-b | i, 1411 | Eddy Cr., Ky. | AA-318 | i, 850 |
| East Rockaway Cr., N. Y. | F-73 | i, 215, 229 | | AA-239 | i, 878 |
| East Rockaway Inlet, N. | | | Edenton B., N. C. | L-296 | i, 413, 442 |
| Y | F-70 | i, 215 | Harbor lines | | ii, 2255 |
| East R., Conn. | D-50 | i, 141 | Edenton B. and H., N. C.: | | |
| Bridges | | ii, 2164, 2233 | (See notes, ii, 2796.) | | |
| East R., Fla. | Q-8 | i, 611 | Appro. | | ii, 2291 |
| East R., Ga. | O-443 | i, 536 | Edenton H., N. C. | L-296 | i, 442 |
| East Rock R., Iowa and | | | Edenton, N. C.: | | |
| Minn. | GG-281 | i, 1027 | Harbor lines | | ii, 2255 |
| East R., Mass. | C-41 | i, 107 | Edgartown H., Mass. | C-29 | i, 107, 113 |
| East R., N. Y. (see New | | | | C-30 | i, 107, 113 |
| York, N. Y.) | E-17 | i, 177, 184 | Wrecks | | ii, 2267 |
| | E-17-a | i, 187 | Edgar Cove, Md. | J-341 | i, 333 |
| | F-3 | i, 215 | Edgard | (HH) | i, 1073* |
| Appro. | | ii, 2289 | Edge Cr., Md. | J-336 | i, 333 |
| Bridges | | ii, 2164 | Edgemoor, Del.: | | |
| Harbor lines | | ii, 2255 | Harbor lines | | ii, 2255 |
| Wrecks | | ii, 2267 | Edinburg and Jackson | | |
| East R., Va. | K-265 | i, 375 | (Pearl R., Miss., be- | | |
| East R., W. Va. and Va. | EE-84 | i, 983 | tween) | R-98-e | i, 676 |
| East R., Wis. | MM-23 | i, 1297 | Edinburg to Carthage, | | |
| Bridges | | ii, 2164 | Pearl R., Miss. | R-98-f | i, 677 |
| Harbor lines | | ii, 2255 | Edinburg to Lake Burn- | | |
| East St. Louis | (HH) | i, 1073* | side, Pearl R., Miss. | R-98-g | i, 677 |
| East St. Louis, Ill. | II-5 | i, 1229 | Edisto R., S. C. | N-219 | i, 500 |
| East Soldier Cr., Iowa | GG-282 | i, 1027 | | N-219-a | i, 525 |
| (See notes, ii, 2814.) | | | Appro. | | ii, 2292 |
| Eastmans Cr., N. C. | M-216 | i, 455 | Bridges | | ii, 2143, 2164, 2165 |
| East Thomaston H., Me. | A-155-b | i, 46 | Edisto R., S. C., North | | |
| East Thoroughfare, N. J.: | | | Fork | N-225 | i, 500 |
| Bridges | | ii, 2164 | | N-219-b | i, 526 |
| East Twin Cr., Kans.: | | | Edisto R., S. C., North | | |
| (See notes, ii, 2822.) | | | and South Forks | N-219-c | i, 526 |
| East Twin R. (see Two | | | Edisto R., S. C., South | | |
| Rs., Wis.) | | | Fork | N-219-d | i, 526 |
| East Twin R., Wis. | MM-28 | i, 1297 | | N-233 | i, 500 |
| Appro. | | ii, 2298 | Edmonds H., Wash. | XX-78-b | i, 1672 |
| Harbor lines | | ii, 2255 | Edmunds, Wash.: | | |
| East Waterway, Wash.: | | | Harbor lines | | ii, 2255 |
| Bridges | | ii, 2164 | Edwards R. | (HH) | i, 1073* |
| East Wing Cr., Mo. | GG-67 | i, 1025 | Edwards R., Ill. | JJ-17 | i, 1234 |
| Eaton Cr., Fla. | P-54 | i, 569 | Eek R., Alaska | XX-169 | i, 1656 |
| Eatons Neck Lighthouse, | | | Eel Pond, Mass. | C-21 | i, 107 |
| Long Island Sound: | | | Eel R., Cal. | TT-171 | i, 1556, 1569 |
| Wrecks | | ii, 2267 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|----------------------|-------------------|------------------------------------|---------------------|-------------------|
| Eel R., Ind. | BB-28..... | i, 891 | Elizabeth R., Va., Deep | | |
| | BB-32..... | i, 891 | Cr. Branch | L-181..... | i, 439 |
| Eel R., Mass. | B-170..... | i, 70 | Elizabeth R., Va. (South | | |
| Egbert, Ft.: | | | Branch) | L-173-e..... | i, 433 |
| Roads..... | ii, 2041, 2117 | | Harbor lines..... | ii, 2255 | |
| Eggenoggin Reach, Me. .. | A-76..... | i, 27 | Elizabeth R., Va. (South- | | |
| Egg H. Inlet, N. J. | I-19..... | i, 299 | ern Branch) | L-173-l..... | i, 436 |
| Egyptian Levee | (HH)..... | i, 1073* | Elizabethtown, Ill. | (CC)..... | i, 909* |
| Eighteen Mile Cr., N. Y. | RR-12..... | i, 1493 | Eliza Pt. | (HH)..... | i, 1073* |
| | RR-29..... | i, 1493 | Eliza Towhead (HH): | | |
| Harbor lines..... | ii, 2255 | | (See notes, ii, 2833.) | | |
| Eighteen Mile Cr., W. Va. | EE-154..... | i, 984 | Elk Cr., Cal. | TT-205..... | i, 1556 |
| Eightmile Bar | (CC)..... | i, 909* | Elk Cr., Kans. | GG-1223..... | i, 1034 |
| Eightmile Cr., Minn. | KK-145..... | i, 1248 | (See notes, ii, 2821.) | | |
| Eightmile Cr., S. Dak. | GG-830..... | i, 1031 | Elk Cr., Minn. | KK-65..... | i, 1247 |
| (See notes, ii, 2818.) | | | Elk Cr., Mo.: | | |
| Eightmile Isld. | (CC)..... | i, 909* | (See notes, ii, 2813.) | | |
| Eightmile R., Conn. | D-30..... | i, 141, 153 | Elk Cr., Mont. | GG-579..... | i, 1029 |
| Appro..... | ii, 2289 | | | GG-585..... | i, 1029 |
| Elbow Bayou, La. | S-107..... | i, 682 | (See notes, ii, 2816.) | | |
| Elbow Branch, Md. | J-936..... | i, 338 | Elk Cr., Nebr. | GG-940..... | i, 1032 |
| Elbow Riffle: | | | | GG-1258..... | i, 1035 |
| Bridge..... | ii, 2165 | | | GG-1302..... | i, 1035 |
| Elberts Cove, Md. | J-337..... | i, 333 | (See notes, ii, 2819, 2822.) | | |
| Elbow Cr., Fla. | P-119..... | i, 570 | Elk Cr., Pa. | J-736..... | i, 336 |
| Elder Cr., N. J.: | | | | J-846..... | i, 337 |
| Bridges..... | ii, 2165, 2184 | | Elk Cr., Pa. and Ohio | RR-2..... | i, 1493 |
| Electrical Appliances: | | | Elk Cr., S. Dak. | GG-840..... | i, 1031 |
| Forts..... | ii, 1824 | | (See notes, ii, 2819.) | | |
| Electrical Equipment: | | | Elk Cr., Tenn. | AA-243..... | i, 850 |
| Forts..... | ii, 1796, 1799, 1832 | | Elk Cr., Va. | EE-93..... | i, 983 |
| Electrical Installation: | | | Elk Cr., W. Va. | EE-41..... | i, 983 |
| Insular possessions..... | ii, 1811 | | | EE-134..... | i, 984 |
| Electricity: | | | Elk Fork, Ky. | DD-207..... | i, 960 |
| Forts..... | ii, 1810 | | Elk Fork R., Mo. | TJ-79..... | i, 1234 |
| El Estero, Cal. | SS-25-b..... | i, 1551 | Elk Fork, W. Va. | DD-325..... | i, 961 |
| Eleven Points R., Ark. | | | Elkhart R., Ind. | OO-4..... | i, 1377 |
| and Mo. | Y-34..... | i, 818 | Elkhorn Cr. | (CC)..... | i, 909* |
| Ell Cove, Md. | J-1171..... | i, 339 | Elkhorn Cr., Kans.: | | |
| Eliza | (HH)..... | i, 1073* | (See notes, ii, 2822.) | | |
| Elizabeth City, N. C.: | | | Elkhorn Cr., Ky. | DD-71..... | i, 959 |
| Harbor lines..... | ii, 2255 | | | DD-189..... | i, 960 |
| Elizabeth, Pa.: | | | | DD-257..... | i, 961 |
| Harbor lines..... | ii, 2255 | | Elk Horn Cr., Mont. | GG-624..... | i, 1030 |
| Elizabeth Pt., N. Y.: | | | Elkhorn Cr., Pa. | J-672..... | i, 336 |
| Harbor lines..... | ii, 2255 | | Elkhorn Cr., W. Va. | DD-316..... | i, 961 |
| Elizabethport, N. J.: | | | Elkhorn Cr., Wyo. | GG-1069..... | i, 1033 |
| Harbor lines..... | ii, 2255 | | (See notes, ii, 2820.) | | |
| Wrecks..... | ii, 2267 | | Elkhorn R., Nebr. | GG-951..... | i, 1032 |
| Elizabeth R., Eastern | | | (See notes, ii, 2819.) | | |
| Branch, N. C., to Lynn | | | Elk Pt. | (GG-2)..... | i, 1038* |
| Haven B., N. C. | L-207-e..... | i, 440 | Elk Prairie Cr., Mont. | GG-620..... | i, 1029 |
| Elizabeth R., N. J. | G-30..... | i, 247, 256 | (See notes, ii, 2817.) | | |
| Appro..... | ii, 2290 | | Elk R. | (HH)..... | i, 1073* |
| Bridges..... | ii, 2165 | | Elk R., Ala.: | | |
| Wrecks..... | ii, 2267 | | Bridges..... | ii, 2165 | |
| Elizabeth R., N. C. | M-327..... | i, 456, 494 | Elk R., Ala. and Tenn. | AA-18..... | i, 855 |
| Elizabeth R., Va. | L-173..... | i, 412, 429 | | AA-209..... | i, 877, 850 |
| (See notes, ii, 2796.) | | | Appro..... | ii, 2296 | |
| Appro..... | ii, 2291 | | Elk R., Cal. | TT-179..... | i, 1556 |
| Bridges..... | ii, 2165 | | Elk R., Md. | J-523..... | i, 335 |
| Harbor lines..... | ii, 2255 | | | J-523-a..... | i, 360 |
| Wrecks..... | ii, 2267 | | Appro..... | ii, 2291 | |
| | | | Wrecks..... | ii, 2267-2268 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|--------------------------------------|----------------------------------|----------------------|
| Elk R., Mont. | GG-618..... | i, 1029 | Emanuel Cr., N. Dak. | | |
| (See notes, ii, 2817.) | | | (see Emmanuel, below)... | GG-770..... | i, 1031 |
| Elk R., Okla. and Mo. | Y-10..... | i, 818 | Emanuel Cr., S. Dak. | | |
| Elk R., Wash. | XX-14..... | i, 1655 | (see Emmanuel, below)... | GG-350..... | i, 1027 |
| Bridges..... | ..... | ii, 2232 | Embankments: | | |
| Elk R., W. Va. | EE-133..... | i, 984, 996 | Forts..... | ii, 1796, 1797, 1799, 1813, 1838 | |
| Appro..... | ..... | ii, 2296 | Embarrass R., Ill. | BB-35..... | i, 891, 903 |
| Bridges..... | ..... | ii, 2165 | Embarrass R., Wis. | MM-17..... | i, 1297 |
| Elk Run, Pa. | J-677..... | i, 336 | Bridges..... | ..... | ii, 2166 |
| Ellicott Cr., N. Y. | RR-22..... | i, 1493 | Emergencies: | | |
| Ellinger Cove, Va. | J-41..... | i, 331 | Appro..... | ..... | ii, 2283 |
| Ellott B., and mouth of | | | Emile Bayou, La. | S-316..... | i, 683 |
| Duwamish R., Wash.: | | | Emmanuel Cr., N. Dak. | | |
| Bridges..... | ..... | ii, 2165-2166 | (see Emanuel, above): | | |
| Ellott Pt. | (WW-2)..... | i, 1617* | (See notes, ii, 2818.) | | |
| Ellott Slough, Wash.: | | | Emmanuel Cr., S. Dak. | | |
| Bridges..... | ..... | ii, 2166 | (see Emanuel, above): | | |
| Ellis..... | (HH)..... | i, 1073* | (See notes, ii, 2815.) | | |
| Ellis B., Md. | J-107..... | i, 331 | Emory Cr., Md. | J-440..... | i, 334 |
| Ellis Branch, Mo. | GG-204..... | i, 1026 | Emory R., Tenn. | AA-173..... | i, 849 |
| Ellis Cr., Cal.: | | | Bridges..... | ..... | ii, 2166 |
| Harbor lines..... | ..... | ii, 2255 | Emory R., Tenn. and Va. | AA-173..... | i, 876 |
| Ellis Cr., Ga. | O-411..... | i, 536 | Empire B. and H., Mich. | OO-54-a..... | i, 1411 |
| Ellis Isld., N. Y. | E-28-c..... | i, 195 | Empire Cut, Cal. | UU-27..... | i, 1577 |
| Harbor lines..... | ..... | ii, 2255 | Emplacements: | | |
| Ellis Isld. to Jersey City | | | Forts..... | ii, 1796, 1799, 1810, 1834 | |
| (ship channel)..... | E-28-f..... | i, 196 | Encampment Cr., Mont. | GG-544..... | i, 1029 |
| Ellis Lake, Miss. | S-284..... | i, 683 | (See notes, ii, 2816.) | | |
| Ellis Slough, Cal. | TT-60..... | i, 1555 | Enconina R., Fla. and | | |
| Ellis Slough, Wash.: | | | Ga. | Q-4..... | i, 611 |
| Bridges..... | ..... | ii, 2166 | Endicott Board: | | |
| Elm Coulee, N. Dak. | KK-183..... | i, 1248 | Forts..... | ..... | ii, 1809 |
| Elm Cr., Kans. | GG-1344..... | i, 1035 | Enemy Cr., S. Dak. | GG-337..... | i, 1027 |
| (See notes, ii, 2822.) | | | (See notes, ii, 2815.) | | |
| Elm Cr., Minn. | KK-134..... | i, 1248 | Engineer Constructions: | | |
| Elm Cr., Mo. | GG-1475..... | i, 1036 | Views..... | ..... | i, 13, ii, 2625 |
| GG-1478..... | ..... | i, 1036 | Engineer Department: | | |
| Elm Cr., S. Dak. | GG-364..... | i, 1028 | Fire control..... | ..... | ii, 1812 |
| (See notes, ii, 2815.) | | | Philippine Islds., contin- | | |
| Elmington Cr., Va. | K-280..... | i, 375 | gencies..... | ..... | ii, 2039, 2042 |
| Elm or Eight Mile Cr., S. | | | Engineer Districts: | | |
| Dak. | GG-830..... | i, 1031 | Appro..... | ..... | ii, 2279 |
| (See notes, ii, 2818.) | | | Engineering Features: | | |
| El Moro H., Estero B., | | | Forts..... | ..... | ii, 1797 |
| Cal. | SS-29..... | i, 1552 | Engineering Works: | | |
| El Morro, P. R.: | | | Plates or views..... | ..... | ii, 2265 |
| Forts..... | ..... | ii, 2031 | Engineer Officers: | | |
| Elm or Wolf Cr., S. Dak. | GG-370..... | i, 1028 | Assistants to..... | ..... | ii, 2039, 2059 |
| Elmot | (HH)..... | i, 1073* | Engineers.......... | ..... | i, 21 |
| Elm R., S. Dak. | GG-320..... | i, 1027 | Engineers, Battalion of..... | ..... | ii, 2039, 2053, 2058 |
| Elm R., S. Dak. and N. | | | Engineers, Board of..... | ..... | ii, 2039, 2042 |
| Dak.: | | | Engineer School: | | |
| (See notes, ii, 2815.) | | | Buildings, D. C..... | ..... | ii, 2039, 2065, 2286 |
| Elochoman R., Wash. | WW-61..... | i, 1615 | Fort Totten..... | ..... | ii, 2039, 2057 |
| Elochoman Slough, | (WW-2)..... | i, 1617* | Engineer School of Appli- | | |
| Wash. | WW-60..... | i, 1615 | cation..... | ..... | ii, 2039, 2057 |
| Eloi B., La. | S-170..... | i, 682 | Engineers, Chief of: | | |
| Elsah | (HH)..... | i, 1073* | Assistants, office..... | ..... | ii, 2039, 2043 |
| Elwha R., Wash. | XX-43..... | i, 1655 | Engineers, Corps of..... | ..... | ii, 2039, 2044, 2050 |
| Elwood | (GG-2)..... | i, 1038* | Chief of Engineers..... | ..... | ii, 2039 |
| Elwood Bend | (GG-2)..... | i, 1038* | Civilian assistants..... | ..... | ii, 2039, 2060 |
| Elwood Pt. | (GG-2)..... | i, 1038* | Divisions..... | ..... | ii, 2039, 2046 |
| | | | Laws affecting..... | ..... | ii, 2040, 2090 |
| | | | Officers, duties of..... | ..... | ii, 2039, 2051 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|----------------------|-------------------|-----------------------------------|---------------------|------------------------|
| Engineer Troops | ii, 2039, 2058 | | Escanaba R., Mich | MM-6..... | i, 1297 |
| Companies..... | ii, 2039, 2053 | | Esopus Cr., N. Y. | E-63..... | i, 177, 199 |
| Engineers: | | | (See notes, ii, 2792.) | | |
| Forts..... | ii, 1797 | | Essex Br., Mass. | B-63..... | i, 69 |
| List of, river and harbor | | | Essex R., Mass. | B-66..... | i, 69, 76 |
| works..... | ii, 2303, 2782 | | (See notes, ii, 2784.) | | |
| Noncommissioned officers | | | Appro..... | | ii, 2288 |
| of..... | ii, 2039, 2060 | | Bridges..... | | ii, 2166 |
| English B., La. | S-321..... | i, 683 | Estero B., Cal. | SS-25-b..... | i, 1551 |
| English Bayou, La. | R-98-z..... | i, 647 | Estero B., El Moro H., | | |
| | S-598..... | i, 686 | Cal..... | SS-29..... | i, 1552 |
| | S-806..... | i, 688 | Estero B., Fla. | P-227..... | i, 570 |
| Bridges..... | | ii, 2166 | | P-227-a..... | i, 590 |
| English Coulee, N. Dak. ... | KK-182..... | i, 1248 | Estero R., Fla. | P-228..... | i, 570 |
| English Kills, N. Y. | F-111..... | i, 216 | | P-227-a..... | i, 590 |
| Englishman B., Me. | A-16..... | i, 27 | Esteros B., Cal. | SS-27..... | i, 1543 |
| Englishman R., Me.: | | | Estherville-Minim Cr. Can- | | |
| (See notes, ii, 2783.) | | | nal, S. C..... | N-100..... | i, 499 |
| Bridges..... | | ii, 2166 | | N-101..... | i, 511 |
| Ennoree R., S. C. | N-169..... | i, 500 | Appro..... | | ii, 2292 |
| Entiat Rapids (WW): | | | Estimates | | ii, 21; ii, 2039, 2042 |
| (See notes, ii, 2841, 2843.) | | | Etowah R., Ga. | Q-53..... | i, 611, 640 |
| Eppes Cr., Va. | L-139..... | i, 412 | (See notes, ii, 2802.) | | |
| Equipment: | | | Appro..... | | ii, 2294 |
| Forts..... | ii, 1796, 1799 | | Eugene Bayou, La. | S-632..... | i, 686 |
| Equipment, Army: | | | Eunice | (HH)..... | i, 1073* |
| Coast Artillery, armories, | | | Eureka | (WW-2)..... | i, 1617* |
| militia..... | ii, 1814, 2041, 2133 | | Eureka Bend | (GG-2)..... | i, 1038* |
| Equipment, Engineer: | | | Eureka Cr., Nebr | GG-924..... | i, 1032 |
| Schools, posts, etc..... | ii, 2041, 2133 | | (See notes, ii, 2819.) | | |
| Equipment of Troops, | | | Eureka H., Cal. | TT-180..... | i, 1571 |
| Engineer: | | | Harbor lines..... | | ii, 2255 |
| Estimates..... | ii, 2039, 2042, 2059 | | Eureka Slough, Cal. | TT-180..... | i, 1556 |
| Erie and Wabash Canal, | | | Bridges..... | | ii, 2166 |
| Ind. and Ohio..... | QQ-5-a..... | i, 1465 | Eutiat Rapids | (WW-2)..... | i, 1617* |
| Appro..... | | ii, 2299 | Eutiat Rapids (WW): | | |
| Erie Basin, N. Y.: | | | (See notes, ii, 2841.) | | |
| Harbor lines..... | ii, 2255 | | Evans Bar | (GG-2)..... | i, 1038* |
| Erie Canal | ii, 2041, 2120 | | Evans Bend | (GG-2)..... | i, 1038* |
| Bridges..... | ii, 2166 | | Evans Cr., Ohio | DD-393..... | i, 962 |
| Erie Canal, Buffalo to | | | Evansville, Ind. | (CC)..... | i, 909* |
| Tonawanda Cr., N. Y. ... | RR-19..... | i, 1493 | Eve Lake, Minn.: | | |
| Erie Canal, N. Y. | E-54-a..... | i, 177 | Dams, private..... | | ii, 2249 |
| | RR-19-a..... | i, 1512 | Everett H., Wash | XX-79..... | i, 1655, 1672 |
| Erie H., Pa. | RR-5..... | i, 1494 | Appro..... | | ii, 2301 |
| | RR-5-a..... | i, 1494 | Harbor lines..... | | ii, 2255 |
| | RR-5-b..... | i, 1497 | Evergreen | (HH)..... | i, 1073* |
| (See notes, ii, 2838.) | | | Evergreen Cr., Nebr | GG-928..... | i, 1032 |
| Appro..... | | ii, 2299 | (See notes, ii, 2819.) | | |
| Harbor lines..... | ii, 2255 | | Eversole B., Ky | DD-117..... | i, 960 |
| Wrecks..... | ii, 2268 | | Ewings Cr., Mo. | GG-66..... | i, 1025 |
| Erie H., Presque Isle B., | | | (See notes, ii, 2813.) | | |
| Pa..... | RR-5..... | i, 1493 | Examinations: | | |
| Erie, Lake (see Lakes | | | Appro..... | | ii, 2283 |
| Huron and Erie). | | | Examinations and sur- | | |
| Ermatinger R., Mich | PP-8..... | i, 1419 | veys: | | |
| Escambia and Conecuh | | | South Pass, Mississippi R..... | | ii, 2279 |
| Rs., Fla. and Ala. | Q-43..... | i, 611, 630 | Executive Mansion (White | | |
| | Q-43-c..... | i, 631 | House), D. C..... | | ii, 2039, 2067 |
| Escambia B., Fla. | Q-42..... | i, 611 | Exeter R., N. H. | A-289..... | i, 29, 63 |
| Escambia R., Fla. | Q-43-a..... | i, 631 | (See notes, ii, 2783.) | | |
| (See notes, ii, 2801.) | | | Appro..... | | ii, 2288 |
| Appro..... | | ii, 2294 | Bridges..... | | ii, 2166 |
| Bridges..... | | ii, 2166 | Expansion | (GG-2)..... | i, 1038* |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------|---------------------|-------------------|--------------------------------|---------------------|-------------------|
| Expenditures | ii, 2039, 2042 | | Explorations—Continued. | | |
| (See Appropriations.) | | | Geological explorations..... | ii, 2040, 2086 | |
| Explorations | ii, 2040, 2086 | | Lava beds..... | ii, 2040, 2087 | |
| Alaska..... | ii, 2040, 2090 | | One hundredth meridian..... | ii, 2040, 2089 | |
| Fortieth parallel..... | ii, 2040, 2086 | | Utah Mountains..... | ii, 2040, 2090 | |

F.

| | | | | |
|---------------------------------------|----------------|--------------------------------------|--------------|-------------|
| Fabius (HH)..... | i, 1073* | Falls Run, Md. | J-1120..... | i, 339 |
| Fabius R. (HH)..... | i, 1073* | Falls Slough Crossing | (CC)..... | i, 909* |
| Fabius R., Mo. | JJ-74..... | Falls (The), Ohio R. | (CC)..... | i, 909* |
| Factory Cr., Mo. | GG-1447..... | Falmouth H., Mass. | C-16..... | i, 107, 110 |
| (See notes, ii, 2823.) | | False B., Cal. | TT-122..... | i, 1556 |
| Factory Wallind Cr., Ga. | O-361..... | False Bayou, La. | S-432..... | i, 684 |
| Fair Forest Swamp, S. C. | N-210..... | False Palouse Rapids | (WW-2)..... | i, 1617* |
| Fairhaven H., Mass. | C-53..... | False Presque Isle H., | | |
| Harbor lines..... | ii, 2255 | Mich..... | PP-47..... | i, 1419 |
| Wrecks..... | ii, 2268 | False Presque Isle H., | | |
| Fairhaven H., N. Y. | RR-47..... | Mich. (harbor of refuge) PP-46..... | i, 1433 | |
| Fairhaven, Wash. | XX-103..... | False R., Cal. | UU-8..... | i, 1577 |
| Appro..... | ii, 2301 | False R., La. | S-297..... | i, 1573 |
| Fairlee Cr., Md. | J-504..... | Fancy Cr., Kans. | GG-1266..... | i, 1035 |
| Appro..... | ii, 2291 | (See notes, ii, 2822.) | | |
| Fairmont, W. Va. | FF-6-a..... | Fancy Hall, Ga. | O-189..... | i, 534 |
| Fairport. (HH)..... | i, 1073* | Far Cr., N. C. | M-30..... | i, 454 |
| Fairport H., Ohio. | QQ-28..... | Farm Cr., Conn. | D-83..... | i, 141 |
| Appro..... | ii, 2299 | Bridges..... | ii, 2167 | |
| Harbor lines..... | ii, 2255 | Farm Cr., Ill. | NN-5-a..... | i, 1355 |
| Navigation rules..... | ii, 2041, 2107 | Farm Cr., Md. | J-170..... | i, 332 |
| Wrecks..... | ii, 2268 | Farmers Cr., Nebr. | GG-1292..... | i, 1035 |
| Fajardo R. (YY): | | (See notes, ii, 2822.) | | |
| (See notes, ii, 2845.) | | Farmington R., Conn. | D-34..... | i, 141 |
| Falkners Isld., Conn. | D-49..... | Farmington Canal, Conn. | D-35..... | i, 141 |
| Fall Cr., Kans. | GG-1195..... | | D-35..... | i, 153 |
| (See notes, ii, 2821.) | | Farnam Br., Minn. | KK-108..... | i, 1248 |
| Fall Cr., Tenn. | AA-129..... | Farnham Cr., Va. | K-189..... | i, 374 |
| Falling Branch, Pa. | J-926..... | Far Rockaway B., N. Y.: | | |
| Falling Cr., Ga. | O-31..... | Bridges..... | ii, 2167 | |
| | O-284..... | Far Rockaway, N. Y. | F-86..... | i, 216, 231 |
| | O-350..... | Fattig Cr., Mont.: | | |
| Falling Cr., Va. | L-146..... | (See notes, ii, 2817.) | | |
| | L-371..... | Fattio Cr., Mont. | GG-597..... | i, 1029 |
| Falling Rock Cr., W. Va. | EE-136..... | Faulkner Branch, Md. | J-130..... | i, 332 |
| Falling Run | (CC)..... | Fawn R., Mich., Ind., | | |
| Fall Isld. (near Cobscok | | and Ohio. | OO-7..... | i, 1377 |
| B., Me.) | A-5..... | Fayetteville, N. C. (above), | | |
| Fallkill Cr., N. Y. | E-42..... | Cape Fear R..... | M-305-e..... | i, 490 |
| Fall River H., Mass. | C-70..... | Feather R., Cal. | UU-57..... | i, 1577 |
| (See notes, ii, 2786, 2787.) | | | UU-55..... | i, 1585 |
| Appro..... | ii, 2288 | | UU-55-a..... | i, 1586 |
| Harbor lines..... | ii, 2255 | | UU-55-C..... | i, 1589 |
| Fall Run, Va. | K-206..... | (See notes, ii, 2840, 2841.) | | |
| Fallsburg Cr., N. Y. | E-44..... | Appro..... | ii, 2300 | |
| Falls Cr., Pa. | J-629..... | Feather R., Cal. (see Call- | | |
| Falls of St. Anthony | (HH)..... | forma Débris Comm.) | i, 1580 | |
| (See notes, ii, 2832, 2833.) | | Felgates Cr., Va. | K-318..... | i, 375 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|----------------------------|-------------------------------------|---------------------|-------------------|
| Feltons Lake, Ga. | O-473..... | i, 536 | Firesteel Cr., S. Dak. | GG-335..... | i, 1027 |
| Femme Osage Cr., Mo. | GG-6..... | i, 1025 | (See notes, ii, 2815.) | | |
| (See notes, ii, 2813.) | | | Firesteel Cr., West, S. | | |
| Fenhalloway R., Ala. | Q-3..... | i, 611 | Dak. | GG-336..... | i, 1027 |
| Fenhalloway R., Fla. | Q-3..... | i, 611 | First Cr., Ky. | DD-149..... | i, 960 |
| Fenwicks Isld. Light, Del.: | | | First Cr., Mo. | GG-211..... | i, 1026 |
| Wrecks..... | | ii, 2268 | (See notes, ii, 2814, 2824.) | GG-1536..... | i, 1037 |
| Fergus Falls (above), Red | | | First Fork, Pa. | J-776..... | i, 336 |
| R. of the North. | KK-170-c..... | i, 1258 | First Herring R., Mass. | B-153..... | i, 70 |
| Ferguson. | (HH)..... | i, 1073* | First Mine Branch, Md. | J-1009..... | i, 338 |
| Fernandina, Fla. | O-501-c..... | i, 562, 564 | First Rapids. | (WW-2)..... | i, 1617* |
| Ports..... | | ii, 1948 | First Reach. | (GG-2)..... | i, 1038* |
| Harbor lines..... | | ii, 2255 | First R., Minn. | KK-89..... | i, 1248 |
| Navigation rules..... | | ii, 2041, 2107 | Fish Bend. | (HH)..... | i, 1073* |
| Fernandina, Fla., and St. | | | Fish Brook, Mass. | B-48..... | i, 69 |
| Johns R. (inside pas- | | | Fish Cr. Isld. | (CC)..... | i, 909* |
| sage between)..... | P-2..... | i, 575 | Fish Cr., Mo. | GG-1430..... | i, 1036 |
| Fernandina, Fla., and Sa- | | | (See notes, ii, 2823.) | | |
| vannah, Ga. (inside wa- | | | Fish Cr., Mont. | GG-592..... | i, 1020 |
| ter route between)..... | O-2-g..... | i, 546 | (See notes, ii, 2816.) | | |
| Navigation rules..... | | ii, 2041, 2108 | Fish Cr., Nebr. | GG-944..... | i, 1032 |
| Fernandina, Fla. (inside | | | (See notes, ii, 2819.) | | |
| passage to)..... | P-10-a..... | i, 576 | Fish Cr., S. Dak. | GG-876..... | i, 1032 |
| Appro..... | | ii, 2293 | (See notes, ii, 2819.) | | |
| Fernandina, Ga. and | | | Fish Cr., W. Va. | EE-190..... | i, 984 |
| Fla.: | | | Fish Eating Cr., Fla. | P-252..... | i, 571 |
| Appro..... | | ii, 2293 | Fisher Cr., Kans.: | | |
| Fernback, Ohio. | (CC)..... | i, 909* | (See notes, ii, 2822.) | | |
| Ferriday. | (HH)..... | i, 1073* | Fishers Island Sound | | |
| Ferry Cove, Md. | J-361..... | i, 333 | (See notes, ii, 2788.) | | |
| Ferry Cr., Va. | K-243..... | i, 375 | Fishermans Inlet, Va. | L-60..... | i, 411 |
| Fiddle Cr., Mo. | GG-1551..... | i, 1037 | Fishermans Slough, Cal. .. | UU-11..... | i, 1577 |
| (See notes, ii, 2824.) | | | Fisher B., Wis. | KK-33..... | i, 1247 |
| Field Lake, La. | S-431..... | i, 684 | Fishers Bayou, La. | S-556..... | i, 686 |
| Fields B., Vt. | E-109..... | i, 178 | Fishers Isld., N. Y. | D-10..... | i, 141, 146 |
| Field Service, Engineer Of- | | | (See notes, ii, 2788.) | | |
| icers..... | | ii, 2039, 2047, 2048, 2049 | Fishhook Rapids | (WW-2)..... | i, 1617* |
| Porto Rico..... | | ii, 2039, 2050 | Fishing B., Md. | J-137..... | i, 332 |
| Fields Landing, Cal.: | | | Fishing B., Va. | K-237..... | i, 375 |
| Harbor lines..... | | ii, 2255 | Fishing Cr. | (CC)..... | i, 909* |
| Field, Work in the, Engi- | | | Fishing Cr., Ga. | O-39..... | i, 533 |
| neer Officers (see above) | | ii, 2040, 2086 | O-306..... | | i, 535 |
| Fila Bayou, La. | S-408..... | i, 684 | Fishing Cr., Ky. | AA-284..... | i, 850 |
| Fifteen Mile Cr., Ga. | O-154..... | i, 534 | Fishing Cr., Md. | J-78..... | i, 331 |
| Fifteen-mile Falls, N. H. .. | D-25..... | i, 141, 153 | J-212..... | | i, 332 |
| Fighting Isld. Chan., | | | J-237..... | | i, 332 |
| Mich. | PP-112..... | i, 1420 | J-1242..... | | i, 340 |
| Filtration, D. C. | | ii, 2040, 2081, 2083 | K-4..... | | i, 373 |
| Finding lists, special | | i, 12, 13, 14, 19 | Fishing Cr., N. C. | M-85..... | i, 454, 463 |
| (See also titular pages of | | | Appro..... | | ii, 2292 |
| Vol. II, and Contents | | | Bridges..... | | ii, 2167 |
| pages of both volumes | | | Fishing Cr., Pa. | J-564..... | i, 335 |
| of this Index.) | | | J-595..... | | i, 335 |
| Finleys. | (HH)..... | i, 1073* | J-702..... | | i, 336 |
| Finney Cr., Va. | L-11..... | i, 411 | J-830..... | | i, 337 |
| Finneys Cr., Va. | L-84..... | i, 411 | J-901..... | | i, 337 |
| Finns Pt., N. J.: | | | J-907..... | | i, 337 |
| Ports..... | | ii, 1806, 1903 | Fishing Cr., S. C. | N-134..... | i, 500 |
| Fire Control, Forts | | ii, 1796, | Fishing Cr., Va. | J-5..... | i, 331 |
| 1799, 1812, 1824, 1831 | | | Fishing Cr., W. Va. | EE-189..... | i, 984 |
| Firehole R., Wyo. | GG-527..... | i, 1029 | Fishing Place Cove, R. I. | C-64..... | i, 120 |
| (See notes, ii, 2816.) | | | | | |
| Fire Isld. Inlet, N. Y. | F-47..... | i, 215, 226 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|------------------------------------|---------------------|--|
| Fishing B. | (GG-2)..... | i, 1038* | Flat Cr., La. | S-829..... | i, 688 |
| Fishing R., Mo. | GG-176..... | i, 1026 | Flat Cr., Md. | J-1253..... | i, 340 |
| (See notes, ii, 2814.) | | | Flat Cr., Mo. | GG-1434..... | i, 1036 |
| Fishing Smack Lake, La. | S-165..... | i, 682 | (See notes, ii, 2823.) | | |
| Fishkill Cr., N. Y. | E-39..... | i, 177 | Flat Cr., S. C. | N-67..... | i, 499 |
| Fish Pond Cr., Kans. | GG-1208..... | i, 1034 | Flat Cr., Tenn. | AA-118..... | i, 849 |
| (See notes, ii, 2821.) | | | Flat Cr., Va. | L-363..... | i, 414 |
| Fish Rock, Cal. | TT-131-a..... | i, 1568 | Flathead Lake. | (WW-2)..... | i, 1617* |
| Fish R., Ala. | R-8..... | i, 646, 648 | Flathead Lake, Mont. | XX-110-c..... | i, 1678 |
| Fish R., Alaska. | XX-243..... | i, 1657 | Appro..... | | ii, 2301 |
| Fishtrap Bayou, La. | S-656..... | i, 686 | Flathead R. | (WW-2)..... | i, 1617* |
| Fish Trap Cut, Ga. | O-311..... | i, 535 | Flathead R., Mont. | XX-110-b..... | i, 1677 |
| Fishways, D. C. | | ii, 2040, 2071 | Appro..... | | ii, 2301 |
| Fishweir Cr., Fla. | P-25..... | i, 569 | Flat Lake, La. | S-503..... | i, 685 |
| Fisks Mill, Cal. | TT-131-a..... | i, 1568 | | S-620..... | i, 686 |
| Fitler | (HH)..... | i, 1073* | Flatland Cove, Md. | J-61..... | i, 331 |
| Fitlers | (HH)..... | i, 1073* | Flat Rock Cr., S. C. | N-118..... | i, 500 |
| Fitzhugh Run, Md. | J-1001..... | i, 338 | Flat R., Mich. | OO-32..... | i, 1377 |
| Five and Twentymile Cr., | | | "Flats," Anacostia R., D. | | |
| W. Va. | EE-65..... | i, 983 | C..... | | ii, 2039, 2067 |
| Five Creeks Cr., Kans.: | | | Flat Swamp, S. C. | N-87..... | i, 499 |
| (See notes, ii, 2822.) | | | Flatty Cr., N. C. | L-281..... | i, 413 |
| Fivemile (WW): | | | Fleeces | (HH)..... | i, 1073* |
| (See notes, ii, 2843.) | | | Fleeces Crossing (HH): | | |
| Fivemile Bar | (CC)..... | i, 909* | (See notes, ii, 2831.) | | |
| Fivemile Cr., Ala. | R-30..... | i, 646 | Fletchers | (HH)..... | i, 1073* |
| Five-Mile Cr., Ala., to | | | Flint and Chattahoochee | | |
| Black Warrior R. (canal | | | Rs., Ala., Fla., and Ga. | | |
| to connect via Valley | | | | Q-23..... | i, 618 |
| Cr.) | R-23-c..... | i, 662 | | Q-23-a..... | i, 619 |
| Five Mile Cr., Ga. | O-407..... | i, 536 | Flint Cr. | (HH)..... | i, 1073* |
| Five Mile Cr., Kans. | GG-1170..... | i, 1034 | Flint Cr., Ala. | AA-47..... | i, 848 |
| (See notes, ii, 2821.) | | | Flint Isld. | (CC)..... | i, 909* |
| Fivemile Cr., Minn. | KK-151..... | i, 1248 | Flint Rock Cr., S. Dak. | GG-814..... | i, 1031 |
| Five Mile Cr., S. Dak. | GG-361..... | i, 1028 | (See notes, ii, 2818.) | | |
| (See notes, ii, 2815.) | | | Flint R. | O-2-l..... | i, 547 |
| Fivemile Rapids | (WW-2)..... | i, 1617* | Flint R., Ala. and Tenn. | AA-203..... | i, 850 |
| Fivemile R., Conn. | D-84..... | i, 141 | | AA-18..... | i, 855 |
| (See notes, ii, 2791.) | | | Flint R., Fla. and Ga. | Q-22..... | i, 611 |
| Fivemile R. H., Conn. | D-85..... | i, 141, 170 | | Q-23-c..... | i, 622 |
| (See notes, ii, 2738.) | | | (See notes, ii, 2800, 2801.) | | |
| Appro..... | | ii, 2289 | Appro..... | | ii, 2293 |
| Harbor lines..... | | ii, 2255 | Bridges..... | | ii, 2167 |
| Flag Cove, Md. | J-218..... | i, 332 | Wrecks..... | | ii, 2268 |
| Flag Cr., Nebr. | GG-1301..... | i, 1035 | Flint R., Mich. | PP-72..... | i, 1419 |
| (See notes, ii, 2822.) | | | | PP-69-a..... | i, 1438 |
| Flag Lake, Wis. | LL-25-b..... | i, 1281 | Flirt Cr., Mont. | GG-606..... | i, 1029 |
| Flagg Meadow Brook, | | | (See notes, ii, 2817.) | | |
| Mass. | B-14..... | i, 69 | Floating Plant, Engineer | | |
| Flag R., Wis. | LL-25..... | i, 1265 | Department..... | | ii, 2041, 2115, 2337 |
| Flag R., Wis. (mouth) | LL-25-b..... | i, 1281 | Flood Cr., Md. | K-61..... | i, 373 |
| Flambeau R., Wis. | KK-36..... | i, 1247 | Floods (see Mississippi R.) | (HH)..... | i, 1073* |
| Bridges..... | | ii, 2167 | Floodwood R., Minn. | LL-22..... | i, 1265 |
| Flanders B., Me. | A-46..... | i, 27 | Flor de Hundred Cr., Va. | L-154..... | i, 412 |
| Flatbeach or Tuckers | | | Florence | (GG-2)..... | i, 1038* |
| Isld., N. J. | I-12..... | i, 299, 302 | Florence, Ala. | AA-18..... | i, 855 |
| Appro..... | | ii, 2290 | Florence Lake, Nebr. | GG-947..... | i, 1032 |
| Flat Boat Bayou, La. | S-235..... | i, 683 | (See notes, ii, 2819.) | | |
| Flatboat Bayou, La. | S-721..... | i, 687 | Florida: | | |
| Flat Branch, Mo. | GG-87..... | i, 1025 | Appro..... | | ii, 2293 |
| Flat Cr., Ga. | O-261..... | i, 535 | Forts..... | | ii, 1796, 1802, 1816, 1955, 1962, 1965 |
| | O-315..... | i, 535 | Hyacinth removal..... | | ii, 2293 |
| Flat Cr., Ky. | DD-7..... | i, 959 | Florida, across: | | |
| | | | (See notes, ii, 2799.) | | |

| | District and Fo. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|---------------------|-------------------|
| Florida B., Fla..... | P-172..... | i, 570 | Fords Cr., Mont..... | GG-576..... | i, 1029 |
| Florida (canal, St. Marys R. to Gulf of Mexico).... | O-510-c..... | i, 566 | (See notes, ii, 2816.) | | |
| Florida Keys, Fla.: Bridges..... | | ii, 2167 | Foreman Branch, Md. | J-447..... | i, 334 |
| Florida Passage, Ga..... | O-155..... | i, 534 | Fore R., Portland H., Me. A-264..... | | i, 29 |
| Florida R. and H. im- provements..... | P-1-f..... | i, 575 | Bridges..... | | ii, 2167 |
| Florida waters..... | P-1..... | i, 569 | Harbor lines..... | | ii, 2255 |
| Florida waters (removing water hyacinths)..... | P-1-b..... | i, 572 | Fore R. (Weymouth), Mass..... | B-138..... | i, 93 |
| | P-1-b-e..... | i, 572 | Wrecks..... | | ii, 2278 |
| Florida (waterway across, connecting with Atlan- tic Ocean)..... | O-510-b..... | i, 565 | Forest..... | (HH)..... | i, 1073* |
| Florida Waterways, Fla.: Bridges..... | | ii, 2167 | Forester H., Mich..... | PP-84..... | i, 1419, 1443 |
| Floyd R..... | (GG-2)..... | i, 1038* | Forest R., Mass..... | B-105..... | i, 70 |
| Floyd R., Iowa..... | GG-269..... | i, 1027 | Forestville H., Mich..... | PP-83..... | i, 1419, 1443 |
| (See notes, ii, 2814, 2825.) | | | Fort Bayou, La..... | S-795..... | i, 688 |
| Floyds B., Va..... | L-10..... | i, 411 | Forge Branch, Del..... | J-290..... | i, 333 |
| Floyds Cr., Ga..... | O-505..... | i, 536 | Forge R., N. Y..... | F-54..... | i, 215 |
| Floyd, Sergt.: Monument..... | | ii, 2040, 2095 | Forgery Cr., Tenn..... | AA-139..... | i, 849 |
| Fuel: | | | Forb Cr., Tenn..... | AA-91..... | i, 849 |
| Harbor lines..... | | ii, 2255 | Forked Cr., Fla..... | P-270..... | i, 571 |
| Flushing B., N. Y..... | F-5..... | i, 215, 216 | Forked Cr., Md..... | J-1199..... | i, 340 |
| (See notes, ii, 2792.) | | | | J-1220..... | i, 340 |
| Appro..... | | ii, 2289 | Forked Deer R..... | (HH)..... | i, 1073* |
| Flushing Cr., N. Y..... | F-6..... | i, 215 | Forked Deer R., South Fork, Tenn..... | AA-6-b..... | i, 854 |
| Bridges..... | | ii, 2167 | Forked Deer R., Tenn..... | AA-6..... | i, 848, 853 |
| Wrecks..... | | ii, 2268 | | AA-6-a..... | i, 853 |
| Flushing R., N. Y.: Harbor lines..... | | ii, 2255 | (See notes, ii, 2809.) | | |
| Flying Passage, Me..... | A-165..... | i, 28 | Appro..... | | ii, 2296 |
| Flynn Lick Cr., Tenn..... | AA-266..... | i, 850 | Bridges..... | | ii, 2167 |
| Flynns Knoll, N. Y.: Wrecks..... | | ii, 2268 | Forked Deer R., North Fork, Tenn..... | AA-6-c..... | i, 855 |
| Fodder Stock Cut-off, Ga..... | O-398..... | i, 536 | Forked R., N. J..... | I-7..... | i, 299, 301 |
| Fog Pt. Cove, Md..... | J-182..... | i, 332 | Forrest R., Ga..... | O-124..... | i, 534 |
| Folly Cove, Mass..... | B-75..... | i, 69 | Fort..... | | |
| Folly Cr., Va..... | L-4..... | i, 411 | (See last word in a com- bination of words begin- ning with "Fort.") | | |
| Folly Cr., Ga..... | O-218..... | i, 534 | Fort Adams..... | (HH)..... | i, 1073* |
| Folsom..... | (GG-2)..... | i, 1038* | Fort Bayou, La..... | S-200..... | i, 682 |
| Fond du Lac R., Wis..... | MM-22..... | i, 1297, 1316 | Fort Bayou, Miss.: Bridges..... | | ii, 2167 |
| Fontanelle..... | (GG-2)..... | i, 1038* | Fort Benton..... | (GG-2)..... | i, 1038* |
| Fontanelle Bar..... | (GG-2)..... | i, 1038* | Fort Benton, Mont..... | (GG-2)..... | i, 1037* |
| Fontanelle Bayou, La..... | S-325..... | i, 683 | Fort Benton to mouth of Missouri R..... | GG-2-g..... | i, 1048 |
| Fooks Pond, Md..... | J-96..... | i, 331 | Fort Brown, Tex., Rio Grande R..... | U-74-a..... | i, 775 |
| Foot Cr., S. Dak..... | GG-324..... | i, 1027 | Fort Buford..... | (GG-2)..... | i, 1038* |
| Foot, Fort, Md..... | | ii, 1804, 1921 | Fort Chartres..... | (HH)..... | i, 1073* |
| Subpost..... | | ii, 2039, 2052 | (See notes, ii, 2833.) | | |
| Force Cr., Md..... | J-358..... | i, 333 | Fort Covington, N. Y., Salmon R..... | RR-78..... | i, 1539 |
| Ford Cr., Iowa..... | GG-277..... | i, 1027 | Fortescues Cr., N. C..... | M-44..... | i, 454 |
| (See notes, ii, 2814.) | | | Fort Gage..... | (HH)..... | i, 1073* |
| Fordoch Bayou, La..... | S-536..... | i, 685 | Fort George Cr., S. Dak.. | GG-871..... | i, 1031 |
| | S-596..... | i, 686 | (See notes, ii, 2819.) | | |
| | S-808..... | i, 686 | Fort George Inlet, Fla..... | P-8..... | i, 569 |
| Ford R., Mich..... | MM-7..... | i, 1297 | Fort George R., Fla..... | P-9..... | i, 569 |
| Fords..... | (HH)..... | i, 1073* | Fort Gibson, Okla..... | Y-2-c..... | i, 820 |
| Fords Cr., Miss..... | S-280..... | i, 683 | Fortier Bayou, La..... | S-381..... | i, 684 |
| | | | Fortieth Parallel: Explorations..... | | ii, 2040, 2086 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Fortifications (shortened to "forts" throughout this Finding list).....i, 13; ii, 1793, 1797, 1839, 2040, 2090 | | | | | |
| Appro..... | | ii, 1277 | Fosters Meadow Canal, N. Y.: | | |
| Boards..... | | ii, 1817 | Bridges..... | | ii, 2168 |
| Contingencies..... | | ii, 1809 | Foundry Brook, N. Y. | E-38..... | i, 177 |
| Data, arrangement of..... | | i, 9; ii, 1795 | Fountain | (HH)..... | i, 1073* |
| Estimates..... | | ii, 2039, 2042 | Fountain Cr. | (HH)..... | i, 1073* |
| Frontiers..... | | ii, 1810 | Fountains, McMillan Me- morial, D. C. | | |
| Hawaii Islands..... | | ii, 1810, 1811 | | ii, 2040, 2069 | |
| Insular possessions..... | | ii, 1810 | Four Bears Cr., S. Dak. ... | GG-815..... | i, 1031 |
| Laws..... | | ii, 2329 | (See notes, ii, 2818.) | | |
| Lights..... | | ii, 1810 | Fourche Dumas, Ark. and Mo. | | |
| Miscellaneous..... | | ii, 1809, 1816 | | Y-32..... | i, 818 |
| Philippine Islds..... | | ii, 1810, 1811 | Fourche La Faive R., Ark. | Y-22..... | i, 826 |
| Plans..... | | ii, 1810 | Fourche La Fave, Ark. ... | Y-22..... | i, 818 |
| Plant..... | | ii, 1810 | Fourche Le Fevre R., Ark. | Y-22..... | i, 826 |
| Ports and harbors..... | | ii, 1810, 1817 | Appro..... | | ii, 2295 |
| Power..... | | ii, 1810 | Bridges..... | | ii, 2168 |
| Preservation and repair..... | | ii, 1811, 1812 | Fourche Le Fevre R., Tex.: | | |
| Searchlights..... | | ii, 1810 | Bridges..... | | ii, 2168 |
| Fort Jackson | (HH)..... | i, 1073* | Fourchett Cr., Mont. | GG-464..... | i, 1028 |
| Fort Leavenworth | (GG-2)..... | i, 1038* | (See notes, ii, 2816.) | | |
| (See notes, ii, 2829, 2834.) | | | Fourche La Feve' R., Ark. Y-22..... | | i, 826 |
| Fort Leavenworth, Kans., and Detroit, Mich.: | | | Four-Hole Swamp, S. C. ... | N-221..... | i, 500 |
| Longitude..... | | ii, 2041, 2122 | Four League B., La. | S-478..... | i, 685 |
| Fort Lee, N. J.: | | | Fourmile Bar | (CC)..... | i, 909* |
| (See notes, ii, 2255.) | | | Four Mile Bayou, Fla. | P-316..... | i, 571 |
| Fort Madison | (HH)..... | i, 1073* | Four Mile Cr., Ala. | AA-213..... | i, 850 |
| Fort Pierre | (GG-2)..... | i, 1038* | Four Mile Cr., Cal. | TT-167..... | i, 1556 |
| Fort Pillow | (HH)..... | i, 1073* | Four Mile Cr., Colo. | GG-1097..... | i, 1033 |
| Fort Pt. Chan., Mass. | B-127..... | i, 70 | (See notes, ii, 2820.) | | |
| Bridges..... | | ii, 2167 | Four Mile Cr., Fla.: | | |
| Fort Point, Conn.: | | | Bridges..... | | ii, 2168 |
| Forts..... | | ii, 1824 | Four Mile Cr., Kans. | GG-1252..... | i, 1034 |
| Fort Pt. Cove, Me. | A-107..... | i, 28 | | GG-1277..... | i, 1035 |
| Fort Pond B., N. Y. | F-44..... | i, 215, 226 | (See notes, ii, 2821, 2822.) | | |
| Fort Pond H., N. Y. | F-44..... | i, 226 | Four Mile Cr., Kans. and Nebr. | | |
| Fort Riley Military Reser- vation, Kans. | GG-1276-a..... | i, 1062 | | GG-1150..... | i, 1034 |
| Fort Ripley | (HH)..... | i, 1073* | Fourmile Cr., Nebr.: | | |
| Fort Rose, Cal. | TT-131-a..... | i, 1568 | (See notes, ii, 2821.) | | |
| Fort St. Phillip | (HH)..... | i, 1073* | Four Mile Cr., N. Dak. | GG-789..... | i, 1031 |
| Fort Smith, Ark. | Y-2-c..... | i, 820 | (See notes, ii, 2818.) | | |
| Fort Smith, Ark., Arkan- sas R. | Y-2-j..... | i, 824 | Fourmile Cr., N. Dak. and Mont.: | | |
| Fort Snelling | (HH)..... | i, 1073* | (See notes, ii, 2817.) | | |
| Fort Stevens | (WW-2)..... | i, 1617* | Four Mile Cr., Tenn. | AA-105..... | i, 849 |
| Fortville | (HH)..... | i, 1073* | Four Mile Cr., Va. | L-141..... | i, 412 |
| Fossil Cr., Kans. | GG-1329..... | i, 1035 | Fourmile Cr., W. Va. | EE-12..... | i, 983 |
| (See notes, ii, 2822.) | | | Four Mile R., Conn. | D-22..... | i, 141 |
| Foster Branch, Md. | J-982..... | i, 338 | Four Mile Run, Va. | K-91..... | i, 373 |
| Foster Cr. | (WW-2)..... | i, 1617* | Fountain Bayou, La. | S-106..... | i, 682 |
| (See notes, ii, 2842.) | | | Four Pt. Bayou, La. | S-462..... | i, 685 |
| Foster Cr. Rapids (WW): | | | Four-Pole Cr., W. Va. | EE-9..... | i, 983 |
| (See notes, ii, 2843.) | | | Fourteenmile Cr., W. Va. | EE-14..... | i, 983 |
| Foster Cr., S. Dak. | GG-310..... | i, 1027* | Fourteen Mile Slough, Cal. | UU-41..... | i, 1577 |
| (See notes, ii, 2815.) | | | Fourth Cr., Kans.: | | |
| Foster Isld | (HH)..... | i, 1073* | (See notes, ii, 2822.) | | |
| (See notes, ii, 2833.) | | | Fourth Cr., N. C. | N-53..... | i, 499 |
| Fosters Cove, Me. | A-182..... | i, 28 | Fourth Mine Branch, Md. | | |
| Fosters Cr., N. C. | L-227..... | i, 413 | | J-1012..... | i, 338 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|---------------------|-------------------------------------|---------------------|-------------------|
| Fowler Cr., Mo. | GG-78 | i, 1025 | Frank Horan Slough, | | |
| Fowlers Cr., Mo.: | | | Cal. | TT-99 | i, 1555 |
| (See notes, ii, 2813.) | | | Franklin Branch, Md. | J-16 | i, 331 |
| Fowling Cr., Md. | J-277 | i, 333 | Franklin City, Va., to | | |
| Fowl R., Ala. | R-51 | i, 646, 664 | Cape Charles, Va. (in- | | |
| Bridges | | ii, 2162, 2168 | ternal waterway from) .. | I-79-b | i, 327 |
| Fowl R. B., Ala. | R-57 | i, 646 | Franklin Canal, La. | S-688 | i, 687 |
| Fox and Wisconsin Rs., | | | Franklin, Pa. | FF-20 | i, 1015 |
| Wis. | MM-15 | i, 1306 | Franklin to Mementau, | | |
| | MM-15-a | i, 1307 | La. (inland waterway) .. | S-696-c | i, 710 |
| Fox Cr., Ga. | O-219 | i, 534 | Franks Bayou, La. | T-2-fl | i, 717 |
| Fox Cr., Md. | J-205 | i, 332 | Frasers Cr., Cal. | TT-162 | i, 1556 |
| Fox Cr., Mass. | B-63 | i, 69 | Frechette Cr., Mich. | PP-7 | i, 1419 |
| Fox Cr., Mich. | PP-107 | i, 1420 | Frederica R., Ga. | O-428 | i, 536, 557 |
| Fox Cr., Mont.: | | | Frederick the Great: | | |
| (See notes, ii, 2817.) | | | Monument, D. C. | | ii, 2040, 2091 |
| Fox Cr., Mont. | GG-628 | i, 1030 | Freedom | (CC) | i, 909* |
| Fox Cr., Nebr.: | | | Freeman Cr., Md. | J-512 | i, 335 |
| (See notes, ii, 2821.) | | | Freemans Run, Pa. | J-779 | i, 337 |
| Fox Cr., Nebr. and Kans. | GG-1148 | i, 1034 | Freeport (channel con- | | |
| Fox Cr., S. Dak. | GG-822 | i, 1031 | necting with Great | | |
| (See notes, ii, 2818.) | | | South B., N. Y.) | F-48-a | i, 227 |
| Fox Cr., Va. | EE-95 | i, 983 | Freeport Cr., Va. | K-241 | i, 375 |
| Foxhole Cr., Md. | J-332 | i, 333 | Freeport or Harraseeket | | |
| Fox Isld. | (HH) | i, 1073* | R., Me. | A-259 | i, 29 |
| (See notes, ii, 2827.) | | | Freeport, Pa. | FF-20 | i, 1015 |
| Fox Isld. Thoroughfare, | | | Free School Cr., Va. | K-291 | i, 375 |
| Me. | A-122 | i, 28 | Fremont Chan. and | | |
| Fox R. | (HH) | i, 1073* | McLeod Lake, Cal. | UU-38 | i, 1577 |
| (See notes, ii, 2827.) | | | French B., N. Y. | E-83 | i, 177 |
| Fox R. and Portage Ca- | | | French Broad and Little | | |
| nal, Wis.: | | | Pigeon Rs., N. C. and | | |
| Bridges | | ii, 2169 | Tenn. | AA-112 | i, 872 |
| Fox R. and U. S. Canal, | | | French Broad and Little | | |
| Wis.: | | | Pigeon Rs., Tenn. | AA-112-c | i, 873 |
| Bridges | | ii, 2168, 2169 | French Broad R., N. C. | AA-112-b | i, 872 |
| Fox R., Highcliff H., Wis. | MM-21-e | i, 1316 | French Broad R., Tenn. | AA-18 | i, 855 |
| Fox R., Ill. | JJ-11 | i, 1234 | French Broad R., Tenn. | | |
| | NN-9 | i, 1349 | and N. C. | AA-112 | i, 849 |
| Fox R., Mo. | JJ-73 | i, 1234 | | AA-112-a | i, 872 |
| Fox R. (operating and | | | French Camp Slough, | | |
| care of locks and dams), | | | Cal. | UU-34 | i, 1577 |
| Wis. | MM-15-b | i, 1314 | French Cr., Pa. | FF-20 | i, 1015 |
| Fox R., Stockbridge H., | | | French Cr., Pa. and N. Y. | FF-36 | i, 1003 |
| Wis. | MM-21-c | i, 1316 | French Cr., Va. | K-242 | i, 375 |
| Fox R., Wis. | KK-7 | i, 1247 | French Cr., W. Va.: | | |
| | MM-15 | i, 1297 | Bridges | | ii, 2169 |
| Appro. | | ii, 2298 | French Cr., Wyo. | GG-1047 | i, 1033 |
| Bridges | | ii, 2168-2169, 2240 | (See notes, ii, 2820.) | | |
| Dams, private. | | ii, 2249 | French Isld. | (CC) | i, 909* |
| Harbor lines. | | ii, 2255 | Frenchman Cr. | (HH) | i, 1073* |
| Navigation rules. | | ii, 2041, 2107 | Frenchmans B., Me. | A-43 | i, 27 |
| Fox R., Wis., Lake Winne- | | | Frenchmans Cr., Mont. | GG-427 | i, 1028 |
| bago. | MM-21-a | i, 1316 | Frenchmans Cr., Mont. | | |
| Fraleigh Cr., Ky. | DD-108 | i, 960 | and Canada: | | |
| Frankford Cr., Pa. | H-18 | i, 271, 288 | (See notes, ii, 2815.) | | |
| Appro. | | ii, 2290 | Frenchs Beach H., Me. | A-140 | i, 42 |
| Bridges | | ii, 2169, 2230 | Frenchs Beach H. (Duck | | |
| Wrecks | | ii, 2268 | Trap H.), Me. | A-140 | i, 28 |
| Frankfort H., Mich. | OO-53 | i, 1377, 1409 | Frenchs Cr., N. C. | M-292 | i, 456 |
| Appro. | | ii, 2298 | Frene Cr., Mo. | GG-1539 | i, 1037 |
| Navigation rules. | | ii, 2041, 2107 | (See notes, ii, 2824.) | | |
| Wrecks | | ii, 2268 | Fresh Cr., N. Y. | F-94 | i, 216 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------|----------------------|-------------------|---------------------------|---------------------|-------------------|
| Fresh Kills, N. Y..... | G-28..... | i, 247 | Fridges Cr., W. Va..... | EE-50..... | i, 983 |
| Fresh Water Bayou, La.... | S-741..... | i, 687 | Friggitt Br., Ky..... | DD-164..... | i, 980 |
| Freshwater Slough, Cal.... | TT-181..... | i, 1556 | Fullards Cr., N. C..... | M-304..... | i, 456 |
| Fresno Slough, Cal..... | UU-30..... | i, 1577 | Fulton..... | (CC)..... | i, 909* |
| Friar Roads, Me..... | A-4..... | i, 27 | | (HH)..... | i, 1074* |
| Friar Pt..... | (HH)..... | i, 1073* | (See notes, ii, 2808.) | | |
| Friday Cap Cr., Ga..... | O-413..... | i, 536 | Fulton, Ark. (above), Red | | |
| Friday Cr., Ga..... | O-119..... | i, 534 | R..... | X-28-e..... | i, 101 |
| Friendship H., Me..... | A-161..... | i, 28 | Fulton, Ark. (above), Red | | |
| Fritz Isld..... | (HH)..... | i, 1073* | R., La. and Ark..... | X-28-c..... | i, 797 |
| Frog Cr., Mich..... | PP-101..... | i, 1420 | Fulton, Ark. (below), Red | | |
| Frog Mortar Cr., Md..... | J-1058..... | i, 339 | R..... | X-28..... | i, 785 |
| Frontenac..... | (HH)..... | i, 1074* | Fulton Cr., Ohio..... | DD-464..... | i, 962 |
| Frontiers: | | | Fulton, Miss., to Walkers | | |
| Defenses..... | ii, 1810, 1818, 2279 | | Br., Tombigbee R..... | R-23-i..... | i, 657 |
| Frontiers, Mexican..... | ii, 2041, 2120 | | Fulton to Columbus, | | |
| Front R., Ga..... | O-202..... | i, 534 | Miss., Tombigbee R..... | R-23-f..... | i, 656 |
| Front Wye R., Md..... | J-880..... | i, 334 | Fulton to head of Atcha- | | |
| Frost Slough, Cal..... | TT-87..... | i, 1555 | talaya..... | X-28-d..... | i, 799 |
| Frowlands Cr., N. C..... | M-243..... | i, 456 | Funks Bayou, La.: | | |
| Frozen Cr., Ky..... | DD-167..... | i, 960 | (See notes, ii, 2805.) | | |
| Froze to Death Cr., Mont. | GG-647..... | i, 1030 | Furlong Cr., S. Dak..... | GG-302..... | i, 1027 |
| (See notes, ii, 2817.) | | | Furnace Brook, N. Y..... | E-33..... | i, 177 |
| Fryingpan Cove, Md..... | J-488..... | i, 334 | Furnace Cr., Md..... | J-1158..... | i, 339 |
| Frying Pan Cr., Va..... | DD-266..... | i, 961 | Fusil Bayou, La..... | S-175..... | i, 682 |
| Frying Pan (The), N. C.... | M-11..... | i, 454 | Fuslier Bayou, La..... | S-647..... | i, 686, 707 |
| | | | | S-726..... | i, 687 |

G.

| | | | | | |
|----------------------------|----------------|---------------|--------------------------|-------------|--------|
| Gahanna Cr., Ohio..... | DD-456..... | i, 962 | Galloway Cr., Md..... | J-1057..... | i, 339 |
| Gaines Cr., Md..... | J-240..... | i, 332 | Galloway Run, Md..... | J-305..... | i, 333 |
| Gaines, Fort..... | ii, 1801, 1970 | | Galloways Cr., N. C..... | M-49..... | i, 454 |
| Gakona R., Alaska..... | XX-143..... | i, 1656 | Galveston and Brazos | | |
| Galena..... | (HH)..... | i, 1074* | Canal, Tex..... | U-38-c..... | i, 758 |
| Galena R..... | (HH)..... | i, 1074* | Galveston and Brazos | | |
| Galena R., Ill..... | JJ-24..... | i, 1234, 1241 | Canal, Tex. (operating | | |
| | JJ-24-a..... | i, 1241 | and care)..... | U-38-d..... | i, 758 |
| Appro..... | ii, 2297 | | Galveston B.-Ship Chan., | | |
| Bridges..... | ii, 2170 | | Tex..... | U-26-a..... | i, 741 |
| Navigation rules..... | ii, 2041, 2107 | | Galveston B., Tex..... | U-5..... | i, 735 |
| Galena R., Ill. (operating | | | Appro..... | ii, 2295 | |
| and care)..... | JJ-24-b..... | i, 1242 | Bridges..... | ii, 2170 | |
| Gales Cr., La..... | S-272..... | i, 683 | Harbor lines..... | ii, 2255 | |
| Gales Cr., Md..... | J-56..... | i, 331 | Wrecks..... | ii, 2268 | |
| | J-1275..... | i, 340 | Galveston B. to Brazos | | |
| Gales Cr., N. C..... | M-131..... | i, 455 | R., Tex. (channel be- | | |
| | M-280..... | i, 456 | tween)..... | U-38-b..... | i, 757 |
| Gallards Lake, Miss..... | S-290..... | i, 683 | Galveston B. to Sabine | | |
| Gallatin R..... | (GG-2)..... | i, 1038* | Lake, Tex..... | U-7..... | i, 737 |
| Gallatin R., Mont..... | GG-529..... | i, 1029 | Galveston B. tributaries | | |
| (See notes, ii, 2816.) | | | (West Galveston B. | | |
| Gallinas Cr., Cal..... | TT-125..... | i, 1556 | Chan., Turtle Bayou, | | |
| Bridges..... | ii, 2170 | | Trinity R., Anahuac | | |
| Gallinipper Cr., Mo..... | GG-1468..... | i, 1036 | Chan., Oyster Cr., Ce- | | |
| (See notes, ii, 2824.) | | | dar, Chocolate, and | | |
| Gallipolis..... | (CC)..... | i, 909* | Bastrop Bayous), Tex., | | |
| Gallons Cr., Mo..... | GG-71..... | i, 1025 | including mouths of | | |
| Galloway Cr., Ky..... | AA-271..... | i, 850 | adjacent streams..... | U-5-a..... | i, 736 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|----------------------------|-------------------|--|---------------------|-------------------|
| Galveston Chan., Tex. | U-30-b..... | i, 715 | Gasparilla Sound and Lemon B., Fla., includ- ing cut-off. | P-264-a..... | i, 596 |
| Galveston H., Tex. | U-2-b..... | i, 735 | Gasparilla Sound, Fla. | P-264..... | i, 571 |
| | U-30..... | i, 735 | Bridges..... | | ii, 2170 |
| | U-30-a..... | i, 747 | Gaudalupe R., Cal.: | | |
| Galveston, Tex.: | | | Dams, private..... | | ii, 2249 |
| (See notes, ii, 2807.) | | | Gauging (WW-2)..... | | i, 1617* |
| Appro..... | ii, 2287, 2295 | | Great Lakes..... | | ii, 2041, 2131 |
| Forts..... | ii, 1796, 1808, 1823, 1984 | | Gauging, Mississippi R. | | |
| Harbor lines..... | ii, 2255 | | (see Mississippi R.): | | |
| Navigation rules..... | ii, 2041, 2107 | | Appro..... | | ii, 2279 |
| Wrecks..... | ii, 2268 | | Gauley R., W. Va. | EE-114..... | i, 984, 995 |
| Galveston H. to Texas | | | Appro..... | | ii, 2296 |
| City, Tex. (channel) | U-29-a..... | i, 746 | Bridges..... | | ii, 2170 |
| Appro..... | | ii, 2295 | Gay Head, Mass.: | | |
| Galveston Isld., Tex. (east end) | U-30-d..... | i, 754 | Wrecks..... | | ii, 2268 |
| Galveston Ship Chan., Tex. | U-26..... | i, 740 | Gazeland Bayou, La. | S-360..... | i, 684 |
| | U-26-c..... | i, 743 | Geanquakin Cr., Md. | J-76..... | i, 331 |
| Appro..... | | ii, 2295 | Geary Millpond, Md. | J-295..... | i, 333 |
| Galveston, Tex., District.. | U(with map)..... | i, 731, 735 | Gedney Chan., N. Y. | F-105-c, d, f..... | i, 236 |
| (See notes, ii, 2807.) | | | Gedney Chan., New York, N. Y. (see New York, N. Y.): | | |
| Appro..... | | ii, 2295 | Wrecks..... | | ii, 2268 |
| Galveston, Tex. (sea wall, etc.) | U-30-c..... | i, 753 | Generals Cut, Ga. | O-230..... | i, 534 |
| Galveston to Port Bol- var, Tex. (channel) | U-3..... | i, 736 | Genesee R., N. Y. | RR-40..... | i, 1493 |
| Appro..... | | ii, 2295 | | RR-39..... | i, 1518 |
| Gamble Run, Pa. | J-763..... | i, 336 | | RR-40-a..... | i, 1520 |
| Game Cock Lake, Ga. | O-242..... | i, 534 | Appro..... | | ii, 2299 |
| Gans Cr., Mo. | GG-81..... | i, 1025 | Bridges..... | | ii, 2170 |
| Gap Cr., Tenn. | AA-114..... | i, 849 | Genesee R. to Oswego R., N. Y. (harbors between) | RR-40-b..... | i, 1520 |
| Garbacon Cr., N. C. | M-212..... | i, 455 | Geneva (HH)..... | | i, 1074* |
| Garcla R., Cal. | TT-138..... | i, 1556 | Genoa (HH)..... | | i, 1074* |
| Gar Cr., Kans. | GG-1280..... | i, 1035 | Gentilly Bayou, La.: | | |
| (See notes, ii, 2822.) | | | (See notes, ii, 2804.) | | |
| Garden Cove, Fla. | P-180..... | i, 570 | Geodetic Survey, Coast and: | | |
| Garden Cr., S. Dak. | GG-902..... | i, 1032 | Index checked with data of..... | | i, 13 |
| (See notes, ii, 2819.) | | | Geographical Survey | | ii, 2041, 2120 |
| Garden Cr., Va. | K-258..... | i, 375 | Geographical explorations | | ii, 2040, 2086 |
| Garden Fork, Va. | DD-276..... | i, 961 | Geological maps | | ii, 2040, 2088 |
| Garden Isld. B., La. | S-221..... | i, 683 | Geological surveys | | ii, 2041, 2120 |
| Garden Keys, Fla.: | | | George Cr., Pa. | J-880..... | i, 337 |
| Forts..... | | ii, 1955 | George Cr., Va. | DD-262..... | i, 961 |
| Gardiners B., N. Y. | F-30..... | i, 215 | Georges Cr., Md. | J-1020..... | i, 338 |
| Gardiners Cr., N. C. | L-396..... | i, 414 | Georges Cr., Ky. | DD-229..... | i, 960 |
| Gardner Cr., Pa. | J-627..... | i, 335 | Georges Cr., S. C. | N-184..... | i, 500 |
| Gardner R., Wyo. | GG-528..... | i, 1029 | Georges Cr., Va. | K-165..... | i, 374 |
| (See notes, ii, 2816.) | | | Georges Cr., W. Va. | EE-131..... | i, 984 |
| Gargathy Inlet, Va. | I-87..... | i, 299 | Georges Cut, Ga. | O-332..... | i, 535 |
| Garritson Cr., N. Y. | F-99..... | i, 216 | Georges Isld.: | | |
| Gary H., Ind. | NN-22-b..... | i, 1368 | Forts..... | | ii, 1855 |
| Gasconade (GG-2)..... | | i, 1038* | Georges R., Me.: | | |
| Gasconade R., Mo. | (GG-2)..... | i, 1037* | Appro..... | | ii, 2287 |
| | GG-1517..... | i, 1037, 1065 | Georges R., Me., Thomas- ton H. | A-155-a..... | i, 46 |
| (See notes, ii, 2824, 2826.) | | | Georgetown H., D. C. | K-46-i..... | i, 385 |
| Appro..... | | ii, 2297 | Georgetown H., S. C. | N-99..... | i, 499 |
| Bridges..... | | ii, 2170 | Appro..... | | ii, 2292 |
| Gaskeys Cr., Md. | J-940..... | i, 338 | Forts..... | | ii, 1949 |
| Gasoline launches, Ist. | | ii, 2349 | Harbor lines..... | | ii, 2255 |
| Gasparilla Pass, Fla. | P-266..... | i, 571 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|----------------------------|-------------------|---|---------------------|-------------------|
| Georgetown H., S. C., | | | Glasscox (HH): | | |
| Sampit R. | N-99..... | i, 511 | (See notes, ii, 2827.) | | |
| Georgetown Reservoir, D. | | | Glebe (The) Cr., Md. | J-1257..... | i, 340 |
| C.: | | | Glebe (The), Va. | K-131..... | i, 374 |
| Remodeling..... | ii, 2040, 2085 | | Glen Cove H. (Clam Cove), | | |
| Georgia | (CC)..... | i, 909* | Me. | A-144..... | i, 28 |
| Forts | ii, 1796, 1803, 1816, 1948 | | Glen Cove H., Me. | A-144..... | i, 44 |
| Georgia Canal, Rome to | | | Glen Cove H., N. Y. | F-11..... | i, 218 |
| Macon, Ga. | O-326-b..... | i, 557 | Appro. | ii, 2289 | |
| Georgiana Slough, Cal. | UU-52..... | i, 1577, 1585 | Wrecks | ii, 2268 | |
| (See notes, ii, 2840.) | | | Glen Cove, N. Y. | F-11..... | i, 215 |
| Bridges | ii, 2170 | | Glendive Cr., Mont. | GG-744..... | i, 1030 |
| German Branch, Md. | J-299..... | i, 333 | (See notes, ii, 2818.) | | |
| German Cr., Tenn. | AA-144..... | i, 849 | Glen Fork, W. Va. | EE-38..... | i, 983 |
| Germantown B., N. C. | M-41..... | i, 454 | Glenhaven | (HH)..... | i, 1074* |
| Germany Cr., Ga. | O-48..... | i, 533 | Glenns Cr., Ky. | DD-188..... | i, 960 |
| Gerome | (WW-2)..... | i, 1617* | Glenora | (HH)..... | i, 1074* |
| Gerrish Isld, Me.: | | | Glen Osborne, Pa.: | | |
| Forts | ii, 1851 | | Harbor lines | ii, 2255 | |
| Gibson Cr., Mont. | GG-461..... | i, 1028 | Globe Cr., Md. | J-372..... | i, 333 |
| (See notes, ii, 2816.) | | | Gloucester H., Mass. | B-83..... | i, 69, 78 |
| Gibsons Landing | (HH)..... | i, 1074* | (See notes, ii, 2784.) | | |
| Giddy Swamp, S. C. | N-230..... | i, 500 | Appro. | ii, 2288 | |
| Gifford | (WW-2)..... | i, 1617* | Gloucester H. to Annls- | | |
| Gila R., Ariz. | SS-2..... | i, 1453 | quam R., Mass.: | | |
| Gilbert | (HH)..... | i, 1074* | Bridges | ii, 2170 | |
| Gilbert Cr., Minn. | JJ-37..... | i, 1234 | Glover Cr., N. C. | M-232..... | i, 456 |
| Gilbert Cr., W. Va. | EE-23..... | i, 983 | Glovers Cut, N. C. | L-268..... | i, 413 |
| Gilbert Islds | (HH)..... | i, 1074* | Gnat Cr., Oreg. | WW-14..... | i, 1615 |
| Gilbert R. | (WW-2)..... | i, 1617* | Goat Cr., Fla. | P-122..... | i, 570 |
| Gilbert R., Oreg. | WW-27..... | i, 1615 | Goat Isld. | (HH)..... | i, 1074* |
| Gilberts Bar, Fla. | P-125..... | i, 570 | Goat Isld., Cal.: | | |
| Giles Bend | (HH)..... | i, 1074* | Forts | ii, 1814 | |
| Gilkey H., Me. | A-132..... | i, 28 | Goble | (WW-2)..... | i, 1617* |
| Gilkys Cr., S. C. | N-165..... | i, 500 | Godfreys B., Va. | K-247..... | i, 375 |
| Gill Cr., S. C. | N-146..... | i, 500 | Godfreys Cr., N. C. | M-201..... | i, 455 |
| Gill Cr. to Tonawanda, | | | Godfreys Cr., Va. | L-244..... | i, 413 |
| N. Y. | RR-15-c..... | i, 1511 | Godsey Cr., Va. | K-274..... | i, 375 |
| Gillis Cr., Va. | L-144..... | i, 412 | Goethals, Gen. G. W.: | | |
| Gillis Falls, Md. | J-1145..... | i, 339 | Isthmian Canal reports, index to | i, 10 | |
| Gilpatrick's Cove, Me.: | | | Gogomain R., Wash. | PP-20..... | i, 1419 |
| Bridges | ii, 2170 | | Goin Moores Cr., S. C. | N-157..... | i, 500 |
| Gilsurs Cr., Ga. | O-451..... | i, 536 | Golconda | (CC)..... | i, 909* |
| Gineatic Cr., Va. | K-197..... | i, 374 | Gold Dust | (HH)..... | i, 1074* |
| Gingerville Cr., Md. | J-1250..... | i, 340 | Goideb Grove Cr., S. C. | N-178..... | i, 500 |
| Gisasa R., Alaska | XX-236..... | i, 1657 | Golden Gate, Cal. | TT-15-a..... | i, 1558 |
| Gitchell Cr., Cal. | TT-157..... | i, 1556 | (See notes, ii, 2840.) | | |
| Gittings Cr., N. C. | M-150..... | i, 455 | Golden Lake | (HH)..... | i, 1074* |
| Givans Cr., N. Y.: | | | Goldsboro Cr., Md. | J-325..... | i, 333 |
| Harbor lines | ii, 2255 | | J-373 | i, 333 | |
| Givens Branch, Md. | J-27..... | i, 331 | Goodbys Lake, Fla.: | | |
| Glade Cr., Tex.: | | | Bridges | ii, 2170 | |
| (See notes, ii, 2805.) | | | Goodfield Cr., Tenn. | AA-79..... | i, 848 |
| Glade Cr., W. Va. | EE-81..... | i, 983 | Goodhands Cr., Md. | J-399..... | i, 334 |
| Glade Run, Pa. | J-720..... | i, 336 | Goodland Swamp, S. C. | N-237..... | i, 501 |
| Gladstone H., Mich. | MM-5-a..... | i, 1298 | Goodman Cr., Wash. | XX-31..... | i, 1655 |
| Appro. | ii, 2298 | | Goodpastor B., Alaska | XX-202..... | i, 1656 |
| Glaise, Bayou des, La.: | | | Goodsbys Cr., Fla. | P-78..... | i, 569 |
| (See notes, ii, 2804.) | | | Goodwin Run, Md. | J-1036..... | i, 338 |
| Glasgow | (GG-2)..... | i, 1038* | Goodwives Cr., Conn. | D-87..... | i, 141 |
| Glasgow Reach | (GG-2)..... | i, 1038* | (See notes, ii, 2788.) | | |
| Glasscock Isld. | (HH)..... | i, 1074* | Goodyear Contracts: | | |
| | | | Brunswick Bar, Ga. | ii, 2282 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|--|---------------------|----------------------|
| Goodyear Slough, Cal. | TT-102 | i, 1555 | Gouldsborough H., Me. | A-38 | i, 27 |
| Goose B., N. Y. | RR-68 | i, 1493 | Goulds Marsh Chan., Va. | L-31 | i, 411 |
| Goose B., Vt. | E-127 | i, 178 | Government Printing Of- fice, Washington, D. C.: | | |
| Gooseberry Cr., Wyo. | GG-684 | i, 1030 | Building | | ii, 2039, 2065 |
| (See notes, ii, 2817.) | | | Governors Isld. and Bat- tery, New York H., N. Y. | | |
| Gooseberry R., Lake Su- perior: | | | (channel between) | F-105-L | i, 241 |
| Reef | | ii, 2041, 2121 | Governors Isld., N. Y. | F-105-L | i, 241 |
| Goose Cr., Colo.: | | | Governors Isld., New York, N. Y.: | | |
| (See notes, ii, 2820.) | | | Appro. | | ii, 2286 |
| Goose Cr., Kans. | GG-1339 | i, 1035 | Enlargement | | ii, 2041, 2134 |
| (See notes, ii, 2822.) | | | Forts | | ii, 1807, 1855, 1881 |
| Goose Cr., Ky. | DD-34 | i, 959 | Governors Run, Md. | K-6 | i, 373 |
| Goose Cove, Md. | J-484 | i, 334 | Gowanus B. Chans., New York H., N. Y.: | F-105-h | i, 239 |
| Goose Cove, Mass. | B-72 | i, 69 | Gowanus B., N. Y.: | | |
| Goose Cr., Md. | J-66 | i, 331 | Harbor lines | | ii, 2255 |
| | J-74 | i, 331 | Gowanus B., New York H., N. Y. | F-105 | i, 239 |
| | J-171 | i, 332 | Gowanus Canal, N. Y. | F-107 | i, 216 |
| | J-181 | i, 332 | Bridges | | ii, 2170 |
| | J-263 | i, 333 | Wrecks | | ii, 2268 |
| | K-76 | i, 373 | Gowanus Cr. Chan., New York H., N. Y. | F-105-i | i, 240 |
| Goose Cr., N. C. | L-334 | i, 413 | Gowanus Cr., N. Y. | F-106 | i, 216, 242 |
| | M-10 | i, 454 | Grace Cr., Md. | J-343 | i, 333 |
| | M-113 | i, 455 | Gracies Cr., Tex.: | | |
| | M-166 | i, 455 | (See notes, ii, 2805.) | | |
| | M-283 | i, 456 | Granary Cr., Md. | J-389 | i, 334 |
| Goose Cr., S. C. | N-213 | i, 500 | Grafton | (HH) | i, 1074* |
| Goose Cr., Va. | L-374 | i, 414 | Grahams Lake, Ga. | O-341 | i, 535 |
| Goose Cr., W. Va. | EE-183 | i, 984 | Granby to Columba, Congaree R. | N-141-b | i, 516 |
| Goose-Fair B., Me. | A-272 | i, 29 | Grand Anglaise Cr., Mo. | GG-1509 | i, 1036 |
| Goose-Fair Cr., Me. | A-273 | i, 29 | (See notes, ii, 2824.) | | |
| Goose Isld. H. | (HH) | i, 1074* | Grand B., Ala. | R-60 | i, 646 |
| Goose Isld. | (WW-2) | i, 1617* | Grand B., La. | S-202 | i, 682 |
| Goose or Lost Park Cr., Colo. | GG-1093 | i, 1033 | Grand Bayou, La. | S-154 | i, 682 |
| Goose Pond, Md. | J-1204 | i, 340 | | S-230 | i, 683 |
| Goose Rapids, Red R. of the North. | KK-170-b | i, 1258 | | S-330 | i, 683 |
| Goose R., N. Dak. | KK-185 | i, 1248 | | S-353 | i, 684 |
| Goose Rock Passage, Me. | A-214 | i, 28 | | S-376 | i, 684 |
| Gordons Cr., Cal. | TT-152 | i, 1556 | | S-388 | i, 684 |
| Gordons Cr., Nebr. | GG-925 | i, 1032 | | S-436 | i, 685 |
| (See notes, ii, 2819.) | | | | S-447 | i, 685 |
| Gordons Cr., Va. | L-119 | i, 412 | | S-510 | i, 685 |
| Gordons Ferry | (HH) | i, 1074* | | S-529 | i, 685 |
| Gordons Landing, Vt. | E-81 | i, 177 | | S-633 | i, 686 |
| Appro. | | ii, 2289 | Bridges | | ii, 2170 |
| Gordons Landing, Vt. (breakwater) | E-81 | i, 203 | Grand Callow Bayou, La. | S-466 | i, 685, 701 |
| Gordons Pass, Fla. | P-218 | i, 570 | Grand Cairo | (HH) | i, 1074* |
| Gorges, Fort, Me. | | ii, 1804, 1841 | (See notes, ii, 2827.) | | |
| Gorsuch Cr., Md. | J-1089 | i, 339 | Grand Calumet R., Ill. and Ind. | NN-18 | i, 1364 |
| Goshen Cr., N. J. | I-30 | i, 299, 305 | Bridges | | ii, 2171 |
| Appro. | | ii, 2290 | Grand Cane Bayou, La. | T-2-mm | i, 717 |
| Gosport H., Me. | A-291 | i, 29 | (See notes, ii, 2805.) | | |
| Goula Bayou, La. | S-520 | i, 685 | Grand Chain | (CC) | i, 909* |
| Gould Cr., Ga. | O-180 | i, 534 | Grand Coquille B., La. | S-201 | i, 682 |
| Goulden Cr., Mont. | GG-595 | i, 1029 | Grand Cutoff Bayou, La. | S-292 | i, 683 |
| (See notes, ii, 2817.) | | | | | |
| Gould Lake, Minn. | | | | | |
| Bridges | | ii, 2238 | | | |
| Gouldsboro. | (HH) | i, 1074* | | | |
| Gouldsborough B., Me. | A-35 | i, 27 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------|---------------------|-------------------|------------------------------|---------------------|-------------------|
| Grande Bayou..... | (HH).....i, | 1071* | Grand R., Iowa and Mo.. | GG-133.....i, | 1026 |
| Grande Bayou, Fla..... | Q-45.....i, | 611 | | S-507.....i, | 685 |
| Bridges..... |ii, | 2171 | | S-514.....i, | 685 |
| Grand Encampment Cr., | | | | S-515.....i, | 685 |
| Wyo. and Colo..... | GG-1025.....i, | 1033 | | S-516.....i, | 685 |
| (See notes, ii, 2820.) | | | | S-517.....i, | 685 |
| Grande Ronde R., Oreg. | | | Grand R., La..... | S-522.....i, | 685 |
| and Wash..... | VV-85.....i, | 1593 | | (GG-2).....i, | 1038* |
| Grand Felicity Bayou, | | | Navigation rules..... |ii, | 2041, 2107 |
| La..... | S-437.....i, | 685 | Wrecks..... |ii, | 2268 |
| Grand Gulf..... | (HH).....i, | 1074* | Grand R., Mich..... | OO-25.....i, | 1377, 1393 |
| Grand Haven H., Mich... | OO-24.....i, | 1390 | (See notes, ii, 2838.) | | |
| Appro..... |ii, | 2298 | Appro..... |ii, | 2298 |
| Navigation rules..... |ii, | 2041, 2107 | Bridges..... |ii, | 2170 |
| Grand Haven, Mich..... | OO-24.....i, | 1377 | Grand R., Mo..... | (GG-2).....i, | 1037* |
| Grand Isld..... | (GG-2).....i, | 1038* | | GG-133.....i, | 1059 |
| | (HH).....i, | 1074* | | GG-1465.....i, | 1036 |
| Grand Isld. Pass, Miss. | | | (See notes, ii, 2824.) | | |
| and La..... | R-95.....i, | 646 | Bridges..... |ii, | 2170 |
| Grand Isle, Adams (To- | | | Grand R., Mo. and Iowa: | | |
| blas) Landing, Vt..... | E-82.....i, | 203 | (See notes, ii, 2813, 2814.) | | |
| Grand Lake..... | (HH).....i, | 1074* | Grand R. H., Ohio..... | QQ-28.....i, | 1482 |
| Grand Lake (canal con- | | | Appro..... |ii, | 2299 |
| necting with, at Cha- | | | Grand R., Ohio..... | QQ-29.....i, | 1461, 1485 |
| renton, La.)..... | S-642-b.....i, | 707 | Bridges..... |ii, | 2170 |
| Grand Lake, La..... | S-191.....i, | 682 | Wrecks..... |ii, | 2268 |
| | S-617.....i, | 686, 705 | Grand R., Okla..... | Y-2-c.....i, | 820 |
| | S-751.....i, | 687 | Grand R., Okla. and | | |
| Wrecks..... |ii, | 2268 | Kans..... | Y-9.....i, | 818 |
| Grand Lizard Bayou, La. | S-317.....i, | 683 | Grand R., S. Dak..... | GG-795.....i, | 1031 |
| Grand Marais Bayou, La. | S-757.....i, | 687 | (See notes, ii, 2818.) | | |
| Grand Marais H., Minn.. | LL-9.....i, | 1265, 1266 | Grand R., Utah..... | SS-6.....i, | 1544 |
| Grand Marais, Mich..... | LL-58.....i, | 1265 | Grand R., Utah and Colo. | SS-6.....i, | 1543 |
| (See notes, ii, 2835.) | | | Grand Tower..... | (HH).....i, | 1074* |
| Appro..... |ii, | 2298 | Grand Traverse B., Mich.. | OO-55.....i, | 1377 |
| Compass variations..... |ii, | 2041, 2121 | | OO-55-a.....i, | 1411 |
| Wrecks..... |ii, | 2268 | Grand Traverse B., Mich., | | |
| Grand Marais, Mich. | | | Torch Lake, Mich..... | OO-55-b.....i, | 1411 |
| (harbor of refuge)..... | LL-9-b.....i, | 1267 | Granite Lake, Minn. and | | |
| Grand Marais R., Minn.. | KK-201.....i, | 1248 | Canada..... | KK-240.....i, | 1249 |
| Grand Pass..... | (HH).....i, | 1074* | Granite Branch, Md..... | J-1118.....i, | 339 |
| Grand Pass, La..... | S-307.....i, | 683 | Grant Bayou, La..... | S-266.....i, | 683 |
| Grand Pass to New Or- | | | Grant Cr., Minn..... | KK-93.....i, | 1248 |
| leans, Barataria B., La. | S-339.....i, | 698 | Grant Line Canal, Cal.... | UU-21.....i, | 1577 |
| Grand Portage and Wans- | | | Grant R..... | (HH).....i, | 1074* |
| Wau-Golsing B., Minn. | | | Grant R., Wis..... | KK-4.....i, | 1247 |
| (harbor of refuge)..... | LL-5.....i, | 1265 | Grants Cr., Ga..... | O-424.....i, | 536 |
| Grand Portage B., Minn.. | LL-5.....i, | 1265 | Grants Pass, Ala..... | R-52.....i, | 646 |
| Grand Rapids..... | (HH).....i, | 1074* | Grape Isld..... | (CC).....i, | 909* |
| | (WW-2).....i, | 1617* | Grapevine Cr., Ky..... | DD-151.....i, | 960 |
| (See notes, ii, 2827, 2833.) | | | | DD-281.....i, | 961 |
| Grand Rapids, Mich.: | | | Grasse R., N. Y..... | RR-75.....i, | 1493, 1538 |
| (See notes, ii, 2838.) | | | Appro..... |ii, | 2299 |
| Appro..... |ii, | 2298 | Bridges..... |ii, | 2171 |
| Harbor lines..... |ii, | 2255 | Grasshopper Cr., Kans... | GG-1204.....i, | 1034 |
| Grand Rapids, Mich. (be- | | | (See notes, ii, 2821.) | | |
| low), Grand R..... | OO-25.....i, | 1393 | Grasshopper Cr., Mont... | GG-519.....i, | 1029 |
| Grand Rapids, Mich., Dis- | | | (See notes, ii, 2816.) | | |
| trict..... | OO(with map).....i, | 1375 | Grasshopper Cr., Tenn... | AA-66.....i, | 848 |
| |1377 | | Grassy Bayou, La..... | S-463.....i, | 685 |
| (See notes, ii, 2838.) | | | Grassy Branch, Ky..... | DD-94.....i, | 959 |
| Grand R. Bayou, La..... | S-298-a.....i, | 695 | Grassy Cr., Va..... | L-382.....i, | 414 |
| | | | | DD-272.....i, | 961 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|---------------------|-------------------|
| Grassy Flats..... | (CC)..... | i, 909* | Grays Run, Pa..... | J-744..... | i, 336 |
| Grassy, Ky..... | DD-197..... | i, 960 | Grayston Cr., W. Va..... | DD-333..... | i, 961 |
| Grassy Lake, La..... | S-505..... | i, 685 | Greasy Cr., Ky..... | AA-286..... | i, 850 |
| | S-619..... | i, 686 | | DD-79..... | i, 959 |
| Grassy Pt., Minn.: Harbor lines..... | | ii, 2255 | | DD-254..... | i, 961 |
| Grassy Sound Chan., N. J.: Bridges..... | | ii, 2171, 2212 | Greasy Cr., Mo..... | DD-288..... | i, 961 |
| Wrecks..... | | ii, 2268 | | GG-1515..... | i, 1036 |
| Gratiot, Fort..... | | ii, 1992 | (See notes, ii, 2824.) | | |
| Gravel Bottom Cr., Mont. | GG-493..... | i, 1029 | Greasy Grass R., Mont... | GG-703..... | i, 1030 |
| (See notes, ii, 2816.) | | | (See notes, ii, 2817.) | | |
| Gravelly Branch, Del..... | J-124..... | i, 332 | Great Bart Cr., N. C..... | N-33..... | i, 499 |
| Gravelly Branch, Md..... | J-280..... | i, 333 | Great B., N. H..... | A-285..... | i, 29 |
| | J-286..... | i, 333 | Great B., N. J..... | I-13..... | i, 299 |
| Gravel Run, Md..... | J-268..... | i, 333 | | I-9-a..... | i, 301 |
| Gravens Thoroughfare, N. J.: Bridges..... | | ii, 2171 | Great B. to Cape May, N. J..... | I-13-a..... | i, 302 |
| Graves Bayou..... | (HH)..... | i, 1074* | Great Bend, Kans..... | Y-2-c..... | i, 820 |
| Graves Bayou Crossing (HH): (See notes, ii, 2831.) | | | Great Bohemia Cr., Md..... | J-530..... | i, 335 |
| Graves Cr., Mo..... | GG-1427..... | i, 1036 | Great Britain: Lake Erie regulation..... | | ii, 2041, 2124 |
| (See notes, ii, 2823.) | | | Great Cacapon R., W. Va. | K-90-b..... | i, 389 |
| Gravesend B., N. Y..... | F-104..... | i, 216, 233 | Great Chan., N. J.: Bridges..... | | ii, 2171 |
| Harbor lines..... | | ii, 2255 | Great Chan., Va..... | L-9..... | i, 411 |
| Graveyard Cove, Md..... | J-476..... | i, 334 | Great Chazy R., N. Y..... | E-76..... | i, 177, 202 |
| Graveyard Cr., Md..... | J-935..... | i, 338 | Appro..... | | ii, 2289 |
| Graveyard Cr., Mont..... | GG-712..... | i, 1030 | Wrecks..... | | ii, 2268 |
| (See notes, ii, 2818.) | | | Great Cove, Md..... | J-176..... | i, 332 |
| Gray Cr., Mo..... | GG-1453..... | i, 1036 | Great Cr., Mass..... | B-189..... | i, 70 |
| Gray Goose Slough, Cal.. | TT-37..... | i, 1555 | Great Cr., Va..... | L-362..... | i, 414 |
| Grays B..... | (WW-2)..... | i, 1617* | Great Diamond Isld. and Peaks Isld., Me. (pas- sage between)..... | A-262-a..... | i, 55 |
| Grays B., Wash..... | WW-66..... | i, 1615 | Great Diamond Isld., Me.: Forts..... | | ii, 1841 |
| Grays Branch, Del..... | J-122..... | i, 332 | Great Drum Drain, Va..... | L-47..... | i, 411 |
| Grays Cr., Ga..... | O-43..... | i, 533 | Great Egg H. and Barne- gat Bs., N. J. (sound between)..... | I-2-a..... | i, 300 |
| Grays Cr., La..... | S-67..... | i, 681 | Great Egg H., N. J..... | I-21..... | i, 299 |
| Grays Cr., Md..... | J-1187..... | i, 340 | Bridges..... | | ii, 2171 |
| Grays Cr., Mo.: (See notes, ii, 2823.) | | | Great Egg H. Inlet, N. J.: Wrecks..... | | ii, 2268 |
| Grays Cr., Va..... | L-157..... | i, 412 | Great Falls..... | (GG-2)..... | i, 1038* |
| Grays H. and Bar En- trance, Wash..... | XX-13-a..... | i, 1659 | (See notes, ii, 2826.) | | |
| Grays H. and Chehalls R., Wash..... | XX-13-b..... | i, 1660 | Great Falls, D. C.: Fishways..... | | ii, 2040, 2071 |
| Grays H. to Cape Flat- tery, Wash..... | XX-24..... | i, 1655 | Great Falls, Mont..... | (GG-2)..... | i, 1037* |
| Grays H. to Puget Sound, Wash..... | XX-13-c..... | i, 1661 | Great Falls to Canyon next below Stubbs Fer- ry, Mont., Missouri R.... | GG-2-1..... | i, 1059 |
| Grays H., Wash..... | XX-13..... | i, 1655, 1659 | Great Falls to Three Forks, Mont., Missouri R..... | GG-2-1..... | i, 1059 |
| Appro..... | | ii, 2301 | Great H., Culebra Isld., P. R..... | YY-5-a..... | i, 1687 |
| Harbor lines..... | | ii, 2255 | Great Hell Gate, Me..... | A-211..... | i, 28 |
| Grays Inn Cr., Md..... | J-481..... | i, 334 | Great Isld., Me.: Bridges..... | | ii, 2212 |
| Grays Pt..... | (HH)..... | i, 1074* | Great Kanawha R. (see Kanawha R.)..... | (CC)..... | i, 909* |
| Grays Prong, Del. and Md..... | J-19..... | i, 331 | Bridges..... | | ii, 9171 |
| Grays R..... | (WW-2)..... | i, 1617* | | | |
| (See notes, ii, 2841.) | | | | | |
| Grays R., Wash..... | WW-67..... | i, 1615, 1651 | | | |
| Appro..... | | ii, 2300 | | | |
| Grays Run, Md..... | I-957..... | i, 338 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|----------------------|--|---------------------|-------------------|
| Great Kills H., N. Y. | G-24 | i, 253 | Great Sodus B., N. Y. | RR-44 | i, 1493 |
| Great Kills, N. Y. | G-24 | i, 247 | Great Sodus H., N. Y. | RR-44 | i, 1522 |
| Great Lakes (see North and Northwestern Lakes) | | | Appro. | | ii, 2299 |
| Appro. | | ii, 2041, 2122 | Great South B., N. Y. | F-48 | i, 215, 226 |
| Description | | ii, 2041, 2124 | (See notes, ii, 2792.) | | |
| Discharge | | ii, 2041, 2124 | Appro. | | ii, 2289 |
| Levels | | ii, 2041, 2124, 2132 | Wrecks | | ii, 2268 |
| Meteorology | | ii, 2041, 2132 | Great South B., N. Y. (channel connecting with Freeport) | F-48-a | i, 227 |
| Outlets, gauging | | ii, 2041, 2131 | Great South B., Jamaica B., and Peconic B., N. Y. (waterway connect- ing) | F-48-b | i, 227 |
| Ports, forts | | ii, 1823 | Great Thorofare, Va. | J-44 | i, 331 |
| Ship channel | | ii, 2299 | Great Wicomico R., Va. | K-137 | i, 374, 397 |
| Surveys | | ii, 2041, 2123, 2124 | Great Works R., Me. | A-283 | i, 29 |
| Valley of, outflow, etc. | | ii, 2041, 2132 | Green and Barren Rs., Ky.: | | |
| Great Lakes (ship chan- nel connecting waters of) | PP-1-a | i, 1420 | Navigation rules | | ii, 2041, 2107 |
| Great Lakes (ship canal to Hudson R.) | RR-19-d | i, 1513 | Green and Barren Rs., Ky. (locks and dams, care and operating) | BB-7-d | i, 895 |
| Great Lakes system | | i, 20 | Green B. H., Wis. | MM-14 | i, 1297, 1304 |
| Great Lakes to Hudson R.: | | | Appro. | | ii, 2298 |
| Appro. | | ii, 2299 | Harbor lines | | ii, 2255 |
| Great Lakes to New York City | RR-19-c | i, 1512 | Wrecks | | ii, 2268 |
| Appro. | | ii, 2299 | Green B., Mich.: | | |
| Great Machipongo Inlet, Va. | L-24 | i, 411 | Forts | | ii, 1805 |
| Great Machipongo R., Va. | L-25 | i, 411 | Green B., Mich. and Wis. | MM-3 | i, 1297 |
| Great Marsh Cr., Md. | J-211 | i, 332 | Green B., Va. | K-214 | i, 374 |
| Great Miami | (CC) | i, 909* | Green B., Wis.: | | |
| Great Peconic B., N. Y. | F-37 | i, 214 | Harbor lines | | ii, 2255 |
| Great Pedee R., N. C. | N-49 | i, 499 | Wrecks | | ii, 2268 |
| Great Pedee R., N. C. and S. C. | N-19 | i, 504 | Green Briar Cr., Ga. | O-293 | i, 535 |
| (See notes, ii, 2798.) | | | Greenbriar R., W. Va. | EE-108 | i, 995 |
| Appro. | | ii, 2292 | (See notes, ii, 2811.) | | |
| Bridges | | ii, 2171 | Greenbrier Cr., W. Va. | EE-4 | i, 983 |
| Wrecks | | ii, 2268 | Greenbrier R., W. Va. | EE-108 | i, 984, 995 |
| Great Pedee R., S. C. | N-19 | i, 499 | Green Cr., N. C. | M-146 | i, 455 |
| Great Pocket, Fla. | P-131 | i, 570 | Green Cr., Pa. | J-711 | i, 336 |
| Great Pocket-Peck Lake, Fla. (canal between) | P-132 | i, 570 | Green Cr., S. C. | N-97 | i, 499 |
| Great Pt., Mass. | C-33 | i, 116 | Greenfield Bend | (HH) | i, 1074* |
| Great Pt., Mass. (break- water) | C-33 | i, 107 | Green, Fort, R. I. | | ii, 1866 |
| Great Pt. Rlp, Mass.: | | | Green H., Mass. | B-158 | i, 70 |
| Wrecks | | ii, 2268 | Green H. R., Mass. | B-159 | i, 70 |
| Great Pond, N. Y. | F-45 | i, 215 | Green Isld. Bayou, La. | S-719 | i, 687 |
| Great Porcupine Cr., Mont. | GG-645 | i, 1030 | Green Jacket Shoal, R. I. | C-81-a | i, 128 |
| (See notes, ii, 2817.) | | | Greenlaws Cove, Me. | A-83 | i, 27 |
| Great Rigolets, La.: | | | Green Leaf Bend | (HH) | i, 1074* |
| Bridges | | ii, 2171 | Green Log Cr., Ga. | O-390 | i, 536 |
| Great R., Mass. | C-17 | i, 107 | Greenmill, N. Y.: | | |
| Great R., N. Y. | F-59 | i, 215 | Harbor lines | | ii, 2255 |
| Great Salt Pond, Block Isld., R. I. | C-103 | i, 108 | Greenport B., N. Y. | F-33 | i, 215 |
| Great Salt Pond, R. I. | C-103 | i, 134 | Greenport H., N. Y. | F-33 | i, 215, 224 |
| Wrecks | | ii, 2268 | Appro. | | ii, 2289 |
| | | | Harbor lines | | ii, 2255 |
| | | | Wrecks | | ii, 2268 |
| | | | Green R., Ky. (above mouth of Big Barren R.) | BB-7-b | i, 893 |
| | | | Green R., Ill. | JJ-19 | i, 1234 |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Green R., Ky. | BB-7..... | i, 891, 892 | Grindstone Cr., Mo. | GG-84..... | i, 1025 |
| | BB-11..... | i, 896 | | GG-142..... | i, 1026 |
| | (CC)..... | i, 909* | (See notes, ii, 2813, 2814.) | | |
| Appro..... | | ii, 2296 | Grindstone Cr., S. Dak. | GG-863..... | i, 1031 |
| Bridges..... | | ii, 2171 | (See notes, ii, 2819.) | | |
| Green R., Ky., and tribu- | | | Griswold, Fort, Conn. | ii, 1802, 1874 | |
| taries (purchase of im- | | | Grizzly B., Cal. | TT-83..... | i, 1555 |
| provements, and their | | | Grizzly Cr., Colo. | GG-1031..... | i, 1033 |
| repair)..... | BB-7-a..... | i, 892 | (See notes, ii, 2820.) | | |
| Green R., Ky., Rumsey | BB-7-c..... | i, 894 | Grocery Cr., Ga. | O-383..... | i, 536 |
| Green R., N. C. | N-163..... | i, 517 | Gross Cr., Md. | J-382..... | i, 334 |
| Green R., S. C. | N-163..... | i, 500 | Grosse Isle, Mich.: | | |
| Green R., Utah | SS-7..... | i, 1544 | Harbor lines..... | ii, 2255 | |
| Green R., Utah, Colo., | | | Grosse Isle, Mich. (chan- | | |
| and Wyo. | SS-7..... | i, 1543 | nel west of)..... | PP-113..... | i, 1420 |
| Green R., Wash. | XX-75..... | i, 1655 | Grosse Pointe, Mich. | PP-105-b..... | i, 1455 |
| Green Run Inlet, Md.: | | | Harbor lines..... | ii, 2255 | |
| Wrecks..... | | ii, 2268 | Grosse Pointe, Mich. | | |
| Green Run Lightship | | | (channel)..... | PP-106..... | i, 1420 |
| Station, Md.: | | | Grossetete Bayou, La. | S-524..... | i, 685, 703 |
| Wrecks..... | | ii, 2268 | Appro..... | ii, 2294 | |
| Green Run, Md. | J-22..... | i, 331 | Bridges..... | ii, 2171 | |
| Greens Bayou, Tex. | U-18..... | i, 735 | Groton, Conn.: | | |
| | U-32..... | i, 735 | Forts..... | ii, 1874 | |
| Greens Branch, Md. | J-1004..... | i, 338 | Grounds, Historic: | | |
| Greens Cr., Mass. | B-59..... | i, 69 | Maumee Valley..... | ii, 2040, 2088 | |
| Green Timber Cr., S. | | | Grounds, Parking, D. C. | ii, 2040, 2085 | |
| Dak. | GG-800..... | i, 1031 | Grounds, Public, D. C. | ii, 2040, 2072 | |
| (See notes, ii, 2818.) | | | Grove Cr., Md. | J-431..... | i, 334 |
| Greenville. | (HH)..... | i, 1074* | Groveland Park. | (HH)..... | i, 1074* |
| Greenville, N. J.: | | | Guadalupe R., Cal. | TT-35..... | i, 1555 |
| Harbor lines..... | | ii, 2255 | Guadalupe R., Tex. | U-61..... | i, 735, 768 |
| Greenwich B., R. I. | C-88..... | i, 107, 130 | Appro..... | ii, 2295 | |
| | C-89..... | i, 130 | Bridges..... | ii, 2171 | |
| Appro..... | | ii, 2288 | Guayataca R., P. R. | YY-24..... | i, 1685 |
| Greenwich H., Conn. | D-97..... | i, 141, 173 | Guadala R., Cal. | TT-137..... | i, 1556 |
| (See notes, ii, 2792.) | | | Guamani R., P. R. | YY-7..... | i, 1685 |
| Appro..... | | ii, 2289 | Guam H.: | | |
| Harbor lines..... | | ii, 2255 | Appro..... | ii, 2282 | |
| Greenwich H., R. I. | C-89..... | i, 107, 130 | Forts..... | ii, 1823 | |
| Greenwood Cr., Md. | J-393..... | i, 334 | Guanajibo R., P. R. | YY-19..... | i, 1685 |
| Greggs Cr., Mo. | GG-117..... | i, 1026 | Guanica H., P. R. | YY-16..... | i, 1685 |
| (See notes, ii, 2813.) | | | Guano R., Fla. | P-86..... | i, 569 |
| Gregoire Bayou, La. | S-692..... | i, 687 | Guantanamo: | | |
| Gregory Landing. | (HH)..... | i, 1074* | Forts..... | ii, 1823 | |
| Gregory Pt. | (HH)..... | i, 1074* | Guayanilla H., P. R. | YY-15..... | i, 1685 |
| Gregorys Bend. | (HH)..... | i, 1074* | Gueydan Canal, La. | S-753..... | i, 687 |
| Gregorys Landing. | (HH)..... | i, 1074* | Guffin B., N. Y. | RR-61..... | i, 1493 |
| Grey Bull R., Wyo. | GG-681..... | i, 1030 | Gulbert Cr., S. Dak. | GG-358..... | i, 1027 |
| (See notes, ii, 2817.) | | | (See notes, ii, 2815.) | | |
| Grey Cloud. | (HH)..... | i, 1074* | Guides to use of this In- | | |
| Greys Bayou, Tex.: | | | dex: | | |
| (See notes, ii, 2806.) | | | See immediately follow- | | |
| Greys Cr., Md. | J-1085..... | i, 339 | ing the title page of | | |
| Greyson Cr., Mont. | GG-533..... | i, 1029 | each part. | | |
| (See notes, ii, 2816.) | | | Gulldford Courthouse: | | |
| Grices Run, Va. | L-112..... | i, 412 | Monument..... | ii, 2040, 2092 | |
| Griffiths Cr., Ky. | DD-290..... | i, 961 | Gulford H., Conn. | D-48..... | i, 141 |
| Grimballs Cr., Ga. | O-96..... | i, 533 | Guimara Strait, P. I. | YY-133..... | i, 1686 |
| Grimes Cr., Md. | J-120..... | i, 332 | Gulon Cr., N. Y. | E-8..... | i, 177 |
| Grindle Cr., N. C. | M-79..... | i, 454 | Guiuan, P. I. | YY-113..... | i, 1686 |
| Grindool Cr., N. C. | M-79..... | i, 454 | Guldens Cr., N. C. | M-197..... | i, 455 |
| Grindstone Branch, Mo. | GG-95..... | i, 1025 | Gulf Division, Engineer | | |
| | | | Department..... | ii, 2039, 2046 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|---------------------|
| Gulf of Alaska | XX-122..... | i, 1656 | Gum Cr., Ga | O-280..... | i, 535 |
| Gulf of Davao, P. I. | YY-159..... | i, 1686 | | O-356..... | i, 535 |
| Gulf of Mexico | (HH)..... | i, 1074* | Gum Cr., Mo | GG-1462..... | i, 1036 |
| (See notes, ii, 2799.) | | | (See notes, ii, 2824.) | | |
| Gulf of Mexico, Dallas, Tex., district | T (with map)..... | i, 715 | Gumlog Bayou, La | S-555..... | i, 686 |
| Gulf of Mexico, entrance to Withlacoochee R., Fla.: | | | Gun and mortar bat- teries | | ii, 1809 |
| Wrecks..... | | ii, 2268 | Gunbys Cr., Md | J-37..... | i, 331 |
| Gulf of Mexico, Fla., to St. Marys R. (canal) | O-510-c..... | i, 586 | Gun Flint Lake, Minn. and Canada | KK-243..... | i, 1249 |
| Gulf of Mexico, north shore (waterway) | Q-25..... | i, 611, 623 | Gunners Cove, Md | J-213..... | i, 332 |
| Gulf of Mexico to Atlantic Ocean (canal between) | P-1-a..... | i, 572 | Gunpowder Bar | (CC)..... | i, 909* |
| Gulf of Mexico, Waterway System | | i, 19 | Gunpowder Cr., Ky | DD-194..... | i, 960 |
| Gulf of Mexico, waterway to: | | | Gunpowder Falls, Md | J-992..... | i, 338 |
| Appro..... | | ii, 2293 | Gunpowder R., Md | J-976..... | i, 338 |
| Gulfport H., Miss | R-88..... | i, 646, 672 | Bridges..... | | ii, 2171 |
| Gulfport, Miss.: | | | Gun B., Mich | OO-19..... | i, 1377 |
| Appro..... | | ii, 2294 | Guns | | ii, 1824 |
| Navigation rules..... | | ii, 2041, 2107 | Gunston Cove, Va | K-95..... | i, 373 |
| Gulfport Ship Chan., Miss | R-87..... | i, 646 | Gunters Cr., Ala | AA-53..... | i, 870 |
| Gulfport to Ship Isld. H., Miss. (channel from) | R-87..... | i, 672 | Guntersville, Ala | AA-18..... | i, 855 |
| Gulfport to Ship Isld., Miss.: | | | Guttenberg | (HH)..... | i, 1074* |
| (See notes, ii, 2803.) | | | Guttenberg, N. J.: | | |
| Gulf (The), Va | L-68..... | i, 411 | Harbor lines..... | | ii, 2255 |
| Gulkana R., Alaska | XX-144..... | i, 1656 | Gut, Me.: | | |
| Gull Lake | (HH)..... | i, 1074* | Bridges..... | | ii, 2171 |
| Gull R. | (HH)..... | i, 1074* | Gut (The), N. Y | E-3..... | i, 177 |
| Gull R., Minn | KK-104..... | i, 1248 | Gut (The), South Bristol H., Me | A-188..... | i, 28 |
| Gum Branch, Del | J-21..... | i, 331 | Guyandot R., W. Va | EE-11..... | i, 985 |
| | J-125..... | i, 332 | (See notes, ii, 2811.) | | |
| Gumbottom Cr., Md | J-1224..... | i, 340 | Appro..... | | ii, 2296 |
| Gumbridge Branch, Md | J-17..... | i, 331 | Bridges..... | | ii, 2171-2172, 2210 |

H.

| | | | | | |
|------------------------------------|----------------|---------|----------------------------------|-------------|-------------|
| Habana, Cuba: | | | Hackensack R., N. J | G-6..... | i, 247, 248 |
| "Maine," removal of..... | ii, 2041, 2117 | | Appro..... | | ii, 2290 |
| Wrecks..... | ii, 2268 | | Bridges..... | | ii, 2173 |
| Habersham Cr., Ga | O-78..... | i, 533 | Harbor lines..... | | ii, 2255 |
| (See notes, ii, 2798.) | | | Wrecks..... | | ii, 2268 |
| Hackberry B., La | S-404..... | i, 684* | Hackley | (HH)..... | i, 1074* |
| Hackberry Cr., Kans | GG-1334..... | i, 1035 | Haddaway Cove, Md | J-361..... | i, 333 |
| (See notes, ii, 2822.) | | | Hadleys Cr., Cal | TT-161..... | i, 1556 |
| Hackberry Cr., S. Dak | GG-376..... | i, 1028 | Hague (The), Va.: | | |
| (See notes, ii, 2815.) | | | Harbor lines..... | | ii, 2255 |
| Hackberry Lake, La | S-695..... | i, 687 | Haha Branch, Md | J-963..... | i, 338 |
| Hack Cr., Va | K-135..... | i, 374 | Hahnville | (HH)..... | i, 1074* |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|----------------------|
| Hall Cr., Md. | J-492..... | i, 334 | Hampton Cr., Va. | L-102..... | i, 412, 418 |
| Haines Cr., Fla. | P-42..... | i, 569 | Bridges..... | ..... | ii, 2173 |
| Halawa Bay, H. I.: (See notes ii, 2846.) | | | Wrecks..... | ..... | ii, 2268 |
| Halawa H., Hawaii | YY-52..... | i, 1685 | Hampton H., N. H. | A-293..... | i, 29 |
| Hale, Fort..... | ..... | ii, 1802, 1874 | Hampton (Jones and Herbert) Cr., Va.: Harbor lines..... | ..... | ii, 2255 |
| Haleiwa H., Hawaii | YY-49..... | i, 1685 | Hampton R. and H., N. H. | A-293-a..... | ig '6 |
| Hale Lake | (HH)..... | i, 1074* | Hampton R., Ga. | O-431..... | i, 536 |
| Halepalaoa Landing, H. I.: (See notes, ii, 2846.) | | | Hampton R., Me.: Bridges..... | ..... | ii, 2173 |
| Hales Bar, Tenn. | AA-18..... | i, 855 | Hampton R., N. H. | A-294..... | i, 29 |
| (See notes, ii, 2809.) | | | Hampton R., Va. | L-102..... | i, 418 |
| Hales Bar Lock, Tenn. | AA-190..... | i, 849 | Appro..... | ..... | ii, 2291 |
| Hales Rapids | (HH)..... | i, 1074* | Hampton Roads, Va. | L-99..... | i, 412 |
| Half Breed Cr., Mont. | GG-596..... | i, 1029 | Appro..... | ..... | ii, 2291 |
| (See notes, ii, 2817.) | | | Forts..... | ..... | ii, 1796, 1823, 1921 |
| Halfday Cr., Kans.: (See notes, ii, 2821.) | | | Harbor lines..... | ..... | ii, 2255 |
| Half Dry Cr., Kans. | GG-1233..... | i, 1034 | Navigation rules..... | ..... | ii, 2041, 2107 |
| Half Moon B., Cal. | TT-14..... | i, 1555 | Wrecks..... | ..... | ii, 2268 |
| Half Moon Cr., Ga. | O-382..... | i, 536 | Hampton Roads, Va., Jamestown Piers | L-99-b..... | i, 418 |
| Half-moon Cr., N. C. | M-175..... | i, 455 | Hampton Roads, Va., Middle Ground Bar | L-99..... | i, 417 |
| Halfmoon Cr., N. C. | M-300..... | i, 456 | Hanalei B.: (See notes, ii, 2846.) | | |
| Half Moon R., Ga. | O-91..... | i, 533 | Hanalei, Hawaii | YY-30..... | i, 1685 |
| Half Pone Cr., Tenn. | AA-312..... | i, 850 | Hanamaula B., H. I.: (See notes, ii, 2846.) | | |
| Halfway Cr., S. C. | N-190..... | i, 500 | Hanamaula Landing, Ha- wail | YY-31..... | i, 1685 |
| Halfway Swamp, S. C. | N-111..... | i, 500 | Hanapepe B., Isld. of Kauai, Hawaii | YY-35-a..... | i, 1688 |
| Halifax Cr., Fla. | P-97..... | i, 569 | Hanapepe H., H. I.: (See notes, ii, 2846.) | | |
| Halifax R., Fla. | P-96..... | i, 569 | Hancock: Harbor lines..... | ..... | ii, 2255 |
| Bridges..... | ..... | ii, 2173 | Hancocks Cr., N. C. | M-191..... | i, 455 |
| Hall Branch, Va. | K-124..... | i, 374 | Handkerchief Lightship, Mass.: Wrecks..... | ..... | ii, 2268 |
| Hall Cr., Md. | J-57..... | i, 331 | Handkerchief S h o a l, Mass.: Wrecks..... | ..... | ii, 2268 |
| ..... | K-20..... | i, 373 | Handsboro, Miss., Back B. | R-78-a..... | i, 670 |
| Halls Ferry | (GG-2)..... | i, 1038* | Hanging Dog Isld. | (HH)..... | i, 1074* |
| Hall Run, Pa. | J-821..... | i, 337 | Hanging Rock, Ohio: Harbor lines..... | ..... | ii, 2255 |
| Hama-Hama R., Wash. | XX-52..... | i, 1655 | Hanging Woman Cr., Mont. and Wyo. | GG-714..... | i, 1030 |
| Hambleton Cr., Md. | J-367..... | i, 333 | (See notes, ii, 2818.) | | |
| ..... | J-446..... | i, 334 | Hankins Cr., N. C. | M-298..... | i, 456 |
| Hamburg | (HH)..... | i, 1074* | Hannacrois Cr., N. Y. | E-57..... | i, 177 |
| Hamburg, Kans. | Y-2-c..... | i, 820 | Hannah Mills Cr., Fla. | P-12..... | i, 569 |
| Hamburg, Tenn. | AA-18..... | i, 855 | Hannas Reef, Tex.: Appro..... | ..... | ii, 2295 |
| Hamilton | (HH)..... | i, 1074* | Hannas Reef, Tex. (chan- nel across) | U-8..... | i, 737 |
| Hamilton Cr., Mo. | GG-1528..... | i, 1037 | Hannibal | (HH)..... | i, 1074* |
| Hamilton, Fort, N. Y...... | ..... | ii, 1806, 1881 | (See notes, ii, 2827.) | | |
| Harbor lines..... | ..... | ii, 2255 | | | |
| Wrecks..... | ..... | ii, 2268 | | | |
| Hammer Cr., La. | S-262..... | i, 683 | | | |
| Hammer Cr., Pa. | J-574..... | i, 335 | | | |
| Hammersley Fork, Pa. | J-773..... | i, 336 | | | |
| Hammersley Inlet, Puget Sound, Wash. | XX-62-c..... | i, 1667 | | | |
| Appro..... | ..... | ii, 2301 | | | |
| Hammer Smith Cr., Ga. | O-418..... | i, 536 | | | |
| Hammonasset R., Conn. | D-46..... | i, 141 | | | |
| Bridges..... | ..... | ii, 2173, 2233 | | | |
| Hammond Cr., N. Y. and Pa. | J-678..... | i, 336 | | | |
| Hammond B., Mich. | PP-40..... | i, 1419, 1432 | | | |
| Hammond Isld. | (GG-2)..... | i, 1038* | | | |
| Hamoia H., Hawaii | YY-61..... | i, 1685 | | | |
| Hampton | (HH)..... | i, 1074* | | | |
| Hampton Bar, Va. | L-102..... | i, 418 | | | |
| Appro..... | ..... | ii, 2291 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------|---------------------|----------------------|----------------------------------|---------------------|-------------------|
| Hannibal, Mo.: | | | Harness Cr., Md. | J-1246 | i, 340 |
| Harbor lines | | ii, 2255 | Harney R., Fla. | P-203 | i, 570 |
| Hanson Canal, La. | S-651 | i, 686 | Harper Cr., Md. | K-43 | i, 373 |
| Hapleys Cr., Mont. | GG-586 | i, 1029 | Harpers Pond, Md. | J-154 | i, 332 |
| (See notes, ii, 2816.) | | | Harper Slough | (HH) | i, 1074* |
| Happy Valley Branch, | | | Harpeth R., Tenn. | AA-249 | i, 850 |
| Md. | J-557 | i, 335 | | AA-239 | i, 878 |
| Harbor Beach, Harbor of | | | Harpwell H., Me. | A-253 | i, 29 |
| Refuge, Mich. | PP-82 | i, 1419 | Harpwell Sound, Me. | A-250 | i, 29 |
| Harbor Beach, Lake Hu- | | | Harraseeket R., Me. | A-259-a | i, 52 |
| ron, Mich. | PP-82 | i, 1441 | Appro. | | ii, 2288 |
| Harbor Beach, Mich.: | | | Harriet Isld. | (HH) | i, 1074* |
| Appro. | | ii, 2269 | Harriet Isld., Minn.: | | |
| Harbor Cove, Mass. | B-85 | i, 69 | Harbor lines | | ii, 2255 |
| Harbor Cove, Md. | J-362 | i, 333 | Harrington B., Me. | A-27 | i, 27 |
| Harbor Isld. (deep-water | | | Harrington Pt. | (WW-2) | i, 1617* |
| harbor at), Aransas | | | Harrington R., Me. | A-28 | i, 27 |
| Pass, Tex. | U-67-b | i, 772 | Harris Bayou, La. | S-195 | i, 682 |
| Harbor lines | | ii, 2041, 2109, 2137 | Harris Cr., Md. | J-346 | i, 333 |
| Abrogation of | | i, 2041, 2109 | Harris Cr., Tex.: | | |
| Harbor of Refuge, Sandy | | | (See notes, ii, 2805.) | | |
| B., Mass. | BB-77 | i, 76 | Harris Cr. (prong of Back | | |
| Harbors (see Vol. I): | | | R.), Va. | L-98 | i, 417 |
| Appro. | | ii, 2041, 2103 | Harriseeket R., Me. | A-259-a | i, 52 |
| Estimates | | ii, 2039, 2042 | Harris Ferry | (CC) | i, 909* |
| Floating defenses | | ii, 1824 | Harrison Branch, Mo. | GG-54 | i, 1025 |
| Forts | | ii, 1810 | (See notes, ii, 2813.) | | |
| Supervision of, New York | | ii, 2041, 2111 | Harrison Cr., N. C. | M-309 | i, 456 |
| Harbors and Rivers (see | | | Harrison Cr. (prong of | | |
| Vol. I): | | | Back R.), Va. | L-98 | i, 417 |
| (See notes, ii, 2779.) | | | Harrison Cr., Va. | L-98 | i, 412 |
| Harbors, National: | | | Harrison, N. J.: | | |
| Appro. | | ii, 2287 | Harbor lines | | ii, 2256 |
| Harbors, Non - United | | | Harrisonville | (HH) | i, 1074* |
| States work | | ii, 2041, 2109 | Harris Slough | (HH) | i, 1074* |
| Harbors, Rivers and | | ii, 2041, 2104, 2116 | Harry George Cr., Va. | K-222 | i, 374 |
| Hardee Cr., N. C. | M-87 | i, 454 | Hart Branch, Ky. | DD-47 | i, 959 |
| Hardin Cr., Tenn. | AA-223 | i, 850 | Hartford | (CC) | i, 909* |
| Hardings Beach, Mass.: | | | Hartford, Conn.: | | |
| Wrecks | | ii, 2268 | (See notes, ii, 2789.) | | |
| Hard Labor Cr., Ga. | O-296 | i, 535 | Hartford, Ky. | BB-11 | i, 896 |
| Hardscrabble | (HH) | i, 1074* | Hartley Cr., Pa. | J-628 | i, 335 |
| Hardscrabble Cr., Mont. | GG-625 | i, 1030 | Hartsburg | (GG-2) | i, 1038* |
| (See notes, ii, 2817.) | | | Harvey Canal, La.: | | |
| Hardship Branch, Md. | J-10 | i, 331 | (See notes, ii, 2804.) | | |
| Hard Times | (HH) | i, 1074* | Bridges | | ii, 2174 |
| Hardys Cr., Cal. | TT-153 | i, 1556 | Harvey Canal No. 2, La. | S-422 | i, 684 |
| Hare Cr., Cal. | TT-149 | i, 1556 | | S-398 | i, 684 |
| Hares Valley Cr., Pa. | J-887 | i, 337 | Harvey Cr., Kans. | GG-1363 | i, 1085 |
| Harlem | (GG-2) | i, 1038* | (See notes, ii, 2823.) | | |
| | (HH) | i, 1074* | Harvey Cr., Pa. | J-696 | i, 336 |
| Harlem Kills, N. Y. | E-22 | i, 177 | Harvey Lake, Pa. | J-697 | i, 336 |
| Bridges | | ii, 2173 | Harveys Lake No. 1 | S-361 | i, 684 |
| Harlem R., N. Y. | E-24 | i, 177, 188 | Harveys Canal No. 1, La. | S-301 | i, 683 |
| Appro. | | ii, 2289 | Harveys Cr., Ga. | O-125 | i, 534 |
| Bridges | | ii, 2173-2174 | Harveys Cut-off Canal, | | |
| Harbor lines | | ii, 2255 | La. | S-356 | i, 684 |
| Wrecks | | ii, 2268-2269 | Harwich, Mass. | C-5 | i, 108 |
| Harlow Cr., N. C. | M-270 | i, 456 | | C-5-a | i, 108 |
| Harlowe R., N. C. | M-257-f | i, 477 | Hasouse Bayou, La. | S-152 | i, 682 |
| Appro. | | ii, 2292 | Hassock Cr., N. Y. | F-90 | i, 216 |
| Harmar | (CC) | i, 909* | Hass Slough, Cal. | UU-66 | i, 1577 |
| Harmond Cr., Ky. | DD-77 | i, 959 | Hastings | (HH) | i, 1074* |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|----------------------------|-------------------|---|---------------------|-------------------|
| Hastings Cr., Cal..... | TT-67..... | i, 1555 | Haynes Slough, Oreg..... | VV-28..... | i, 1593 |
| Hastings upon Hudson, N. Y.: | | | Hays Cr., La..... | R-98-r..... | i, 647 |
| Harbor lines..... | ii, 2256 | | Hay Stack Branch, Md..... | J-996..... | i, 338 |
| Hatch Canal, La..... | S-484..... | i, 685 | Hayward Cr., Mass..... | B-142..... | i, 70 |
| Hatchee Cr., Mass..... | B-201..... | i, 70 | Hayward Cr., N. C..... | M-184..... | i, 455 |
| Hatchee R..... | (HH)..... | i, 1074* | Hay (West) H., N. Y..... | D-10..... | i, 141, 146 |
| Hatchee R., Tenn..... | AA-4..... | i, 851 | (See notes, ii, 2788.) | | |
| Appro..... | ii, 2296 | | Hazard Cove, Md..... | J-63..... | i, 331 |
| Bridges..... | ii, 2174 | | Hazel Run, Va..... | K-207..... | i, 374 |
| Hatchie R., Tenn. and Miss..... | AA-4..... | i, 848 | Hazelwood, Pa.: | | |
| Hatches Cove, Me..... | A-100..... | i, 28 | Harbor lines..... | ii, 2256 | |
| Hat Cr., S. Dak..... | GG-849..... | i, 1031 | Hazlets Cr., Ga..... | O-111..... | i, 534 |
| Hat Cr., S. Dak., Nebr., and Wyo.: | | | Head H., Me..... | A-89..... | i, 27 |
| (See notes, ii, 2819.) | | | Head of Passes to Cairo (HH): | | |
| Hathaway..... | (HH)..... | i, 1074* | (See notes, ii, 2828.) | | |
| Hathaways Crossing (HH): | | | Healy R., Alaska..... | XX-201..... | i, 1656 |
| (See notes, ii, 2831.) | | | Heart R., N. Dak..... | GG-774..... | i, 1031 |
| Hat Slough, Wash..... | XX-87..... | i, 1655 | (See notes, ii, 2818.) | | |
| Hatteras (Atlantic Ocean south of)..... | L-173-i..... | i, 434 | Heath Cr., Miss..... | JJ-28..... | i, 1234 |
| | L-173-j..... | i, 435 | Heaths Cr., Mo.: | | |
| Hatteras Inlet, N. C..... | M-66..... | i, 454 | (See notes, ii, 2823.) | | |
| | M-261..... | i, 456 | Heat Spring Cr., Mo..... | GG-36..... | i, 1025 |
| Haulover, N. C..... | M-18..... | i, 454 | Heckmann Isld..... | (GG-2)..... | i, 1038* |
| Haven (The), Md..... | J-502..... | i, 334 | Helena..... | (GG-2)..... | i, 1038* |
| Havre de Grace H., Md..... | J-556-g..... | i, 365 | (HH)..... | | i, 1074* |
| Appro..... | ii, 2291 | | Helena, Mont..... | (GG-2)..... | i, 1037* |
| Havre de Grace, Md. (above and below), Sus- quehanna R..... | J-556-a..... | i, 362 | Hell Cr., Kans.: | | |
| Hawaiian Islds..... | YY (with map) i, 1685 | | (See notes, ii, 2822.) | | |
| (See notes, ii, 2845, 2846.) | | | Hell Cr., Va..... | L-235..... | i, 413 |
| Appro..... | ii, 2301 | | Hellen Gut, Md..... | K-11..... | i, 373 |
| Forts..... | ii, 1796, 1809, 1810, 2033 | | Hellens Cr., Md..... | K-12..... | i, 373 |
| Harbor lines..... | ii, 2256 | | Hellers Cr., S. C..... | N-171..... | i, 500 |
| Searchlights..... | ii, 1811 | | Hell for Certain Cr., Ky..... | DD-72..... | i, 959 |
| Sites, forts..... | ii, 1813 | | Hell Gate (Columbia R.).. | (WW-2)..... | i, 1617* |
| Hawaii Isld., Hawaii..... | YY-69..... | i, 1686 | (See notes, ii, 2841.) | | |
| Haw Cr., Fla..... | P-73..... | i, 569 | Hellgate, Ga..... | O-118..... | i, 534 |
| Hawesville, Ky..... | (CC)..... | i, 909* | Hell Gate, N. Y..... | E-17..... | i, 184 |
| Hawk Chan., Fla..... | P-173..... | i, 570 | Bridges..... | ii, 2174 | |
| Hawk Cove, Md..... | J-1065..... | i, 339 | Harbor lines..... | ii, 2256 | |
| Hawk Cr., Minn..... | KK-148..... | i, 1248 | Hell Hole Swamp, S. C..... | N-229..... | i, 500 |
| Hawkins Cr., Ga..... | O-429..... | i, 536 | Hell Roaring Cr., Wyo. and Mont..... | GG-664..... | i, 1030 |
| Haw B., N. C..... | M-317..... | i, 456 | (See notes, ii, 2817.) | | |
| Hawthorn Cove, Md..... | J-1054..... | i, 339 | Hemlock Cr., Pa..... | J-713..... | i, 336 |
| Hay Cr., Minn..... | JJ-35..... | i, 1234 | Hempstead B., N. Y..... | F-71..... | i, 215 |
| | KK-119..... | i, 1248 | Hempstead B., N. Y., Broad Chan..... | F-72..... | i, 215 |
| Hay Cr., Mont.: | | | Hempstead B., N. Y., Woodsburg Chan..... | F-76..... | i, 215, 229 |
| (See notes, ii, 2817.) | | | Hempstead H., N. Y..... | F-9..... | i, 215, 217 |
| Hayden Isld..... | (WW-2)..... | i, 1617* | Appro..... | ii, 2289 | |
| Hayes Cr., Mo..... | GG-203..... | i, 1026 | Wrecks..... | ii, 2269 | |
| Hay, Fort, Kans.: | | | Hen and Chicken Light- ship, Mass.: | | |
| Latitude and longitude..... | ii, 2041, 2122 | | Wrecks..... | ii, 2269 | |
| Hay H., N. Y.: | | | Henderson..... | (HH)..... | i, 1074* |
| (See notes, ii, 2788.) | | | Henderson B., N. Y..... | RR-57..... | i, 1493 |
| Hay Lake Chan., Mich..... | PP-12..... | i, 1419 | Henderson B., Wash.: | | |
| | PP-13..... | i, 1419 | Bridges..... | ii, 2174 | |
| Hay Lake, Mich..... | PP-3-b..... | i, 1427 | Henderson H., N. Y.: | | |
| | | | Wrecks..... | ii, 2269 | |
| | | | Henderson Isld..... | (CC)..... | i, 909* |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| Henderson, Ky. | (CC)..... | i, 909* | Hickman Cr., Ky. | DD-185..... | i, 960 |
| Henderson R., Ill. | JJ-14..... | i, 1234 | Hickman Crossing (HH): (See notes, ii, 2832.) | | |
| Henderson R., South Fork. | JJ-15..... | i, 1234 | Hickory Branch, La. | S-842..... | i, 688 |
| Hendricks Cr., Kans.: (See notes, ii, 2823.) | | | Hickory Chute | (HH)..... | i, 1074* |
| Hendricks H., Me. | A-200..... | i, 28, 48 | Hickory Cove, Md. | J-219..... | i, 332 |
| Hendrix Cr., Kans. | GG-1382..... | i, 1035 | Hickory Cr., Mo. | GG-162..... | i, 1026 |
| Hennepin | (HH)..... | i, 1074* | Hickory Cr., Tenn. | AA-158..... | i, 849 |
| Hennepin Canal | JJ-20-a..... | i, 1235 | Hicks Run, Pa. | J-788..... | i, 337 |
| Hennepin Canal, Illinois R., to Watertown, Mississippi R. (ship ca- nal). | JJ-20-b..... | i, 1236 | Higan, P. I. | YY-176..... | i, 1686 |
| Henrys Cr., Va. | K-153..... | i, 374 | Higgins Slough, Wash.: Bridges..... | | ii, 2174 |
| Hensleys Shoals | (GG-2)..... | i, 1038* | Highbank Cr., S. Dak. | GG-798..... | i, 1031 |
| Herbert Cr., Va.: Harbor lines..... | | ii, 2256 | (See notes, ii, 2818.) | | |
| Herbert Run, Md. | J-1108..... | i, 339 | Highcliff H., Wis. | MM-21-e..... | i, 1316 |
| Herb R., Ga. | O-94..... | i, 533 | High Hill Cr., S. C. | N-197..... | i, 500 |
| Herculaneum | (HH)..... | i, 1074* | High Isld. Cr., Minn. | KK-142..... | i, 1248 |
| Herd Cr., Ga. | O-351..... | i, 535 | Highland | (HH)..... | i, 1074* |
| Hereford Inlet, N. J. | I-25..... | i, 299 | Highland Bayou, Tex. | U-31..... | i, 735, 754 |
| Wrecks..... | | ii, 2269 | Highwood Cr., Mont. | GG-551..... | i, 1029 |
| Hereford Lighthouse, N. J.: Wrecks..... | | ii, 2269 | (See notes, ii, 2816.) | | |
| Herring Cr., Va. | L-137..... | i, 412 | Hill Cr., Pa. | J-726..... | i, 336 |
| Herman H., Me. | A-216..... | i, 28 | Hillebrandt Bayou, Tex.: Bridges..... | | ii, 2174 |
| Hermann | (GG-2)..... | i, 1038* | Hillerman | (CC)..... | i, 909* |
| Hermaphrodite Cr., S. Dak. | GG-387..... | i, 1028 | Hills B., Va. | K-248..... | i, 375 |
| (See notes, ii, 2815.) | | | Hillsboro B. and R., Fla.: Appro..... | | ii, 2293 |
| Hermitage, Ga. | O-452..... | i, 536 | Hillsboro B., Fla. | P-288..... | i, 593 |
| Hero H., Vt. | E-80..... | i, 177 | | P-288-b..... | i, 597 |
| Hero Isld., N. Y.: Appro..... | | ii, 2289 | | P-288-c..... | i, 598 |
| Hero Islds., North and South (channel be- tween). | E-79..... | i, 177 | | P-303..... | i, 571 |
| Heron B., Ala. | R-56..... | i, 646 | (See notes, ii, 2799.) | | |
| Heron Bayou, La. | S-385..... | i, 684 | Bridges..... | | ii, 2174 |
| Herricks B., Me. | A-75..... | i, 27 | Harbor lines..... | | ii, 2256 |
| Herring B., Md. | K-2..... | i, 373 | Navigation rules..... | | ii, 2041, 2107 |
| Bridges..... | | ii, 2174 | Wrecks..... | | ii, 2269 |
| Herring Cr., Md. | J-532..... | i, 335 | Hillsboro Inlet, Fla. | P-147..... | i, 570 |
| | K-59..... | i, 373 | Hillsboro R., Fla. | P-148..... | i, 570 |
| Herring Gut, Port Clyde H., Me. | A-154..... | i, 28 | | P-309..... | i, 571 |
| Herring R., Mass. | B-200..... | i, 70 | | P-288..... | i, 596 |
| | B-205..... | i, 70 | | P-288-b..... | i, 597 |
| | C-5..... | i, 107, 108 | | P-288-d..... | i, 599 |
| Herring Run, Md. | J-282..... | i, 333 | | | ii, 2174 |
| | J-1074..... | i, 339 | | | ii, 2256 |
| Herrington Cr., Md. | J-482..... | i, 334 | | | ii, 2269 |
| Herrs Island, Dam: (See notes, ii, 2812.) | | | Hillsborough R., Fla. | P-106..... | i, 570 |
| Hersheys | (HH)..... | i, 1074* | Hills Cr., N. C. | M-95..... | i, 455 |
| Hewlett B., N. Y. | F-74..... | i, 215 | Hills Cr., Pa. | J-673..... | i, 336 |
| Heybours Bayou, La. | S-744..... | i, 687 | Hill Slough, Cal. | TT-45..... | i, 1555 |
| Hiawasee R., Tenn.: Appro..... | | ii, 2296 | | TT-103..... | i, 1555 |
| Hickman | (HH)..... | i, 1074* | Hillis Pt. Cove, Md. | J-248..... | i, 333 |
| | | | Hill Valley Cr., Pa. | J-888..... | i, 337 |
| | | | Hilo H., Hawaii | YY-73..... | i, 1686, 1690 |
| | | | (See notes, ii, 2846.) | | |
| | | | Appro..... | | ii, 2301 |
| | | | Harbor lines..... | | ii, 2256 |
| | | | Wrecks..... | | ii, 2269 |
| | | | Hilongos, P. I. | YY-117..... | i, 1686 |
| | | | Hinds Cr., Tenn. | AA-161..... | i, 849 |
| | | | Hines Cr., Tenn. | AA-154..... | i, 849 |
| | | | Hingham H., Mass. | B-145..... | i, 70, 94 |
| | | | Appro..... | | ii, 2288 |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Hinkson Cr., Mo. | GG-85. | i, 1025 | Holly Cr., Ky. | DD-168. | i, 900 |
| (See notes, ii, 2813.) | | | Holly Cr., Md. | J-1152. | i, 339 |
| Hiwassee R., Tenn. | AA-18. | i, 855 | Holly Cr., S. C. | N-192. | i, 500 |
| | AA-67. | i, 870 | Holly R., Left Fork, W. | | |
| (See notes, ii, 2809.) | | | Va. | EE-148. | i, 984 |
| Appro. | ii, 2296 | | Holly R., W. Va. | EE-146. | i, 984 |
| Bridges. | ii, 2174 | | Holly Road Dock. | (WW-2). | i, 1617* |
| Hiwassee, Tennessee, and | | | Holmes B., Me. | A-13. | i, 27 |
| Savannah Rs., Ga. and | | | Holmes Bayou, La. | R-98-ff. | i, 647 |
| Tenn. (canal connect- | | | | R-102. | i, 647 |
| ing headwaters) | O-2-j. | i, 547 | Holmes Cr., Mo. | GG-188. | i, 1026 |
| Hiwassee R., Tenn., N. | | | Holmes Hole, Mass. | C-27. | i, 112 |
| C., and Ga. | AA-67. | i, 848 | Holmes R., Fla. | Q-33. | i, 611 |
| Hiwassee R. ("Transpor- | | | | Q-33-b. | i, 627 |
| tation Routes to Sea- | | | (See notes, ii, 2801.) | | |
| board") | AA-18-k. | i, 869 | Holmes R., Fla. and Ala. | Q-33. | i, 626 |
| Hoagland Run, Pa. | J-746. | i, 336 | | Q-33-a. | i, 626 |
| Hobbs Cr., Kans. | GG-1364. | i, 1035 | Appro. | ii, 2293 | |
| (See notes, ii, 2823.) | | | Holmes R., Fla., from | | |
| Hobe Sound, Fla. | P-138. | i, 570 | Vernon to its mouth. | Q-33-c. | i, 627 |
| Hoboken, N. J. (In front | | | Holston R., Tenn. | AA-18. | i, 855 |
| of) | E-28-c. | i, 195 | Holston R., Tenn. and | | |
| Hockomock B., Me. | A-209. | i, 28 | Va. | AA-113. | i, 849, 874 |
| Hockomock Chan., Me. | A-170. | i, 28 | Appro. | ii, 2296 | |
| Hodges Cr., N. C. | L-331. | i, 413 | Bridges. | ii, 2174-2175 | |
| Hodges Cr., Va. | L-190. | i, 412 | Holtz Ridge Gut, Md. | J-166. | i, 332 |
| Hodgkins Cove, Mass. | B-74. | i, 69 | Homassassa B., Fla. | P-338. | i, 571 |
| Hoffler Cr., Va. | L-172. | i, 412 | Homassassa R., Fla. | P-339. | i, 571 |
| Hogans Cr., Fla. | P-23. | i, 569 | Home City | (CC). | i, 909* |
| Bridges. | ii, 2174 | | Home Cr., Va. | DD-279. | i, 961 |
| Harbor lines. | ii, 2256 | | Home Ports: | | |
| Hogans Cr., Ind. | DD-495. | i, 963 | Ports. | ii, 1823 | |
| Hogarty Cr., Tenn. | AA-262. | i, 850 | Homer. | (HH). | i, 1074* |
| Hogarty R., Alaska. | XX-231. | i, 1657 | Homersville to Junction | | |
| Hogback. | (HH). | i, 1074* | of Little R., Ark. and | | |
| Hog Bayou, La. | S-673. | i, 687 | Mo., and the St. Fran- | | |
| | S-694. | i, 687 | cis. | Y-52. | i, 839 |
| | S-747. | i, 687 | Homestead Br., Pa.: | | |
| Hog Cr., Md. | J-273. | i, 333 | Harbor lines. | ii, 2256 | |
| | J-534. | i, 335 | Hominy Branch, Mo. | GG-86. | i, 1025 |
| Hoghole Cr., Md. | J-395. | i, 334 | Hominy Cr., W. Va. | EE-117. | i, 984 |
| Hog Isld. B., N. C. | M-229. | i, 456 | Homly Rapids. | (WW-2). | i, 1617* |
| Hog Isld. Ledge, Me.: | | | (See notes, ii, 2843.) | | |
| Fort. | ii, 1841 | | Homochitto. | (HH). | i, 1074* |
| Hog Isld., Va.: | | | Homochitto District (HH): | | |
| Wrecks. | ii, 2269 | | (See notes, ii, 2832.) | | |
| Hogles Cr., Mo. | GG-1489. | i, 1036 | Homochitto R., La.: | | |
| (See notes, ii, 2824.) | | | Appro. | ii, 2294 | |
| Hog Neck Cr., Va. | L-125. | i, 412 | Homochitto R., Miss. | S-282. | i, 683, 694 |
| Hogpen Cr., Md. | J-1063. | i, 339 | Homosassa B., Fla. | P-338. | i, 604 |
| Hogs Back Bar. | (WW-2). | i, 1617* | Homosassa R., Fla. | P-339. | i, 604 |
| Hog Slough, Cal. | UU-48. | i, 1577 | Honakohau H., Hawaii. | YY-59. | i, 1685 |
| Hoh R., Wash. | XX-30. | i, 1655 | Honda B., P. I. | YY-143. | i, 1686 |
| Hoko R., Wash. | XX-41. | i, 1655 | Honeycomb Cr., Ala. | AA-201. | i, 849 |
| Holland Cr., Kans. | GG-1366. | i, 1035 | Honey Cr., Kans. | GG-1173. | i, 1034 |
| (See notes, ii, 2823.) | | | (See notes, ii, 2821.) | | |
| Hollanders Cr., Pa. | H-19. | i, 271 | Honey Cr., Nebr. | GG-1125. | i, 1033 |
| Holland H., Mich. | OO-22. | i, 1377, 1388 | (See notes, ii, 2821.) | | |
| Appro. | ii, 2298 | | Honey Cr., Mo.: | | |
| Navigation rules. | ii, 2041, 2107 | | (See notes, ii, 2813, 2814.) | | |
| Hollands Branch, Md. | J-925. | i, 338 | Honey Cr., Mo. and Iowa: | | |
| Holland Straits, Md. | J-177. | i, 332 | (See notes, ii, 2814.) | | |
| Holly Bush. | (HH). | i, 1074* | Honey Cr., N. C. | L-347. | i, 414 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Honey Cr., Ohio | DD-411..... | i, 962 | Horn Cove, Md. | J-471..... | i, 334 |
| Honey Cr., Pa. | J-862..... | i, 337 | Horn H., Va. | K-260..... | i, 375, 403 |
| Honeygo Run, Md. | J-1050..... | i, 339 | Horn Isld. H., Ala.: (See notes, ii, 2803.) | | |
| Honga R., Md. | J-202..... | i, 332 | Horn Isld. H., Miss. | R-63..... | i, 664 |
| Honker B., Cal. | TT-78..... | i, 1555 | | R-63-c..... | i, 666 |
| Honolpu Landing, H. I.: (See notes, ii, 2846.) | | | Appro..... | | ii, 2294 |
| Honokahau H., H. I.: (See notes, ii, 2846.) | | | Wrecks..... | | ii, 2269 |
| Honolulu B., H. I.: (See notes, ii, 2846.) | | | Horn Isld. Pass, Ala. | R-61..... | i, 646 |
| Harbor lines..... | | ii, 2256 | | R-63..... | i, 664 |
| Honolulu Engineer De- pot, H. I. | | ii, 2039, 2045 | Horn Isld. Pass, Miss.: Appro..... | | ii, 2294 |
| Honolulu H., Hawaii | YY-45..... | i, 1685 | Horsebridge Cr., Md. | J-31..... | i, 331 |
| | YY-45..... | i, 1688 | Horse Br. Cr., Va. | L-132..... | i, 412 |
| (See notes, ii, 2846.) | | | Horse Cr., Fla. | P-118..... | i, 570 |
| Appro..... | | ii, 2287, 2301 | Horse Cr., Ga. | O-126..... | i, 534 |
| Forts..... | | ii, 1823 | | O-329..... | i, 535 |
| Harbor lines..... | | ii, 2256 | | O-380..... | i, 536 |
| Honolulu, Hawaii (recla- mation of Quarantine Isld.) | YY-45-b..... | i, 1689 | Horse Cr., Ky | DD-39..... | i, 959 |
| Honuaipo H., H. I.: (See notes, ii, 2846.) | | | Horse Cr., Mo.: (See notes, ii, 2824.) | | |
| Hood Canal, Wash. | XX-47..... | i, 1655 | Horse Cr., Mont.: (See notes, ii, 2817.) | | |
| Hood Fork, Ky | DD-224..... | i, 960 | Horse Cr., Nebr. and Wyo.: (See notes, ii, 2820.) | | |
| Hood R. | (WW-2)..... | i, 1617* | Horse Cr., Tenn. | AA-221..... | i, 850 |
| Hood R., Oreg | VV-79..... | i, 1593 | Horse Cr., W. Va. | DD-304..... | i, 961 |
| Hoods Canal to North B., Wash., Puget Sound | XX-62-d..... | i, 1668 | Horse Cr., Mont. | GG-642..... | i, 1030 |
| Hoods Cr., N. C. | M-321..... | i, 456 | Horse Cr., Nebr. | GG-971..... | i, 1032 |
| Hook Canal, N. Y.: Bridges..... | | ii, 2175 | Horse Cr., Nebr. and Wyo. GG-1073..... | | i, 1033 |
| Hook Cr., N. Y. | F-89..... | i, 216 | Horsehead Branch, Md. | J-1104..... | i, 339 |
| Bridges..... | | ii, 2168, 2175 | Horse Head Cr., N. Dak. | GG-390..... | i, 1028 |
| Hookena H., Hawaii | YY-81..... | i, 1686 | (See notes, ii, 2815.) | | |
| Hookton Slough, Cal. | TT-177..... | i, 1556 | Horse Head Cr., S. Dak. | GG-850..... | i, 1031 |
| Hooper Cr., Nebr | GG-1133..... | i, 1034 | (See notes, ii, 2819.) | | |
| Hooper Strait, Md. | J-173..... | i, 332 | Horse Isld. | (HH)..... | i, 1074* |
| Hoopers Strait, Md.: Wrecks..... | | ii, 2269 | Horse Landing Cr., Md. | K-34..... | i, 373 |
| Hoop Pole Cove, Mass. | B-76..... | i, 69 | Horse Mountain Cr. | TT-156..... | i, 1556 |
| Hoopuloa H., Hawaii | YY-80..... | i, 1686 | Horse Neck Pt., Mass.: (See notes, ii, 2786.) | | |
| Hoopuloa Landing, H. I.: (See notes, ii, 2846.) | | | Horse Prairie Cr., Mont. | GG-520..... | i, 1029 |
| Hooster Cr., La. | T-2-l..... | i, 717 | (See notes, ii, 2816.) | | |
| Hoosier Cr., Tex.: (See notes, ii, 2806.) | | | Horse Shoe B., Minn. | LL-6..... | i, 1265 |
| Hoover Cr., Kans. | GG-1359..... | i, 1035 | Horse Shoe Bayou, Tex.: (See notes, ii, 2805.) | | |
| Hop Bottom Cr., Pa. | J-635..... | i, 335 | Horseshoe Cove, Me. | A-82..... | i, 27 |
| Hopfield. | (HH)..... | i, 1074* | Horse Shoe Cr., Kans.: (See notes, ii, 2821.) | | |
| Hopfield Bend (HH): (See notes, ii, 2831.) | | | Horseshoe Cr., Nebr. | GG-1259..... | i, 1035 |
| Hopkins Cove, Md. | J-174..... | i, 332 | Horseshoe Cr., Wyo. | GG-1070..... | i, 1033 |
| Hopkins Cr., Md. | J-1061..... | i, 339 | (See notes, ii, 2820.) | | |
| Hoppow Cr., Cal. | TT-198..... | i, 1556 | Horse Shoe Lake, Miss. | X-6..... | i, 785 |
| Hoquiam R., Wash. | XX-22..... | i, 1655, 1662 | Horseshoe Lake, Miss. | X-6..... | i, 788 |
| Appro..... | | ii, 2301 | Horseshoe Lead, Va. | L-13..... | i, 411 |
| Bridges..... | | ii, 2175 | Horse Tall. | (HH)..... | i, 1074* |
| Harbor lines..... | | ii, 2256 | Horsetail Cr., Colo.: (See notes, ii, 2820.) | | |
| Hoquarten Slough, Oreg. | VV-62..... | i, 1593 | Horsetail or Clear Cr., Colo. | GG-1081..... | i, 1033 |
| Hornbarn Cove, Me. | A-160..... | i, 28 | Horse Thoroughfare, N. C. | L-350..... | i, 144 |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|----------------------|---------------------------------------|---------------------|-------------------|
| Horton Cr., Pa. | J-636..... | i, 335 | Hudson R., N. J. and N. | | |
| Horton Pt., N. Y. (break- water) | F-27..... | i, 223 | Y. (continued)..... | E-28-a..... | i, 191 |
| Hortons Cove, Conn. | D-17..... | i, 141 | | E-28-c..... | i, 195 |
| Hortons Pt., N. Y. | F-27..... | i, 215 | Hudson R., N. Y. | E-28..... | i, 177 |
| Hospital B., La. | S-315..... | i, 683 | (See notes, ii, 2792.) | | |
| Hospital Cr., Fla.: | | | Appro..... | | ii, 2289 |
| Harbor lines..... | | ii, 2256 | Bridges..... | | ii, 2175 |
| Hospital Cr., Vt. | E-107..... | i, 173 | Harbor lines..... | | ii, 2256 |
| Hospital Pt., Va. | L-173-g..... | i, 434 | Wrecks..... | | ii, 2209 |
| Hoskins Cr., Va. | K-218..... | i, 374 | Hudson R. to Great | | |
| Hot Springs Cr., Mont. | GG-511..... | i, 1029 | Lakes: | | |
| Hough Cr., Va. | K-203..... | i, 374 | Appro..... | | ii, 2299 |
| Hound Cr., Mont. | GG-545..... | i, 1029 | Huffeys Cr., S. C. | N-82..... | i, 499 |
| (See notes, ii, 2816.) | | | Huffpower Bayou, La. | S-588..... | i, 686 |
| Houghton and Hancock, | | | Huffs Cr., N. C. | M-239..... | i, 456 |
| Mich.: | | | Huger Bayou, La. | S-690..... | i, 687 |
| Harbor lines..... | | ii, 2256 | Hughes Bar | (CC)..... | i, 909* |
| Housatonic R., Conn. | D-64..... | i, 141, 162 | Hughes Cr., Ohio. | DD-376..... | i, 962 |
| (See notes, ii, 2790.) | | | Hughes Cr., Tenn. | AA-236..... | i, 850 |
| Appro..... | | ii, 2289 | Hughes Cr., W. Va. | EE-127..... | i, 984 |
| Bridges..... | | ii, 2175 | Hughes R., W. Va. | EE-180..... | i, 984 |
| Housing Bayou, Tex.: | | | Hughes R., W. Va., North | | |
| (See notes, ii, 2806.) | | | Fork..... | EE-182..... | i, 984 |
| Houston H., Tex. | U-21..... | i, 735 | Hughes R., W. Va., South | | |
| Houston R., La. | S-848..... | i, 688 | Fork..... | EE-181..... | i, 984 |
| Bridges..... | | ii, 2175 | Hull Gut, Mass. | B-147..... | i, 70 |
| Houstons Cr., Ga. | O-116..... | i, 534 | Hull, Mass. (headland) | B-148..... | i, 70, 95 |
| Houston Ship Chan. (Gal- veston Ship Chan. and | | | Hull Pt. | (GG-2)..... | i, 1035* |
| Buffalo Bayou), Tex. | U-26-c..... | i, 743 | Hulls Cr., Va. | K-133..... | i, 374 |
| Houston Ship Chan., Tex. | U-26..... | i, 735 | | K-133..... | i, 397 |
| Houts Branch, Mo. | GG-62..... | i, 1025 | Humboldt B., Cal. | TT-175..... | i, 1556 |
| Howard Bend | (GG-2)..... | i, 1038* | (See notes, ii, 2840.) | | |
| (See notes, ii, 2825.) | | | Harbor lines..... | | ii, 2256 |
| Howard Branch, Mo. | GG-16..... | i, 1025 | Humboldt Cr., Kans.: | | |
| Howard, Fort, Wis.: | | | (See notes, ii, 2823.) | | |
| Harbor lines..... | | ii, 2255 | Humboldt H., Cal.: | | |
| Howards | (HH)..... | i, 1074* | (See notes, ii, 2840.) | | |
| Howards B., Minn.: | | | Appro..... | | ii, 2300 |
| Harbor lines..... | | ii, 2256 | Humboldt H. and B., Cal. | TT-175..... | i, 1570 |
| Howards B., Wis.: | | | Humbog Cr., Nebr. | GG-954..... | i, 1032 |
| Harbor lines..... | | ii, 2256 | Hummock Chan., Va. | L-8..... | i, 411 |
| Howards Cr., Ky. | DD-180..... | i, 960 | Humphreys Cr., Md. | J-1083..... | i, 339 |
| Howards Cr., W. Va. | EE-110..... | i, 984 | Harbor lines..... | | ii, 2256 |
| Howard Slough, Cal. | TT-76..... | i, 1555 | HUMPHREYS, GEN. A. | | |
| Howards Pass, La. | S-226..... | i, 683 | A.: | | |
| Hoyts Cr., S. Dak. | GG-351..... | i, 1027 | "Robert" Index..... | | i, 9 |
| (See notes, ii, 2815.) | | | Humtulpis R., Wash. | XX-23..... | i, 1655, 1662 |
| Hub Quarter Cr., N. C. | L-388..... | i, 414 | Bridges..... | | ii, 2175 |
| Hudsens Bayou, Fla. | P-291..... | i, 571 | Hungers Cr., Va. | L-68..... | i, 411 |
| Rudon Battery, New | | | Hungry Mother Cr., Mo. | GG-107..... | i, 1026 |
| York H., N. Y. (see New | | | (See notes, ii, 2813.) | | |
| York) | | ii, 1806, 1807, 1881 | Hunlock Cr., Pa. | J-699..... | i, 336 |
| Hudson B., Fla. | P-330..... | i, 571, 603 | Hunter Cr., Cal. | TT-200..... | i, 1556 |
| Hudson Cr., Ga. | O-215..... | i, 534 | Hunter Cove, Oreg. | YV-7..... | i, 1593 |
| Hudson Cr., Md. | J-245..... | i, 333 | Hunter Cr., Pa. | J-854..... | i, 337 |
| Hudson H., Wis. | KK-47-b..... | i, 1253 | Hunters Cr., Va. | K-a..... | i, 375 |
| Hudson R., canal to Great | | | Hunting Bayou, Tex. | U-19..... | i, 735 |
| Lakes | | | Hunting Cr., Accomac | | |
| Hudson R., N. J. | E-28-b..... | i, 195 | Co., Va..... | L-85-b..... | i, 417 |
| Hudson R., N. J. and N. | | | Bridges..... | | ii, 2175 |
| Y. | E-28..... | i, 191 | Hunting Cr., Md. | J-267..... | i, 333, 352 |
| | | | | J-375..... | i, 333 |
| | | | | K-18..... | i, 373 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Hunting Cr., Tenn..... | AA-167..... | i, 849 | Hurricane Branch, Ky.... | DD-85..... | i, 959 |
| Hunting Cr., Va..... | K-92..... | i, 373, 390 | | DD-106..... | i, 960 |
| | K-232..... | i, 375 | Hurricane Cr., Mo..... | GG-116..... | i, 1026 |
| Huntingfield Cr., Md..... | J-500..... | i, 334 | (See notes, ii, 2813.) | | |
| Huntington B., N. Y..... | F-14..... | i, 215 | Hurricane Cr., Ind..... | BB-20..... | i, 891 |
| Huntington Br. to Seven Devils mining district, Snake R. (upper), Ida- ho..... | VV-84-c..... | i, 1611 | Hurricane Cr., Ky..... | DD-247..... | i, 961 |
| Huntington Cr., Pa..... | J-703..... | i, 336 | Hurricane Cr., La..... | S-253..... | i, 683 |
| Huntington H., Long Is- land, N. Y..... | F-16..... | i, 219 | | S-836..... | i, 688 |
| Huntington H., N. Y..... | F-16..... | i, 215 | | S-855..... | i, 688 |
| Appro..... | | ii, 2289 | Hurricane Cr., Tenn..... | AA-233..... | i, 850 |
| Hunts Cove, Va..... | K-161..... | i, 874 | Hurricane Cr., Va..... | DD-268..... | i, 961 |
| Huntsdale..... | (GG-2)..... | i, 1038* | Hurricane Field (HH): (See notes, ii, 2833.) | | |
| Hunts Pt., N. Y.: | | | Hurricane Fork, W. Va..... | EE-129..... | i, 984 |
| Harbor lines..... | | ii, 2256 | Hurricane Isld..... | (CC)..... | i, 909* |
| Hunts Run, Pa..... | J-780..... | i, 337 | Hurricane Sound, Me.... | A-120..... | i, 28 |
| Huron B., Mich..... | LL-48..... | i, 1265 | Hushpuckana..... | (HH)..... | i, 1074* |
| Huron H., Mich..... | PP-81..... | i, 1419 | Hushpuckana Bayou, Miss..... | X-18..... | i, 785 |
| Navigation rules..... | | ii, 2041, 2107 | Hushpuckney Cr., Mo.... | GG-1477..... | i, 1036 |
| Huron H., Ohio..... | QQ-18..... | i, 1461, 1471 | Husla R., Alaska..... | XX-233..... | i, 1657 |
| Appro..... | | ii, 2299 | Hutchinson R., N. Y..... | E-15..... | i, 177, 182 |
| Bridges..... | | ii, 2175-2176 | Bridges..... | | ii, 2176 |
| Wrecks..... | | ii, 2269 | Hutchinson, Kans..... | Y-2-c..... | i, 820 |
| Huron, Lake (waters con- necting with Lake Su- perior)..... | PP-1-b..... | i, 1421 | Hyacinth removal (see P-1-b, e, 572). | | |
| Huron R., Mich..... | PP-119..... | i, 1420, 1456 | Hyannis H., Mass.: Wrecks..... | | ii, 2269 |
| Huron R., Ohio..... | QQ-19..... | i, 1461 | Hyannis H. of Refuge, Mass..... | C-9..... | i, 107, 109 |
| Bridges..... | | ii, 2175-2176 | (See notes, ii, 2786.) | | |
| Hursley Cr., Mich..... | PP-9..... | i, 1419 | Appro..... | | ii, 2288 |
| Hurst Branch, Ky..... | DD-86..... | i, 959 | Hycotet R., Va. and N. C..... | L-380..... | i, 414 |
| Hurst Cr., Md..... | J-260..... | i, 333 | Hylebos Cr., Wash..... | XX-71..... | i, 1655 |
| Hurricane..... | (HH)..... | i, 1074* | Bridges..... | | ii, 2176 |
| Hurricane Bend (HH): (See notes, ii, 2833.) | | | Hymella..... | (HH)..... | i, 1074* |
| | | | Hyner Cr., Pa..... | J-766..... | i, 336 |

I.

| | | | | | |
|---|-------------|-----------------|---|--------------|----------------|
| Iba, P. I..... | YY-102..... | i, 1686 | Illinois and Mississippi Canal, Ill..... | JJ-20..... | i, 1234, 1235 |
| Iberla-St. Mary Canal, La. | S-701..... | i, 687 | | JJ-20-c..... | i, 1237 |
| Ilasco..... | (HH)..... | i, 1074* | | JJ-20-e..... | i, 1240 |
| Iligan B., P. I..... | YY-174..... | i, 1686 | Appro..... | | ii, 2297 |
| Ilog, P. I..... | YY-132..... | i, 1686 | Bridges..... | | ii, 2178 |
| Iloilo, P. I..... | YY-138..... | i, 1686 | Navigation rules..... | | ii, 2041, 2107 |
| Ilana B., P. I..... | YY-164..... | i, 1686 | Illinois Cr., Ark..... | Y-5..... | i, 818 |
| Illetes Bay des, La.: (See notes, ii, 2804.) | | | Illinois Cr., Colo..... | GG-1036..... | i, 1033 |
| Illinois..... | (HH)..... | i, 1074*, 1075* | (See notes, ii, 2820.) | | |
| Illinois and Michigan Ca- nal..... | NN-12..... | i, 1349 | Illinois Cr., Kans..... | GG-1239..... | i, 1034 |
| | NN-1-b..... | i, 1353 | (See notes, ii, 2821.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Illinois R. | (HH) . . .i, | 1074*, 1075* | Indian Cr., Kans. | GG-1231 . . .i, | 1034 |
| (See notes, ii, 2827, 2828, 2832.) | | | (See notes, ii, 2821, 2822.) | GG-1335 . . .i, | 1035 |
| Illinois R., Ark. and Okla. | Y-8i, | 818 | Indian Cr., Ky. | DD-52i, | 959 |
| Illinois R., Ill. | JJ-3i, | 1234 | DD-181i, | 960 | |
| | NN-1i, | 1349 | Indian Cr., La. | S-854i, | 688 |
| | NN-1-ai, | 1349 | Indian Cr., Md. | J-262i, | 333 |
| | NN-1-ci, | 1353 | K-27i, | 373 | |
| (See notes, ii, 2836, 2837.) | | | Indian Cr., Minn. | JJ-45i, | 1234 |
| Appro. | ii, | 2298 | Indian Cr., Mo. | GG-1411 . . .i, | 1036 |
| Bridges | ii, | 2177-2178 | GG-1498 . . .i, | 1036 | |
| Navigation rules | ii, | 2041, 2107 | Indian Cr., Mo. and Kans.: | | |
| Snag boats and dredges, appro. | ii, | 2285 | (See notes, ii, 2823.) | | |
| Wrecks | ii, | 2269 | Indian Cr., N. Y. | F-96i, | 216, 232 |
| Illinois R. and Peoria Lake, Ill.: | | | Indian Cr., N. C. | L-238i, | 413 |
| Harbor lines | ii, | 2256 | M-322i, | 456 | |
| Illinois R., Oreg. | V. V-9i, | 1593 | Indian Cr., N. Dak. | GG-753i, | 1031 |
| Illinois R. to Lockport: | | | (See notes, ii, 2818.) | | |
| Appro., for survey | ii, | 2283 | Indian Cr., Pa. | FF-17i, | 1003 |
| Illinois R. to Watertown, Mississippi R. Hennepin Canal (ship canal) | JJ-20-bi, | 1236 | Indian Cr., S. Dak. | GG-868i, | 1031 |
| Illinois-Wisconsin (HH) | | i, 1075* | (See notes, ii, 2818, 2819.) | | |
| Illinois-Wisconsin State line | KK-2i, | 1247 | Indian Cr., Tenn. | AA-163i, | 849 |
| Illustrations | | i, 14 | AA-222i, | 850 | |
| Ilwaco H., Wash. | WW-71-ai, | 1652 | AA-265i, | 850 | |
| Harbor lines | ii, | 2256 | AA-295i, | 850 | |
| Imperial R., Fla. | P-224i, | 570 | Indian Cr., Va. | K-152i, | 374 |
| Imnaha R. | (WW-2)i, | 1617* | L-196i, | 412 | |
| Imnaha R., Oreg. | VV-86i, | 1593 | DD-260i, | 961 | |
| Improvements, waterway: | | | DD-267i, | 961 | |
| Non-United States work | ii, | 2041, 2109 | Indian Cr., W. Va. | EE-25i, | 983 |
| Imuram B., P. I. | YY-149i, | 1686 | EE-107i, | 984 | |
| Independence Cr., Kans. | GG-1162i, | 1034 | Indian Cr., Wyo. | GG-1068i, | 1033 |
| (See notes, ii, 2821.) | | | (See notes, ii, 2820.) | | |
| Independence, Fort, Mass. | ii, | 1805, 1855 | Indian Field Cr., S. C. | N-222i, | 500 |
| Index, Reports, Chief of Engineers, U. S. Army: | | | Indian Fork, Ohio. | DD-373i, | 962 |
| Congressional authority | i, | 7, 9 | Indian H., Ind. | NN-22i, | 1349 |
| "Raymond" edition | i, | 9 | Indian H., Me. | A-39i, | 27 |
| "Robert" edition | i, | 9 | Indian Hill. | (CC)i, | 909* |
| Indiana Chute | (CC)i, | 909* | Indian Isld. Slough, N. C. | M-102-ai, | 465 |
| Indiana H., Ind. | NN-22i, | 1367 | Indian Key Chan., Fla. | P-186i, | 570 |
| Appro. | ii, | 2298 | Indian Key, Fla.: | | |
| Indiana H. Canal, Ind.: | | | Bridges | ii, | 2178 |
| Bridges | ii, | 2178 | Indian lands | (HH)i, | 1075* |
| Indian B., Fla. | P-333i, | 571 | Indian Mound B., La. | S-162i, | 682 |
| Indian Bayou, La. | S-131i, | 682 | Indian Pass, Fla. | P-320i, | 571 |
| | S-581i, | 686 | Q-27i, | 611 | |
| | S-841i, | 688 | D-45i, | 141 | |
| Indian Brook, Mass. | B-172i, | 70 | D-62i, | 141 | |
| Indian Brook, N. Y. | E-37i, | 177 | Indian R., Del. | I-77i, | 299, 325 |
| Indian Coulee, La. | S-758i, | 687 | Appro. | ii, | 2290 |
| Indian Cr., Ala. | AA-205i, | 850 | Indian R., Fla. | P-112i, | 570 |
| Indian Cr., Fla. | P-160i, | 570 | Appro. | ii, | 2293 |
| Indian Cr., Ga. | O-303i, | 535 | Bridges | ii, | 2178 |
| | O-366i, | 535 | Indian R., Fla., and con- necting waterways | P-112i, | 585 |
| Indian Cr., Iowa. | GG-255i, | 1027 | Indian R. Inlet, Del. | I-75i, | 299 |
| (See notes, ii, 2814.) | GG-276i, | 1027 | Indian R. Inlet, Fla. | P-111i, | 570 |
| | | | Indian R., Me. | A-23i, | 27 |
| | | | Indian R., Mass. | B-50i, | 69 |
| | | | Indian R., Mich. | PP-34i, | 1419 |
| | | | Bridges | ii, | 2178 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------|---|---------------------|-------------------|
| Indian R., Upper Sine- puxent B., and Isle of Wight B., Md. (connec- tion of) | I-81-c..... | i, 328 | Iowa | (HH)..... | i, 1075* |
| Indian Run, Md. | J-1032..... | i, 338 | Iowa Isld. | (HH)..... | i, 1075* |
| | J-1131..... | i, 339 | Iowa Lake, Iowa (outlet to) | GG-256..... | i, 1027 |
| Indian Slough, Cal. | UU-16..... | i, 1577 | (See notes, ii, 2814.) | | |
| Indian Slough, Oreg. | VV-43..... | i, 1593 | Iowa R. | (HH)..... | i, 1075* |
| Indian Territory: | | | Iowa R., Iowa | JJ-65..... | i, 1234, 1243 |
| Forts..... | | ii, 1803, 1816 | | JJ-68-b..... | i, 1243 |
| Indian Town Cr., N. C. | L-262..... | i, 413 | Appro..... | | ii, 2237 |
| Indian Town Cr., S. C. | N-78..... | i, 499 | Iowa R. (upper), Iowa | JJ-59..... | i, 1234 |
| Indiantown Cr., Va. | L-41..... | i, 411 | Ipswich R., Mass. | B-60..... | i, 69 |
| India (reservoirs) | (HH)..... | i, 1075* | | B-60..... | i, 75 |
| Indigo Slough, Cal. | TT-34..... | i, 1555 | (See notes, ii, 2784.) | | |
| Inglutalik R., Alaska | XX-242..... | i, 1657 | Appro..... | | ii, 2288 |
| Ingrams Cr., N. J.: | | | Irish Bayou, La. | S-140..... | i, 682 |
| Bridges..... | | ii, 2184 | Irish Chan., N. Y. | F-93..... | i, 216 |
| Ingrams Thoroughfare, N. J.: | | | Irish Cr., Ky. | DD-218..... | i, 960 |
| Bridges..... | | ii, 2178 | Irish Cr., Md. | J-334..... | i, 333 |
| Inigoes Cr., Md. | K-54..... | i, 373 | Irontale, Wash.: | | |
| Inland Waterways. (See Boston to Beaufort; Charles- ton, S. C., Intercoastal Waterway.) | | | Harbor lines..... | | ii, 2256 |
| Inland Waterways, Del.: | | | Irondequoit B., N. Y. | RR-41..... | i, 1493, 1520 |
| Bridges..... | | ii, 2178 | Iron Lake, Minn. and Canada | KK-232..... | i, 1249 |
| Innoko R., Alaska | XX-190..... | i, 1656 | Iron Pier, Lewes, Del. | H-24..... | i, 271 |
| Inspecting-house Cr., Md. | J-1271..... | i, 340 | Iron R., Wis. | LL-25-b..... | i, 1281 |
| Instruments, surveys | | ii, 2041, 2120 | Ironton | (CC)..... | i, 909* |
| Insular—Porto Rico, Ha- wai, and the Philip- pines | YY..... | i, 1683 | Ironton, Minn.: | | |
| Insular Ports: | | | Harbor lines..... | | ii, 2256 |
| Forts..... | | ii, 1823 | Irrigation: | | |
| Insular Possessions: | | | California, and arid lands..... | | ii, 2040, 2087 |
| Fire control..... | | ii, 1812 | Irving's Branch, La. | S-40..... | i, 681 |
| Forts..... | | ii, 1810, 1811 | Isaacs Cr., N. C. | M-206..... | i, 455 |
| Mines..... | | ii, 1815 | Isabelle Cr., Wis. | KK-44..... | i, 1247 |
| Preservation and repair, and torpedo structures..... | | ii, 1812 | Isabell Station | (GG-2)..... | i, 1038* |
| Sites..... | | ii, 1813 | Isbell (GG): | | |
| Insular Rivers and Har- bors: | | | (See notes, ii, 2826.) | | |
| (See notes, ii, 2845.) | | | Isbell Station to Clays- ville, Missouri R.: | | |
| Interior Department: | | | (See notes, ii, 2824.) | | |
| Surveys..... | | ii, 2041, 2120 | Ish Cr., Tenn. | AA-108..... | i, 849 |
| International boundary, United States and Cana- da | E-74..... | i, 177 | Isla au Breton | (HH)..... | i, 1075* |
| International Congresses, Navigation | | ii, 2041, 2110, 2283 | Isla de Boile Cr. | (HH)..... | i, 1075* |
| International line | (WW-2)..... | i, 1617* | Islais Cr., Cal. | TT-16..... | i, 1555 |
| Intercoastal Canal, Bos- ton, Mass., to Beaufort, N. C. | | i, 474 | Islais R., San Francisco B., Cal. | TT-16..... | i, 1560 |
| Intracoastal Canal, La.: (See notes, ii, 2805.) | | | Island Branch, Md. | J-928..... | i, 338 |
| Intracoastal Waterways (see Waterways)..... | | ii, 2041, 2116 | Island Chan., N. Y. | F-97..... | i, 216 |
| Inwood, N. Y. | F-86..... | i, 216, 231 | Island Cr., Ala. and Ga. | AA-59..... | i, 848 |
| Ione | (WW-2)..... | i, 1617* | Island Cr., Kans. | GG-1174..... | i, 1034 |
| | | | (See notes, ii, 2821.) | | |
| | | | Island Cr., Ky. | DD-29..... | i, 959 |
| | | | | DD-37..... | i, 959 |
| | | | | DD-248..... | i, 961 |
| | | | Island Cr., Md. | J-139..... | i, 332 |
| | | | | J-321..... | i, 333 |
| | | | | J-444..... | i, 334 |
| | | | | J-513..... | i, 335 |
| | | | | K-15..... | i, 373 |
| | | | Island Cr., Mass. | B-166..... | i, 70 |
| | | | Island Cr., N. C. | L-307..... | i, 413 |
| | | | | M-185..... | i, 455 |
| | | | | M-308..... | i, 456 |
| | | | Island Cr., N. Y. | E-55..... | i, 177 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|--|-------------------|
| Island Cr., S. C. | N-247..... | i, 501 | Isle of Shoals H., Me. and N. H.: | | |
| Island Cr., Tenn. | AA-93..... | i, 849 | (See notes, ii, 2783.) | | |
| Island Cr., Va. | L-383..... | i, 414 | Appro..... | ii, 2288 | |
| Island Cr., W. Va. | EE-16..... | i, 983 | Isle of Wight B., Del. and Va. | I-81..... | i, 299 |
| | EE-83..... | i, 983 | Isle of Wight B., Md., Up- per Sinepuxent B., and Indian R. (connection of) | I-81-c..... | i, 328 |
| Island End R., Mass. | B-120..... | i, 70 | Isle Royal | LL-60..... | i, 1265 |
| Island Levee | (HH)..... | i, 1075* | (See notes, ii, 2835.) | | |
| Island 5 | (WW-2)..... | i, 1617* | Isle Royale, Mich. | LL-63..... | i, 1294 |
| Island 8 | (HH)..... | i, 1075* | Islesboro H., Me. | A-111..... | i, 28 |
| Island 20 (HH): | | | Isles of Shoals H. (Gos- port H.), Me. and N. H. | A-291..... | i, 29, 65 |
| (See notes, ii, 2832.) | | | | A-291-a..... | i, 65 |
| Island 21 (HH): | | | Islip Cr., N. Y. | F-61..... | i, 215 |
| (See notes, ii, 2832.) | | | Isthmian Canal: | | |
| Island 30 (HH): | | | Forts..... | ii, 1796, 1823, 2040, 2090, 2453, 2476 | |
| (See notes, ii, 2831.) | | | Reports, index to..... | i, 10; ii, 2357 | |
| Island 65 (HH): | | | Isthmus Slough, Oreg. | VV-21..... | i, 1593 |
| (See notes, ii, 2827.) | | | Istokpoga Cr., Fla. | P-245..... | i, 571 |
| Island Rapids | (HH)..... | i, 1075* | Istokpoga Lake, Fla. | P-246..... | i, 571 |
| Island Slough, Cal. | TT-86..... | i, 1555 | Italian Slough, Cal. | UU-17..... | i, 1577 |
| Isas Verdes B., P. I. | YY-142..... | i, 1686 | Ivy Landing | (HH)..... | i, 1075* |
| Isle Au Haut Thorough- fare, Me. | A-92..... | i, 27, 37 | | | |
| Isle des Cannes Bayou, La. | S-728..... | i, 687 | | | |
| Isle of Hope R., Ga. | O-97..... | i, 533 | | | |

J.

| | | | | | |
|--|--------------|----------------------|--|-------------------|---------|
| Jabez Branch, Md. | J-1222..... | i, 340 | Jackson to Carthage, Pearl R., Miss. | R-98-d..... | i, 676 |
| Jacaguas R., P. R. | YY-12..... | i, 1685 | Jacksonville, Fla.: | | |
| Jaelnto R., Tex. | U-17..... | i, 735 | (See notes, ii, 2799.) | | |
| Jackass B., La. | S-215..... | i, 682 | Harbor lines..... | ii, 2256 | |
| Jack Cr., Colo. | GG-1039..... | i, 1033 | Jacksonville, Fla., dis- trict | P (with map)..... | i, 567 |
| Jack Cr., Md. | J-133..... | i, 332 | (See notes, ii, 2799.) | | 569 |
| Jack Cr., Wyo. | GG-1022..... | i, 1033 | Appro..... | ii, 2293 | |
| (See notes, ii, 2820.) | | | Jacksonville (opposite), St. Johns R., Fla. | P-10-b..... | i, 579 |
| Jacks Cr., Ga. | O-250..... | i, 535 | Jacksonville to Palatka, St. Johns R., Fla. | P-10-c..... | i, 579 |
| | O-295..... | i, 535 | Jacob Bayou, La. | S-523..... | i, 685 |
| Jacks Cr., Ky. | DD-15..... | i, 959 | Jacob Fork, W. Va. | DD-309..... | i, 961 |
| Jacks Cr., N. C. | M-97..... | i, 455 | Jacobi Cr., Cal. | TT-182..... | i, 1556 |
| Jacks Cr., Pa. | J-860..... | i, 337 | Jacobs Cr., Md. | J-518..... | i, 335 |
| Jacks Cr., S. C. | N-110..... | i, 500 | Jacobs Cr., N. C. | M-104..... | i, 455 |
| Jacks Cr., Va. | J-8..... | i, 331 | Jacobs Swamp, N. C. | N-34..... | i, 499 |
| Jacks Fork, Mo. | Y-31..... | i, 818 | Jacobus Cr., Va. | L-69..... | i, 411 |
| Jackson and Edinburg, between (Pearl R., Miss.) | R-98-e..... | i, 676 | Jaget Slough, Cal. | TT-33..... | i, 1555 |
| Jackson Bayou, La. | S-678..... | i, 687 | Jamaica B., N. Y. | F-79..... | i, 215 |
| Jackson (below), Pearl R., Miss. | R-98-c..... | i, 675 | (See notes, ii, 2792.) | | |
| Jackson Chute | (GG-2)..... | i, 1038* | Appro..... | ii, 2289 | |
| Jackson Cr., Md. | J-417..... | i, 334 | Bridges..... | ii, 2179 | |
| Wrecks..... | | ii, 2269 | Harbor lines..... | ii, 2256 | |
| Jackson Crs., Fla. | O-531..... | i, 537 | Jamaica B., N. Y., Indian Cr. | F-96..... | i, 232 |
| Jacksons Bayou, La. | K-120..... | i, 374 | | | |
| | K-236..... | i, 375, 402 | | | |
| Jackson, Fort, Ga. | | ii, 1803, 1948, 1976 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Jamaica B., N. Y., to Cornells Cr. and Landing (water connection). | F-91 | i, 231 | Jean Louis Robin Bayou, La. | S-179 | i, 682 |
| Jamaica B., Great South B., and Peconic B., N. Y. (waterway connecting). | F-48-b | i, 227 | Jefferson | (HH) | i, 1075* |
| Jamaica B. to Long Beach Inlet, N. Y. | F-80 | i, 230 | Jefferson City | (GG-2) | i, 1038* |
| Jamaica B. to Rockaway Inlet, N. Y. (channel). | F-88 | i, 216 | Jefferson City, Mo. | (GG-2) | i, 1037* |
| | F-78-b | i, 230 | Jefferson, Fort. | | ii, 1802, 1955 |
| James Cr. Canal, D. C. | K-46-o | i, 385 | Jefferson R. | (GG-2) | i, 1038* |
| James Cr., Fla. | P-166 | i, 570 | Jefferson R., Mont. | GG-512 | i, 1029 |
| James Cr., N. C. | M-121 | i, 455 | (See notes, ii, 2813.) | | |
| James Fork, Mo. | Y-41 | i, 818 | Jefferson, Tex.: | | |
| James Isld., S. C.: | | | (See notes, ii, 2807.) | | |
| Forts | | ii, 1940 | Appro. | | ii, 2294 |
| James Landing | (HH) | i, 1075* | Jefferson, Tex., and Shreveport, La. (waterway). | T-18-a | i, 729 |
| James or Dakota R., S. Dak. and N. Dak. | GG-301 | i, 1027 | Jeffersonville, Ind. | (CC) | i, 909* |
| | (GG-2) | i, 1037* | Jeffreys Cr., S. C. | N-60 | i, 499 |
| | GG-301-a | i, 1060 | Jeffries Pt., Mass.: | | |
| (See notes, ii, 2815, 2826.) | | | Harbor lines | | ii, 2256 |
| James R. | (GG-2) | i, 1038* | Jekyl Cr., Ga. | O-456 | i, 536, 561 |
| James R. and Kanawha Canal, Va. and W. Va. (survey for extension of) | EE-62-d | i, 992 | Appro. | | ii, 2293 |
| James R. Survey, Ohio R. connecting with. | EE-62-e | i, 993 | Jekyl Sound, Ga. | O-455 | i, 536 |
| James R., Va. and W. Va. | L-105 | i, 412, 419 | Jeiks Mill Cr., Ga. | O-386 | i, 536 |
| | L-117-a | i, 423 | Jelloway Cr., Ohio. | DD-415 | i, 962 |
| (See notes, ii, 2795, 2811.) | | | Jenifer Branch, Md. | J-1047 | i, 339 |
| Appro. | | ii, 2291 | Jenkins Cove, N. C. | L-231 | i, 413 |
| Bridges | | ii, 2179 | Jenkins Cr., Md. | J-47 | i, 331 |
| Harbor lines | | ii, 2256 | | J-257 | i, 333 |
| Wrecks | | ii, 2269 | Jenkins Run, Md. | J-1000 | i, 338 |
| James R., Va., Jamestown Isld. | L-117 | i, 412 | Jennies Cr., Ky. | DD-234 | i, 961 |
| James Run, Md. | J-959 | i, 338 | Jennies Cr., W. Va. | DD-329 | i, 961 |
| Jamestown Exposition (piers). | L-99-b | i, 418 | Jennings, Tenn. | AA-294 | i, 850 |
| Jamestown Isld., Va. | L-117 | i, 412 | Jenny Lind | (CC) | i, 910* |
| | L-117-a | i, 423 | Jericho B., Me. | A-72 | i, 27 |
| Appro. | | ii, 2291 | Jericho Cr., S. C. | N-18 | i, 499 |
| Jamestown Isld., Va. (permanent landing pier). | L-117-b | i, 423 | | N-20 | i, 499 |
| Jamestown, R. I.: | | | Jerome Fork, Ohio. | DD-409 | i, 962 |
| Harbor lines | | ii, 2256 | Jerry's Pt.: | | |
| Jarbole Cr., Kans. | GG-1196 | i, 1034 | Forts | | ii, 1851 |
| (See notes, ii, 2821.) | | | Jersey City, N. J. | E | i, 177 |
| Jarnigan Slough, Cal.: | | | | E-28-b | i, 195 |
| Bridges | | ii, 2179 | Jersey City, N. J. (in front of) | E-28-c | i, 195 |
| Jarrett Cr., Md. | J-458 | i, 334 | Jersey City to Ellis Isld., N. Y. (ship channel). | E-28-f | i, 196 |
| Jarretts B., N. C. | M-241 | i, 456 | Jersey Cr., Kans.: | | |
| Jarvis Chan., N. C. | L-225 | i, 413 | (See notes, ii, 2821.) | | |
| Jarvis Cr., Va. | K-150 | i, 374 | Jersey Flats, New York | | |
| Jaws, La. | S-682 | i, 687 | II: | | |
| Jeanerette Canal, La. | S-702 | i, 687 | Harbor lines | | ii, 2256 |
| (See notes, ii, 2804.) | | | Jessamine Cr., Ky. | DD-186 | i, 960 |
| Jeanerette, La.: | | | Jesuit Bend. | (HH) | i, 1075* |
| (See notes, ii, 2804.) | | | Jewish Cr., Fla. | P-169 | i, 570 |
| Jean Guites Cr., N. C. | L-222 | i, 413 | Jew Fish Cr., Fla.: | | |
| | | | Bridges | | ii, 2179 |
| | | | Jews Cr., La. | S-254 | i, 683 |
| | | | Jim Crow Cr. | (WW-2) | i, 1617* |
| | | | Jim Crow Cr., Wash. | WW-65 | i, 1615 |
| | | | Jim Fords Isld. | (WW-2) | i, 1617* |
| | | | Jim Henry Cr., Mo. | GG-1461 | i, 1036 |
| | | | (See notes, ii, 2823.) | | |
| | | | Jim Smiths. | (HH) | i, 1075* |
| | | | Joachim Crossing | (HH) | i, 1075* |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------|---------------------|-------------------|-------------------------|---------------------|-------------------|
| Joachim Cr., N. C. | M-209 | i, 455 | Jones Cr., Ga. | O-51 | i, 533 |
| Joaquin Valley, Cal.: | | | | O-179 | i, 534 |
| Irrigation | | ii, 2040, 2087 | | O-434 | i, 536 |
| Jobbers Cr., Ga. | O-55 | i, 533 | Jones Cr., La. | S-102 | i, 682 |
| Jobs Ditch, Md. | J-146 | i, 332 | Jones Cr., Md. | J-54 | i, 331 |
| Jocho R. | (WW-2) | i, 1617* | | J-73 | i, 331 |
| Joe Bayou, La. | S-816 | i, 686 | | J-1082 | i, 339 |
| Joe Eckles Crossing. | (HH) | i, 1075* | Bridges | | ii, 2179, 2206 |
| (See notes, ii, 2832.) | | | Jones Cr., Mo.: | | |
| Joe Marcel Bayou, La. | S-767 | i, 687 | (See notes, ii, 2824.) | | |
| Joes Cove, Md. | J-206 | i, 332 | Jones Cr., Nebr. | GG-1140 | i, 1034 |
| Joes Isld. Cr., N. C. | L-272 | i, 413 | (See notes, ii, 2821.) | | |
| Joes Ridge Cr., Md. | J-187 | i, 332 | Jones Cr., Va. | K-302 | i, 375 |
| John Day R., Oreg. | (WW-2) | i, 1617* | | L-162 | i, 412 |
| | VV-81 | i, 1593 | Harbor lines | | ii, 2256 |
| | WW-9 | i, 1615 | Jones Falls, Md. | J-1091 | i, 339 |
| Bridges | | 2139, ii, 2179 | Jones Fork, Ky. | DD-241 | i, 961 |
| John Day Rock | (WW-2) | i, 1617* | Jones Inlet, N. Y. | F-69 | i, 215 |
| John B., Alaska. | XX-228 | i, 1657 | Jones Narrows, Ga. | O-98 | i, 533 |
| Johns B., Me. | A-178 | i, 28 | Jones Old R., Ga. | O-284 | i, 535 |
| Johns Cr., Ky. | DD-283 | i, 961 | Jones Pond, Md. | J-100 | i, 331 |
| Johns Cr., Va. | L-101 | i, 412 | Jones R., Mass. | B-69 | i, 69 |
| Johns R., Wash.: | | | | B-167 | i, 70 |
| Bridges | | ii, 2179 | Jones Top Cr., Va. | K-200 | i, 374 |
| Johnson Cr., N. C.: | | | Jordan Branch, Mo. | GG-227 | i, 1026 |
| Bridges | | ii, 2139, 2179 | (See notes, ii, 2814.) | | |
| Johnson Cr., Tenn. | AA-239 | i, 878 | Jordan Cr., Conn. | D-19 | i, 141 |
| Johnson, Fort, N. C. | | ii, 1935 | Jordan Cr., Ga. | O-339 | i, 535 |
| Johnson, Fort, S. C. | | ii, 1808, 1940 | Jordan R., Miss. | R-94 | i, 646 |
| Johnson Pond, Md. | J-99 | i, 331 | | R-92 | i, 673 |
| Johnsons Bayou, La. | S-158 | i, 682 | | R-92-a | i, 673 |
| | T-2-c | i, 717 | | R-92-c | i, 673 |
| | T-4 | i, 719 | (See notes, ii, 2803.) | | |
| | T-4 | i, 717 | Appro. | | ii, 2294 |
| (See notes, ii, 2805, 2806.) | | | Jordan R., Chan., Miss. | R-93 | i, 646 |
| Appro. | | ii, 2294 | Jordans Cr., N. C. | M-62 | i, 454 |
| Johnsons Cr., Conn. | D-69 | i, 141 | Jordans R., Me. | A-50 | i, 27 |
| Johnsons Cr., Ga. | O-187 | i, 534 | Joseph Bayou, La. | S-232 | i, 683 |
| | O-193 | i, 534 | Joseph Branch, La. | S-58 | i, 681 |
| Johnsons Cr., Ky. | DD-200 | i, 960 | Jotank Cr., Va. | K-110 | i, 374 |
| Johnsons Cr., N. Y. | RR-30 | i, 1493 | Jowler Cr., Mo. | GG-224 | i, 1026 |
| Johnsons Cr., Tenn. | AA-248 | i, 850 | (See notes, ii, 2814.) | | |
| Johnsons Cr., Va. | K-162 | i, 374 | Joyces Cr., N. C.: | | |
| | L-127 | i, 412 | (See notes, ii, 2795.) | | |
| Johnsons Isld. | (HH) | i, 1075* | Joys B., Me. | A-36 | i, 27 |
| Johnson Swamp, S. C. | N-96 | i, 499 | Juan de Fuca Strait, | | |
| Johnsonville, Tenn. | AA-18 | i, 855 | Wash. | XX-39-a | i, 1663 |
| Johns Pass, Fla. | P-217 | i, 570 | Judith | (GG-2) | i, 1038* |
| | P-319 | i, 571 | Judith Pt., E. I.: | | |
| Johns R., Me. | A-181 | i, 28 | Wrecks | | ii, 2269 |
| Johns R., S. C. | N-129 | i, 500 | Judith R., Mont. | GG-558 | i, 1029 |
| Johns R., Wash. | XX-15 | i, 1655 | (See notes, ii, 2816.) | | |
| Johnston Cr., Pa. | J-647 | i, 336 | Jullentown R., Ga. | O-198 | i, 534 |
| Jointers Cr., Ga. | O-454 | i, 536 | Jullington Cr., Fla. | P-77 | i, 569 |
| Jolo, P. I. | YY-182 | i, 1686 | Jumping Gulley Cr., S. | | |
| Jolly R., Fla. | O-525 | i, 537 | C. | N-69 | i, 499 |
| Jonathan Cr., Ky. | AA-20 | i, 848 | Jump R., Wis. | KK-34 | i, 1247 |
| Jonathan Run. | (CC) | i, 910* | Jump (The) | (HH) | i, 1075* |
| Jonathans Cr., Ohio. | DD-431 | i, 962 | Jump (The), La. | S-303 | i, 683 |
| Jones B., N. C. | M-127 | i, 455 | Junlata R., Pa. | J-855 | i, 337 |
| Jones Bayou, La. | S-763 | i, 687 | Junlata to the Potomac | | |
| Jones Cove, Me. | A-189 | i, 28 | R. (for canal). | K-46-n | i, 385 |
| Jones Cr., Ala. | AA-57 | i, 848 | Juniper B., N. C. | M-33 | i, 454 |
| | | | Juniper Cove, Mass. | B-101 | i, 69 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Juniper Cr., S. C. | N-9..... | i, 499 | Jupiter Narrows, Fla.: | | |
| Junop Bayou, La. | S-475..... | i, 685 | Bridges..... | ii, 2179 | |
| Jupiter Inlet, Fla. | P-136..... | i, 570, 587 | Jupiter R., Fla. | P-139..... | i, 570 |
| Jupiter Inlet to St. Johns | | | Bridges..... | ii, 2179 | |
| R., Fla. (canal) | P-10-h..... | i, 582 | Jupiter Sound, Fla. | P-137..... | i, 570 |

K.

| | | | | | |
|-----------------------------------|--------------|---------------|----------------------------------|----------------------|----------|
| Kaalualu H., Hawaii | YY-78..... | i, 1686 | Kanapou B., H. I.: | | |
| Kaalualu H., H. I.: | | | (See notes, ii, 2846.) | | |
| (See notes, ii, 2846.) | | | Kanawha Canal and | | |
| Kaanapali Landing, H. I.: | | | James R., Va. and W. | | |
| (See notes, ii, 2846.) | | | Va. (survey for exten- | | |
| Kabe Cr., Tenn. | AA-83..... | i, 848 | sion of) | EE-62-d..... | i, 992 |
| Kabekona Narrows, | | | Kanawha Canal, Va. and | | |
| Minn.: | | | W. Va.: | | |
| Bridges..... | ii, 2180 | | (See notes, ii, 2811.) | | |
| Kabetogama Lake, Minn. | KK-222..... | i, 1249 | Kanawha R. | (CC)..... | i, 910* |
| Kahana B., H. I.: | | | Kanawha R. Ls. and Ds. | | |
| (See notes, ii, 2846.) | | | (operating and care).... | EE-62-b..... | i, 990 |
| Kahilitna R., Alaska | XX-158..... | i, 1656 | Kanawha R., W. Va. | EE-62..... | i, 986 |
| Kahoolawe Isld., H. I.: | | | (See notes, ii, 2811.) | EE-62-a..... | i, 986 |
| (See notes, ii, 2846.) | | | Appro..... | ii, 2296 | |
| Kahookee Cr., N. C. | M-192..... | i, 455 | Bridges..... | ii, 2180 | |
| Kahoolawe Isld., Hawaii. | YY-64..... | i, 1685 | Navigation rules..... | ii, 2041, 2107 | |
| Kahuku H., Hawaii. | YY-40..... | i, 1685 | Kanawha R., W. Va. and | | |
| Kahului H., Hawaii. | YY-60..... | i, 1685 | Va. | EE-62..... | i, 983 |
| (See notes, ii, 2846.) | | | Kandik R., Alaska | XX-209..... | i, 1656 |
| Appro..... | ii, 2301 | | Kane Cr., Tenn. | AA-232..... | i, 850 |
| Harbor lines..... | ii, 2256 | | Kanektok R., Alaska | XX-168..... | i, 1656 |
| Kahului H., Maui, Ha- | | | Kaneohe B., H. I.: | | |
| wai | YY-60..... | i, 1690 | (See notes, ii, 2846.) | | |
| Kaighn Pt., N. J.: | | | Kaneohe H., Hawaii | YY-42..... | i, 1685 |
| Harbor lines..... | ii, 2256 | | Kankakee R., Ill. | JJ-8..... | i, 1234 |
| Kallua B., H. I.: | | | NN-6..... | i, 1349 | |
| (See notes, ii, 2846.) | | | Kankakee R., Ill. and | | |
| Kallua, Hawaii. | YY-83..... | i, 1686 | Ind. | NN-6..... | i, 1356 |
| Kakhtul R., Alaska | XX-165..... | i, 1656 | Kansas City | (GG-2)..... | i, 1038* |
| Kalama | (WW-2)..... | i, 1617* | (HH)..... | i, 1075* | |
| Kalama B. | (WW-2)..... | i, 1617* | (See notes, ii, 2825, 2826.) | | |
| Kalama R., Wash. | WW-47..... | i, 1615 | Kansas City, Kans. | GG-1178..... | i, 1062 |
| Kalamazoo H., Mich. | OO-15-a..... | i, 1385 | Harbor lines..... | ii, 2256 | |
| Kalamazoo R., Mich. | OO-15..... | i, 1377, 1385 | Kansas City, Mo. | (GG-2)..... | i, 1037* |
| OO-15-a..... | i, 1385 | | Kansas City, Mo., dis- | | |
| OO-15-c..... | i, 1387 | | trict. | GG(with map)i, 1023, | |
| Appro..... | ii, 2298 | | 1025 | | |
| Bridges..... | ii, 2180 | | (See notes, ii, 2813.) | | |
| Kalspel | (WW-2)..... | i, 1617* | Appro..... | ii, 2297 | |
| Kaltag R., Alaska | XX-237..... | i, 1657 | Harbor lines..... | ii, 2256 | |
| Kalapana H., Hawaii. | YY-75..... | i, 1686 | Kansas City to mouth of | | |
| Kalaupapa H., Hawaii | YY-51..... | i, 1685 | Missouri R. | GG-2-i..... | i, 1054 |
| Kalaupapa Landing, H. I.: | | | Kansas Junction | (GG-2)..... | i, 1038* |
| (See notes, ii, 2846.) | | | Kansas R. | (GG-2)..... | i, 1038* |
| Kalili H., H. I.: | | | Kansas R., Colo. and | | |
| (See notes, ii, 2846.) | | | Kans. | GG-1178..... | i, 1034 |
| Kalohi Chan., H. I.: | | | | | |
| (See notes, ii, 2846.) | | | | | |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Kansas R., Kans. and Mo. (GG-2)..... | i, 1037* | | Keelers B., Vt. | E-119..... | i, 178 |
| (See notes, ii, 2821, 2826.) | | | Keene Ditch, Md. | J-153..... | i, 332 |
| Appro..... | ii, 2297 | | Keene Narrows, Me. | A-171..... | i, 28 |
| Bridges..... | ii, 2180 | | Keeney Branch, Mo. | GG-177..... | i, 1026 |
| Harbor lines..... | ii, 2256 | | (See notes, ii, 2814.) | | |
| Kantishna R., Alaska | XX-197..... | i, 1656 | Keg Cr., Ga. | O-278..... | i, 535 |
| Kanuck Cr., Mont. | GG-465..... | i, 1028 | Keg Cr., Iowa: | | |
| (See notes, ii, 2816.) | | | (See notes, ii, 2814.) | | |
| Kanuti R., Alaska | XX-225..... | i, 1657 | Keithsburg | (HH)..... | i, 1075* |
| Karrs Cr., La. | S-249..... | i, 683 | Kelso Bayou, La. | S-859..... | i, 688 |
| Kashunuk R., Alaska | XX-187..... | i, 1656 | Kellums Cr., N. C. | M-203..... | i, 455 |
| Kashwina R., Alaska | XX-153..... | i, 1656 | Kelly Branch, Md. | J-1041..... | i, 338 |
| Kaskaskia Bend | (HH)..... | i, 1075* | Kelly Cr., N. Dak. | GG-315..... | i, 1027 |
| Kaskaskia Isld. | (HH)..... | i, 1075* | Kelly Cr., W. Va. | EE-128..... | i, 984 |
| Kaskaskia R. | (HH)..... | i, 1075* | Kemp Chan., Fla. | P-195..... | i, 570 |
| Kaskaskia R., Ill. | II-4..... | i, 1229 | Kempe Bend | (HH)..... | i, 1075* |
| (See notes, ii, 2834.) | | | Kender, C. L.: | | |
| Appro..... | ii, 2297 | | Index compilation..... | | i, 13 |
| Bridges..... | ii, 2180 | | Kenduskeag R., Me.: | | |
| Katalla B., Alaska | XX-125-a..... | i, 1680 | Bridges..... | | ii, 2180 |
| Kateel R., Alaska | XX-235..... | i, 1657 | Kenduskeag Stream, Me. | A-105..... | i, 28 |
| Kauai Isld., Hawaii. | YY-29..... | i, 1685, 1688 | Kennebec R., Me. | A-219..... | i, 29, 48 |
| (See notes, ii, 2846.) | | | (See notes, ii, 2783.) | | |
| Kauai, Isld. of, Hawaii; | | | Appro..... | | ii, 2288 |
| Hanapepe B. | YY-35-a..... | i, 1688 | Bridges..... | | ii, 2143, 2180 |
| Kauhako B., H. I.: | | | Forts..... | | ii, 1823, 1841 |
| (See notes, ii, 2846.) | | | Wrecks..... | | ii, 2269 |
| Kaumuhonu B., H. I.: | | | Kennebunk R., Me. | A-275..... | i, 29, 58 |
| (See notes, ii, 2846.) | | | Appro..... | | ii, 2288 |
| Kaunakakai H., H. I.: | | | Kennedys Cr., N. C. | M-77..... | i, 454 |
| (See notes, ii, 2846.) | | | Kennewick | (WW-2)..... | i, 1617* |
| Kaunakakai Landing, | | | Kenney Branch, Mo.: | | |
| Hawaii | YY-54..... | i, 1685 | (See notes, ii, 2814.) | | |
| Kaw Bend | (GG-2)..... | i, 1038* | Kennys Coulee, La. | S-729..... | i, 687 |
| (See notes, ii, 2825.) | | | Kennon Cr., Va. | L-133..... | i, 412 |
| Kawaihae, Hawaii | YY-85..... | i, 1686 | Kenosha H., Wis. | MM-38..... | i, 1341 |
| (See notes, ii, 2846.) | | | Appro..... | | ii, 2298 |
| Kawkawlin R., Mich. | PP-63..... | i, 1419, 1435 | Harbor lines..... | | ii, 2256 |
| Bridges..... | ii, 2180 | | Navigation rules..... | | ii, 2041, 2107 |
| Kaw R. | (GG-2)..... | i, 1038* | Kenosha, Wis. | MM-38..... | i, 1297 |
| Kaw R., Kans.: | | | Kent Isld. Narrows, Md. | J-398..... | i, 334, 355 |
| Bridges..... | ii, 2180 | | Bridges..... | | ii, 2180 |
| Harbor lines..... | ii, 2256 | | Kent Narrows, Md.: | | |
| Kaw R., Mo.: | | | Bridges..... | | ii, 2180 |
| Harbor lines..... | ii, 2256 | | Kents Cove, Me. | A-126..... | i, 28 |
| Kaw Valley | (GG-2)..... | i, 1038* | Kents Lake, Ga. | O-322..... | i, 535 |
| Kays Cr., Va. | K-202..... | i, 374 | Kentuck Slough, Oreg. | VV-27..... | i, 1593 |
| Kealahikahi Chan., Ha- | | | Kentucky Bend | (HH)..... | i, 1075* |
| wall | YY-67..... | i, 1685 | Kentucky line | (HH)..... | i, 1075* |
| Kealakekua B., H. I.: | | | Kentucky R., Ky. | (CC)..... | i, 910* |
| (See notes, ii, 2846.) | | | DD-4..... | | i, 959, 963 |
| Kealla B., H. I.: | | | Appro..... | | ii, 2296 |
| (See notes, ii, 2846.) | | | Bridges..... | | ii, 2180-2181 |
| Keanae Landing, H. I.: | | | Navigation rules..... | | ii, 2041, 2107 |
| (See notes, ii, 2846.) | | | Kentucky R. and its trib- | | |
| Keanhou Landing, Ha- | | | utaries, Ky., including | | |
| wall | YY-76..... | i, 1686 | North Fork, Boone | | |
| (See notes, ii, 2846.) | | | Fork, Middle Fork, | | |
| Kearneys Cr., N. C. | M-204..... | i, 455 | Troublesome Cr., and | | |
| Keaton Fork, Ky. | DD-221..... | i, 960 | South Fork..... | DD-4-a..... | i, 963 |
| Kedges Straits, Md. | J-179..... | i, 332 | Kentucky R., Ls. and Ds. | | |
| Keel Cr., N. C. | L-337..... | i, 413 | (operating and care).... | DD-4-b..... | i, 966 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|----------------------|---------------------------------|---------------------|-------------------|
| Kentucky Whites Cr., Ky. | DD-214 | i, 960 | Kickapoo Isld. | (GG-2) | i, 1038* |
| Keokuk. | (HH) | i, 1075* | Kickapoo R., Wis. | KK-23 | i, 1247 |
| (See notes, ii, 2827.) | | | Kickemult R., Mass. | C-77 | i, 107 |
| Keokuk to Cairo (HH): | | | Kickemult R., R. I.: | | |
| (See notes, ii, 2827.) | | | Bridges. | ii | 2181 |
| Kerrs Run. | (CC) | i, 910* | Kiholo B., Hawaii. | YY-84 | i, 1686 |
| Kershaw Cr., N. C. | M-158 | i, 455 | (See notes, ii, 2846.) | | |
| Kettle Cove, Mass. | B-88 | i, 69 | Kil Landing, H. I.: | | |
| Kettle Cr., Pa. | J-729 | i, 336 | (See notes, ii, 2846.) | | |
| | J-770 | i, 336 | Kilchus R., Oreg. | VV-67 | i, 1593 |
| Kettle Cr., Tenn. | AA-270 | i, 850 | Kilgore Cr., W. Va. | EE-57 | i, 983 |
| Kettle Falls. | (WW-2) | i, 1617* | Kilkenny Cr., Ga. | O-168 | i, 534 |
| (See notes, ii, 2843.) | | | Kill Cr., Kans. | GG-1401 | i, 1036 |
| Kettle R., Minn. | KK-60 | i, 1247 | (See notes, ii, 2822, 2823.) | | |
| Kettle R., Wash. | XX-113 | i, 1656 | Killed Woman Cr., Mont. | GG-463 | i, 1028 |
| Kewahae H., H. I.: | | | (See notes, ii, 2816.) | | |
| (See notes, ii, 2846.) | | | Killbuck Cr., Ohio. | DD-397 | i, 962 |
| Kewaunee H., Wis. | MM-27 | i, 1297, 1322 | Kill Pond Bar, Mass.: | | |
| Appro. | | ii, 2298 | Wrecks. | ii | 2270 |
| Harbor lines. | | ii, 2256 | Kill Van Kull, N. J.: | | |
| Navigation rules. | | ii, 2041, 2107 | (See notes, ii, 2793.) | | |
| Wrecks. | | ii, 2269 | Harbor lines. | ii | 2256 |
| Kewaunee R., Wis.: | | | Wrecks. | ii | 2270 |
| Bridges. | | ii, 2181 | Kill Van Kull, N. Y. and | | |
| Keweenaw B. to Lake Su- | | | N. J. | G-3 | i, 247 |
| perior (waterway). | LL-41-a | i, 1288 | Kimages Cr., Va. | L-138 | i, 412 |
| Keweenaw Pt. (vicinity | | | Kimberling Cr., Va. | EE-87 | i, 983 |
| of), Lake Superior, | | | Kimmswick. | (HH) | i, 1075* |
| Mich. | LL-36-b | i, 1287 | (See notes, ii, 2834.) | | |
| Keweenaw Waterway, | | | Kinak R., Alaska. | XX-184 | i, 1656 |
| Mich. | LL-41 | i, 1265, 1288 | King Cr., Ky. | DD-130 | i, 960 |
| | LL-41-a | i, 1288 | King Cr., S. C. | N-158 | i, 500 |
| (See notes, ii, 2836.) | | | King Cr., Tenn. | AA-175 | i, 849 |
| Appro. | | ii, 2298 | Kingdom Come Cr., Ky. | DD-131 | i, 960 |
| Keweenaw Waterway, | | | KINGMAN, GEN. DAN C., | | |
| Mich. (operating and | | | Chief of Engineers: | | |
| care). | LL-41-b | i, 1290 | Index compilation (see | | |
| Keya Paha R., Nebr. and | | | Title pages). | | |
| S. Dak. | GG-907 | i, 1032 | Kings B., Ga. | O-509 | i, 537 |
| (See notes, ii, 2819.) | | | Kings B., N. Y. | E-75 | i, 177 |
| Key Cr., Iowa. | GG-253 | i, 1027 | Kings Bayou, La. | S-790 | i, 688 |
| Keyport H., N. J. | G-43 | i, 247, 262 | Kingseote Cr., Va. | K-130 | i, 374 |
| (See notes, ii, 2793.) | | | Kings Coulee. | (HH) | i, 1075* |
| Appro. | | ii, 2290 | Kings Cr., Md. | J-72 | i, 331 |
| Wrecks. | | ii, 2269 | | J-302 | i, 333 |
| Keys Cr., Ala. | AA-217 | i, 850 | | J-466 | i, 334 |
| Keyser Cr., Mont. | GG-657 | i, 1030 | | J-972 | i, 338 |
| (See notes, ii, 2817.) | | | Kings Cr., Minn. | JJ-39 | i, 1234 |
| Keyers Run, Md. | J-1126 | i, 339 | Kings Cr., N. C. | M-193 | i, 455 |
| Keystone Canal, La. | S-649 | i, 686 | Kings Cr., Va. | K-317 | i, 375 |
| Key West, Fla.: | | | | L-63 | i, 411 |
| (See notes, ii, 2799.) | | | Kingsland B., Vt. | E-111 | i, 178 |
| Appro. | | ii, 2287, 2293 | Kingsland Cr., N. J. | G-14 | i, 247 |
| Bridges. | | ii, 2181 | Kingsland Cr., Va. | L-147 | i, 412 |
| Forts. | | ii, 1803, 1823, 1955 | Kingsleys Cr., Fla. | O-530 | i, 537 |
| Harbor lines. | | ii, 2256 | Bridges. | ii | 2181 |
| Wrecks. | | ii, 2269, 2270 | Kingsleys Cut, Fla. | P-4 | i, 569 |
| Key West H., Fla. | P-200 | i, 570 | Kings Mountain, S. C.: | | |
| Key West H., Fla. (Includ- | | | Monuments. | ii | 2040, 2093 |
| ing entrance thereto). | P-200 | i, 589 | Kings Pt. | (HH) | i, 1075* |
| Khotol R., Alaska. | XX-191 | i, 1656 | Kings R., Ark. and Mo. | Y-42 | i, 818 |
| Klamchi R., Okla. | T-13 | i, 717, 728 | Kings Slough, Oreg. | VV-46 | i, 1593 |
| Bridges. | | ii, 2181 | Kingston B. and H., | | |
| | | | Mass. | B-165 | i, 70 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|---------------------------------------|---------------------|-------------------|
| Kingston H., Mass. | B-165..... | i, 97 | Knife Lake, Minn. and | | |
| Appro..... | | ii, 2288 | Canada..... | KK-237..... | i, 1249 |
| Kingston, Tenn. | AA-18..... | i, 855 | Knife R. H., Minn. | LL-16..... | i, 1270 |
| Kinnikinnick Cr., Ohio. | DD-454..... | i, 962 | Knife R., Minn. | LL-16..... | i, 1265 |
| Kinnikinnick R., Wis. | MM-35..... | i, 1297 | Knife R., N. Dak. | GG-771..... | i, 1031 |
| Bridges..... | | ii, 2181-2182 | (See notes, ii, 2818.) | | |
| Kinseys Cr., Cal. | TT-163..... | i, 1556 | Knight Cr., Pa. | J-561..... | i, 335 |
| Kinsley Cr., Kans. | GG-1383..... | i, 1035 | Knights Key Chan., Fla. | P-189..... | i, 570 |
| (See notes, ii, 2823.) | | | Knobbs Cr., N. C. | L-274..... | i, 413 |
| Kio Kee Cr., Ga. | O-49..... | i, 533 | Knott Isld. Chan., N. C. | L-232..... | i, 413 |
| Kiowa Cr., Colo. | GG-1109..... | i, 1033 | Knott Millpond, Md. | J-293..... | i, 333 |
| (See notes, ii, 2820.) | | | Knowlton. | (HH)..... | i, 1075* |
| Kipahulu Landing, H. I.: | | | Knox Cr., Ky. and Va. | DD-301..... | i, 961 |
| (See notes, ii, 2846.) | | | Knox Cr., Tenn. | AA-111..... | i, 849 |
| Kirby Cr., Wyo. | GG-693..... | i, 1030 | Knox, Fort, Me. | | ii, 1804, 1841 |
| (See notes, ii, 2817.) | | | Knox Suck, Ga. | O-472..... | i, 536 |
| Kirwan Cr., Md. | J-400..... | i, 334 | Knoxville, Tenn. | AA-18..... | i, 855 |
| Kishacoquillas Cr., Pa. | J-861..... | i, 337 | Knubble B., Me. | A-212..... | i, 28 |
| Kiska Isld.: | | | (See notes, ii, 2783.) | | |
| Forts..... | | ii, 1823 | Kobuk R., Alaska. | XX-245..... | i, 1657 |
| Kiskiminetas R., Pa. | FF-21..... | i, 1003 | Kohala H., Hawaii. | YY-71..... | i, 1686 |
| FF-20..... | | i, 1015 | Kokosing R., Ohio. | DD-414..... | i, 962 |
| FF-21-a..... | | i, 1020 | Koloa, Hawaii. | YY-34..... | i, 1685 |
| Kissimee R., Fla. | P-237..... | i, 571, 593 | Koloa Landing, H. I.: | | |
| Appro..... | | ii, 2293 | (See notes, ii, 2846.) | | |
| Kitchen Cr., Pa. | J-704..... | i, 336 | Kootenai R. | (WW-2)..... | i, 1617* |
| Kittanning, Pa. | FF-20..... | i, 1015 | Kootenai R., Idaho: | | |
| Kittery Pt., N. H.: | | | Bridges..... | | ii, 2182 |
| Forts..... | | ii, 1851 | Kootenai R., Mont.: | | |
| Kittewan Cr., Va. | L-134..... | i, 412 | Bridges..... | | ii, 2182 |
| Kittyhawk B., N. C. | L-220..... | i, 413 | Kootenai R., Mont. and | | |
| Klamath Lake, Oreg. | VV-2..... | i, 1593 | Idaho..... | XX-112..... | i, 1656, 1678 |
| Klamath R. and tribu- | | | Appro..... | | ii, 2301 |
| taries, Cal...... | TT-193..... | i, 1556 | Kotsina R., Alaska. | XX-136..... | i, 1656 |
| Klamath R., Cal. | TT-193..... | i, 1572 | Koyukuk R., Alaska. | XX-224..... | i, 1657 |
| Skaskanine R., Oreg. | WW-6-a..... | i, 1640 | Kramer Cr., Kans. | GG-1190..... | i, 1034 |
| (See notes, ii, 2841.) | WW-7..... | i, 1615 | Krebs Lake, Miss. | R-64..... | i, 646 |
| Skaskuine R., Oreg. | WW-6-a..... | i, 1640 | Kugulik R., Alaska. | XX-183..... | i, 1656 |
| (See notes, ii, 2844.) | | | Kuhio B., H. I.: | | |
| Appro..... | | ii, 2300 | (See notes, ii, 2846.) | | |
| Klatsuta R., Alaska. | XX-193..... | i, 1656 | KUHN, LT. COL. JOS. E.: | | |
| Klawasi R., Alaska. | XX-140..... | i, 1656 | Index compilation..... | | i, 10, 13 |
| Kleinston. | (HH)..... | i, 1075* | Kukalau Landing, Ha- | | |
| Kleinston Landing. | (HH)..... | i, 1075* | wall..... | YY-72..... | i, 1686 |
| Klickitat R. | (WW-2)..... | i, 1617* | Kumukahl Chan., H. I.: | | |
| Klickitat R., Wash. | VV-98..... | i, 1594 | (See notes, ii, 2846.) | | |
| Bridges..... | | ii, 2182 | Kunkpapa Cr., S. Dak. | GG-792..... | i, 1031 |
| Klu B., Alaska. | XX-130..... | i, 1656 | (See notes, ii, 2818.) | | |
| Knapp Narrows, Md. | J-353..... | i, 333 | Kuskokwim R., Alaska. | XX-170..... | i, 1656, 1680 |
| Knawl Cr., W. Va. | EE-169..... | i, 984 | Kusk B., Alaska. | XX-135..... | i, 1656 |
| Knick R., Alaska. | XX-148..... | i, 1656 | Kvichak R., Alaska. | XX-162..... | i, 1656 |
| Knife Isld., Minn. | LL-17..... | i, 1265 | Kwikil R., Alaska. | XX-171..... | i, 1656 |

L.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| La Badie Cr., Mo. | GG-1550..... | i, 1037 | Lafourche Bayou, La. | | |
| (See notes, ii, 2824.) | | | (head of)..... | S-423..... | i, 684 |
| La Barge Cr., N. Dak. | GG-787..... | i, 1031 | La Grange. | (HH)..... | i, 1075* |
| (See notes, ii, 2818.) | | | La Grange Bayou. | Q-33-b..... | i, 627 |
| La Barre Bayou, La. | S-129..... | i, 682 | La Grange Bayou, Fla. | Q-33..... | i, 626 |
| Labatre Bayou, Ala. | R-59..... | i, 646, 664 | (See notes, ii, 2801.) | | |
| Wrecks..... | | ii, 2264 | Appro..... | | ii, 2293 |
| Labauves Bayou, La. | S-791..... | i, 688 | La Grange Cr., Va. | K-224..... | i, 374 |
| La Bonte Cr., Wyo. | GG-1067..... | i, 1033 | Lagrange (NN): | | |
| (See notes, ii, 2820.) | | | (See notes, ii, 2837.) | | |
| Labor-In-Vain Cr., Mass. | B-61..... | i, 69 | Lagrange to Hannibal | | |
| La Branche Bayou, La. | S-122..... | i, 682 | (HH): | | |
| La Branche Canal, La. | S-370..... | i, 684 | (See notes, ii, 2827.) | | |
| La Cache Bayou, La. | S-451..... | i, 685 | La Grange to Reeves Pt. | M-305-d..... | i, 490 |
| La Camas Slough, Wash. | VV-102..... | i, 1594 | La Grue R., Ark. | Y-46..... | i, 818 |
| Lacassine Bayou, La. | S-778..... | i, 687 | Laguna Madre, Tex. | U-70..... | i, 735 |
| Bridges..... | | ii, 2144, 2183 | Lahaina H., Hawaii. | YY-68..... | i, 1685 |
| Lacassine Lake, La. | S-776..... | i, 687 | Lahaina Landing, H. I.: | | |
| Lacey Cr., Va. | L-128..... | i, 412 | (See notes, ii, 2846.) | | |
| Lachiel Cr., Kans. and | | | Lale B., H. I.: | | |
| Nebr. | GG-1309..... | i, 1035 | (See notes, ii, 2846.) | | |
| Lackawanna R., Pa. | J-625..... | i, 335 | Lake Allen, La. | S-487..... | i, 685 |
| Lackey Cr., Tenn. | AA-109..... | i, 849 | Lake Amede, La. | S-180..... | i, 682 |
| Lac La Bellé, Mich. | LL-40..... | i, 1265 | Lake Apopka, Fla. | P-52..... | i, 569 |
| Lac La Belle H., Mich. | LL-40..... | i, 1288 | Lake Arbuckle, Fla. | P-248..... | i, 571 |
| Lac La Croix, Minn. and | | | Lake Arthur, La. | S-754..... | i, 687 |
| Canada. | KK-231..... | i, 1249 | Lake Athanasia, La. | S-173..... | i, 682 |
| Lacombe Bayou, La. | S-13..... | i, 681 | Lake Barnett. | (HH)..... | i, 1075* |
| Bridges..... | | ii, 2183 | Lake Barre, La. | S-444..... | i, 685 |
| Laconia. | (HH)..... | i, 1075* | Lake Beaulclair, Fla. | P-50..... | i, 569 |
| La Conner, Wash. | XX-98..... | i, 1655 | Lake Bjeau, La.: | | |
| Harbor lines..... | | ii, 2256 | Bridges..... | | ii, 2183 |
| Lac Qui Parle R., Minn. | KK-155..... | i, 1248 | Lake Billot, La. | S-441..... | i, 685 |
| La Crescent. | (HH)..... | i, 1075* | Lake Bistenau, La. | X-46..... | i, 812 |
| La Crosse. | (HH)..... | i, 1075* | Appro..... | | ii, 2295 |
| La Crosse R. | (HH)..... | i, 1075* | Lake Bisteneau, La. | X-47..... | i, 785 |
| La Crosse R., Wis. | KK-25..... | i, 1247 | Lake Boca Raton, Fla. | P-149..... | i, 570 |
| L'Curse Bayou, La.: | | | Lake Boeuf Canal, La. | S-392..... | i, 684 |
| (See notes, ii, 2804.) | | | (See notes, ii, 2804.) | | |
| Ladder Cr., Kans. | GG-1342..... | i, 1035 | Lake Boeuf Drainage Ca- | | |
| Ladder Cr., Kans. and | | | nal, La. | S-422..... | i, 684 |
| Colo.: | | | (See notes, ii, 2804.) | | |
| (See notes, ii, 2822.) | | | Lake Boeuf, La. | S-391..... | i, 684 |
| La Du Landing. | (WW-2)..... | i, 1617* | Lake Bolivar. | (HH)..... | i, 1075* |
| Lafayette, Fort, N. Y. | | ii, 1806, 1881 | Lake Borgne. | (HH)..... | i, 1075* |
| Lafayette, Ind. | BB-23..... | i, 898 | (See notes, ii, 2827.) | | |
| La Fourche. | (HH)..... | i, 1075* | Lake Borgne Canal, La. | S-149..... | i, 682 |
| Lafourche Bayou. | (HH)..... | i, 1071* | (See notes, ii, 2804.) | | |
| Lafourche Bayou, La. | S-299..... | i, 683 | Lake Borgne, La. | S-4..... | i, 681 |
| | S-419..... | i, 684, 699 | Lake Borgne, Miss. and | | |
| (See notes, ii, 2805.) | | | La. | R-96..... | i, 646 |
| Appro..... | | ii, 2294 | Lake Boudreau, La. | S-457..... | i, 685 |
| Bridges..... | | ii, 2144, 2183 | Lake Brusle, La. | S-402..... | i, 684 |
| Locks and dams, private..... | | ii, 2249 | Lake Burnside to Edin- | | |
| | | | burg, Pearl R., Miss. | R-98-g..... | i, 677 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Lake Callebasse, La. | S-177 | i, 682 | Lake Dorcheat, La. (con.) | X-46 | i, 812 |
| Lake Calumet, Ill. | NN-19 | i, 1349 | Appro. | | ii, 2295 |
| (See notes, ii, 2837.) | | | Lake Dunham, Fla. | P-48 | i, 569 |
| Lake Canisnia, La. | S-569 | i, 686 | Lake Earl, Cal. | TT-207 | i, 1556 |
| Lake Cataouatche, La. | S-369 | i, 684 | Lake East Tohopekaliga, Fla. | P-243 | i, 571 |
| Lake Centennial | (HH) | i, 1075* | Lake Eaton, Fla. | P-55 | i, 569 |
| Lake Champlain, N. Y. | E-74 | i, 177 | Lake Elol, La. | S-172 | i, 682 |
| Lake Champlain, N. Y. and Vt. (breakwaters) | E-74-a | i, 201 | Lake Erie | (CC) | i, 910* |
| Lake Champlain, N. Y. and Vt.: | | | PP-118 | | i, 1420 |
| (See notes, ii, 2792.) | | | Bridges | | ii, 2183 |
| Appro. | | ii, 2289 | Regulation | | ii, 2041, 2124 |
| Bridges | | ii, 2183 | Shoals in | | ii, 2041, 2121 |
| Wrecks | | ii, 2270 | Water levels | | ii, 2041, 2121 |
| Lake Champlain, N. Y. and Vt. (Narrows) | E-105 | i, 206 | Wrecks | | ii, 2270 |
| Lake Champlain, Nar- rows, N. Y.: | | | Lake Erie entrance to Black Rock H., N. Y. | RR-13-d | i, 1507 |
| Appro. | | ii, 2289 | Lake Erie, reef near Bass Isld. | QQ-15-b | i, 1467 |
| Lake Champlain, N. Y. (breakwaters) | E-77 | i, 202 | Lake Erie to Ohio R.: | | ii, 2299 |
| Lake Champlain, N. Y., Port Henry H. | E-97 | i, 205 | Appro. | | ii, 2299 |
| Lake Champlain, Vt. (channel between North and South Hero Islds.) | E-79 | i, 203 | Lake Erie to Ohio R. (canal through Ohio) | QQ-5-b | i, 1465 |
| Lake Champlain, Vt., Gordons Landing | E-81 | i, 203 | Lake Erie to Wabash and Ohio Rs. | QQ-5-c | i, 1465 |
| Lake Champlain, Vt., North Hero H. | E-80 | i, 203 | Lake Eugenie, La. | S-164 | i, 682 |
| Lake Champlain, Vt., St. Albans H. | E-120 | i, 210 | Lake Eustis, Fla. | P-43 | i, 569 |
| Lake Champlain Waters | E-73 | i, 177 | Bridges | | ii, 2183 |
| Lake Charles, Ga.: | | | Lake Fausse Pointe, La. | S-631 | i, 686 |
| Bridges | | ii, 2183 | Lake Felicity, La. | S-439 | i, 685 |
| Lake Charles, La. | S-805 | i, 683 | Lake Five, La. | S-346 | i, 684 |
| Lake Chautauqua | (CC) | i, 910* | Lake Flirt, Fla. | P-234 | i, 571 |
| Lake Chelan | (WW-2) | i, 1617* | Lake George Chan., Mich. | PP-14 | i, 1419 |
| Lake Chicot, La. | S-622 | i, 686 | Lake George, Fla. | P-58 | i, 569 |
| Lake Chien, La. | S-440 | i, 685 | Lake George, N. Y. | E-100 | i, 178, 206 |
| Lake City | (HH) | i, 1075* | Lake George to Lake Monroe, St. Johns R., Fla. | P-10-e | i, 581 |
| Lake Cocodrie, La. | S-593 | i, 686 | Lake Gracie, La. | S-246 | i, 683 |
| Lake Concordia | (HH) | i, 1075* | Lake Grand Ecaille, La. | S-338 | i, 684 |
| Lake Contrary | (GG-2) | i, 1038* | Lake Griffin, Fla. | P-41 | i, 569 |
| Lake Contrary, Mo.: | | | Lake Harney, Fla. | P-63 | i, 569 |
| (See notes, ii, 2814.) | | | Bridges | | ii, 2183 |
| Lake Contrary, Mo. (dis- charge from) | GG-233 | i, 1026 | Lake Harney to Palatka, St. Johns R., Fla. | P-10-d | i, 580 |
| Lake Coquille, La. | S-176 | i, 682 | Lake Harris, Fla. | P-46 | i, 569 |
| Lake Co., Tenn. | (HH) | i, 1075* | Lake Hatchineha, Fla. | P-239 | i, 571 |
| Lake Cr., Mo. | GG-132 | i, 1026 | Lake Hatch, La. | S-485 | i, 685 |
| (See notes, ii, 2813.) | | | Lake Hermitage, La. | S-345 | i, 684 |
| Lake Cr., Wyo. | GG-1045 | i, 1033 | Lake Hickpochee, Fla. | P-235 | i, 571 |
| Lake Cypress, Fla. | P-240 | i, 571 | Lake Huron | PP-23 | i, 1419 |
| Lake Dauterive, La. | S-636 | i, 686 | Lake Huron (levels) | PP-23 | i, 1430 |
| Lake de Cade, La. | S-483 | i, 685 | Lake Huron, Mich.: | | |
| Lake Des Allemands, La. | S-380 | i, 684 | Appro. | | ii, 2299 |
| Lake Dexter, Fla. | P-59 | i, 569 | Bridges | | ii, 2183 |
| Lake Dora Canal, Fla. | P-44 | i, 569 | Regulation | | ii, 2041, 2124 |
| Lake Dora, Fla. | P-49 | i, 569 | Wrecks | | ii, 2270 |
| Bridges | | ii, 2183 | Lake Itasca | (HH) | i, 1075* |
| Lake Dorcheat, La. | X-48 | i, 785 | Lake Jean Louis Robin, La. | S-178 | i, 682 |
| | | | Lake Jessup, Fla. | P-62 | i, 569 |
| | | | Lake Kissimmee, Fla. | P-238 | i, 571 |
| | | | Lake la Fortune, La. | S-174 | i, 682 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Lake Lagrassie, La. | S-452.....i, | 685 | Lake Monroe to Lake George, St. Johns R., Fla. | P-10-e.....i, | 581 |
| Lake La Pointe, La. | S-726.....i, | 687 | Lake Natchez, La. | S-518.....i, | 685 |
| Lake Lee..... | (HH).....i, | 1075* | Lake Netherlands, La. | S-369.....i, | 684 |
| Lake Lery, La. | S-184.....i, | 682 | Lake of the Woods, Minn. KK-209.....i, | 1249 | |
| Lake Lochloosa, Fla. | P-39.....i, | 569 | KK-210.....i, | 1261 | |
| Lake Long, La. | S-434.....i, | 684 | Lake of the Woods, Minn. and Canada. | KK-210.....i, | 1249 |
| | S-559.....i, | 686 | Lake Okechobee, Fla. | P-236.....i, | 571, 592 |
| | S-638.....i, | 686 | Lake Ontario: Regulation.....ii, | 2041, 2124 | |
| Lake Mabel, Fla. | P-154.....i, | 570 | Wrecks.....ii, | 2270 | |
| Lake Machias, La. | S-175.....i, | 682 | Lake Ontario, Black Cr. Shoal.....RR-45-b.....i, | 1524 | |
| Lake Maurepas, La. | S-50.....i, | 681 | Lake Ontario Hs., N. Y.: Appro. | ii, | 2299 |
| Lake Meahach, N. Y. (Lake Meahayh): (See notes, ii, 2792.) | | | Lake Ontario (southern shore, harbors on).....RR-40-b.....i | 1520 | |
| Lake Meahayh, N. Y. (see above). | | | Lake Ontario to Chesapeake B. | J-1-a.....i, | 340 |
| Lake Meahayh, N. Y. | E-34.....i, | 177 | Lake Ontario to Youngs- town, Niagara R., N. Y. RR-15-e.....i, | 1511 | |
| Lake Mechant, La. | S-473.....i, | 685 | Lake Palourde, La. | S-504.....i, | 685 |
| Lake Michigan..... | (HH).....i, | 1075* | Lake Panasoffkee, Fla. | P-345.....i, | 571 |
| | KK-5.....i, | 1247 | Lake Pelgneur, La. | S-714.....i, | 687 |
| | MM-1.....i, | 1297 | Lake Peltto, La. | S-460.....i, | 685 |
| (See notes, ii, 2837.) | | | Lake Pend Oreille, Idaho: Bridges.....ii, | 2183 | |
| Reef..... | ii, | 2041, 2133 | Lake Pepin..... | (HH).....i, | 1075* |
| Regulation..... | ii, | 2041, 2144 | Lake Poinsett, Fla. | P-65.....i, | 569 |
| Tides..... | ii, | 2041, 2126 | Lake Pontchartrain..... | (HH).....i, | 1075* |
| Wrecks..... | ii, | 2270 | Lake Pontchartrain, La. R-111.....i, | 647 | |
| Lake Michigan and Stur- geon B. (see Sturgeon B. and Lake Michigan Canal). | | | S-8.....i, | 681 | |
| Lake Michigan and Stur- geon B. Ship Canal, Wis.: Navigation rules.....ii, | 2041, 2108 | | Appro. | ii, | 2294 |
| Lake Michigan Canal, Wis.: Appro. | ii, | 2298 | Bridges.....ii, | 2183-2184 | |
| Lake Michigan (datum planes)..... | MM-1-a.....i, | 1297 | Wrecks.....ii, | 2270 | |
| Lake Michigan, east shore | OO-1-a.....i, | 1377 | Lake Pontchartrain, in- cluding vicinity of Pass Manchac, La. | S-8.....i, | 688 |
| Lake Michigan, Mich. and Wis. (wave action)... | OO-1-b.....i, | 1378 | Lake Pontchartrain, St. John Bayou, and The Rigolets (connecting ship canal).....R-110.....i, | 678 | |
| Lake Michigan to Calu- met R., Ill. (canal)..... | NN-18-b.....i, | 1366 | Lakeport..... | (HH).....i, | 1075* |
| Lake Michigan to Stony Lake, Mich. | OO-39-b.....i, | 1400 | Lake Providence..... | (HH).....i, | 1075* |
| Lake Michigan to Wa- bash R., Ind. and Ohio (canal)..... | NN-24.....i, | 1371 | (See notes, ii, 2832.) | | |
| Lake Michigan (water levels)..... | OO-1-c.....i, | 1378 | Lake Providence Bend (HH): (See notes, ii, 2832.) | | |
| Lake Michigan to Wa- bash R.: (See notes, ii, 2837.) | | | Lake Raccourel, La. | S-296.....i, | 683 |
| Appro. | ii, | 2298 | S-428.....i, | 684 | |
| Lake Mineola..... | P-53.....i, | 569 | Lake R. | (WW-2).....i, | 1617* |
| Lake Minnetonka, Minn. KK-136-b.....i, | 1253 | | Lake R., Mich. | OO-34-b.....i, | 1394 |
| Appro. | ii, | 2297 | Lake R., Wash. | WW-43.....i, | 1615 |
| Lake Misere Canal, La. | S-782.....i, | 687 | Bridges.....ii, | 2184 | |
| Lake Misere, La. | S-781.....i, | 687 | Lake Roland, Md. | J-1093.....i, | 339 |
| Lake Mongoulois, La. | S-625.....i, | 686 | Lake Rosalie, Fla. | P-250.....i, | 571 |
| Lake Monroe, Fla. | P-61.....i, | 569 | Lake St. Catherine, La. S-6.....i, | 681 | |
| Wrecks..... | ii, | 2270 | Lake St. Clair, Mich. PP-99.....i, | 1420 | |
| | | | Wrecks.....ii, | 2270 | |
| | | | Lake St. Clair, Mich., Swan Lake.....PP-100.....i, | 1451 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Lake St. Croix, Wis. and Minn.: | | | Lake Union, Wash.: | | |
| Bridges..... | | ii, 2184 | Appro..... | | ii, 2301 |
| Logs, floating of..... | | ii, 2041, 2109 | Bridges..... | | ii, 2184, 2219 |
| Lake Salvador, La..... | S-365..... | i, 684 | Harbor lines..... | | ii, 2256 |
| Lake Sammamish, Wash. | | | Lake Union, Wash. (wa- | | |
| (waterway connecting | | | terway connecting with | | |
| with Puget Sound)..... | XX-62-b..... | i, 1666 | Puget Sound)..... | XX-62-b..... | i, 1666 |
| Lakes Cr., Md..... | J-207..... | i, 332 | Lake Verret, La..... | S-509..... | i, 685 |
| Lake Scrub, Fla..... | P-56..... | i, 569 | Lake Villere, La..... | S-352..... | i, 684 |
| Lakes Ditch, N. J.: | | | Lake Walk-in-the-Water, | | |
| Bridges..... | | ii, 2183 | Fla..... | P-249..... | i, 571 |
| Lakes Ferry..... | (GG-2)..... | i, 1035* | Lake Washington Canal, | | |
| Lakes, Great, Engineer- | | | Wash.: | | |
| ing division..... | | ii, 2039, 2046 | Bridges..... | | ii, 2184, 2219 |
| Lakes, Great, defenses | | | Lake Washington, Fla.... | P-67..... | i, 569 |
| (see Great Lakes)..... | | ii, 1818 | Lake Washington, Miss.. | X-27..... | i, 785 |
| Lakes Huron and Erie | | | | X-25..... | i, 794 |
| (channel to connect).... | PP-118-a..... | i, 1456 | Appro..... | | ii, 2295 |
| Lakes, North and North- | | | Lake Washington, Wash.: | | |
| western (see Great | | | Appro..... | | ii, 2301 |
| Lakes): | | | Bridges..... | | ii, 2184, 2219 |
| Forts..... | | ii, 1991 | Harbor lines..... | | ii, 2256 |
| Lakes Superior and Hu- | | | Lake Washington, Wash. | | |
| ron (connecting waters) PP-1-b..... | | i, 1421 | (waterway connecting | | |
| Lake Superior..... | LL-1..... | i, 1265 | with Puget Sound)..... | XX-62-b..... | i, 1666 |
| (See notes, ii, 2834.) | | | Bridges..... | | ii, 2184 |
| Harbor lines..... | | ii, 2256 | Lake Winder, Fla..... | P-66..... | i, 569 |
| Navigation rules..... | | ii, 2041, 2107 | Lake Winnebago, Wis.... | MM-21..... | i, 1297 |
| Reef..... | | ii, 2041, 2121 | | MM-21-a..... | i, 1316 |
| Regulations..... | | ii, 2041, 2124 | Appro..... | | ii, 2298 |
| Surveys..... | | ii, 2041, 2121 | Lake Winnebago, Calu- | | |
| Wrecks..... | | ii, 2270 | met H., Wis..... | MM-21-d..... | i, 1316 |
| Lake Superior Hs. (north | | | Lake Winnebago, Fox R., | | |
| shore)..... | LL-1-a..... | i, 1265 | Wis. (pier)..... | MM-21-b..... | i, 1316 |
| Lake Superior, Mich. (vic- | | | Lake Winnebago, High- | | |
| inity of Keweenaw Pt.) LL-36-b..... | | i, 1287 | cliff H., Wis..... | MM-21-e..... | i, 1316 |
| Lake Superior to Kewee- | | | Lake Winnebago, Wis., | | |
| naw B. (waterway)..... | LL-41-a..... | i, 1288 | Stockbridge H..... | MM-21-c..... | i, 1316 |
| Lake Superior to Missis- | | | Lake Winnibigoshish..... | (HH)..... | i, 1075* |
| sippi R.: | | | Lake Winnipiseogee, N. H. | B-25..... | i, 69, 75 |
| Appro..... | | ii, 2298 | Appro..... | | ii, 2288 |
| Lake Superior to Missis- | | | Lake Worth Cr., Fla..... | P-143..... | i, 570 |
| sippi R. (canal)..... | LL-19-b..... | i, 1280 | Lake Worth, Fla..... | P-145..... | i, 570 |
| Lake Surveys (see Great | | | Lake Worth Chan., Fla.: | | |
| Lakes): | | | Bridges..... | | ii, 2184 |
| Appro..... | | ii, 2286 | Lake Worth, Fla.: | | |
| Lake Swamp, S. C..... | N-25..... | i, 499 | Bridges..... | | ii, 2184 |
| | N-29..... | i, 499 | Lake Worth Inlet, Fla.... | P-144..... | i, 570 |
| | N-63..... | i, 499 | Lake Wyman, Fla..... | P-150..... | i, 570 |
| Lake Theriot, La..... | S-486..... | i, 685 | Lakina R., Alaska..... | XX-134..... | i, 1656 |
| Lake Tohopekaliga, Fla.. | P-242..... | i, 571 | La Loutre Bayou, La..... | S-171..... | i, 682 |
| Lake Traverse, Minn., N. | | | Lamar R., Wyo..... | GG-662..... | i, 1030 |
| Dak., and S. Dak..... | KK-189..... | i, 1248 | (See notes, ii, 2817.) | | |
| | KK-153-a..... | i, 1256 | Lamb Cr., Va..... | K-204..... | i, 374 |
| | KK-189-a..... | i, 1259 | Lambert Cr., Va..... | L-201..... | i, 412 |
| | KK-190..... | i, 1259 | Lamberts Pt.: | | |
| | KK-190-b..... | i, 1260 | Harbor lines..... | | ii, 2256 |
| Lake Traverse, Minn. | | | Lambs Cr., Va..... | L-89..... | i, 412 |
| and S. Dak.: | | | La Mer Bayou, La..... | S-333..... | i, 683 |
| (See notes, ii, 2834.) | | | Lamine Cr., Mo..... | GG-1438..... | i, 1036 |
| Appro..... | | ii, 2297 | Lamine R., Mo..... | GG-1432..... | i, 1036 |
| Lake Tsala Apoka, Fla.... | P-343..... | i, 571 | (See notes, ii, 2823.) | | |
| | | | La Moelle Canal, Vt..... | E-118..... | i, 210 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| La Moelle R., Vt. | E-118..... | i, 178 | Lasker Cr., Nebr. | GG-967..... | i, 1032 |
| La Moille | (HH)..... | i, 1075* | (See notes, ii, 2819.) | | |
| Lamon B., P. I. | YY-93..... | i, 1686 | Lassine Bayou, La. | S-383..... | i, 684 |
| Lamoque Bayou, La. | S-196..... | i, 682 | Last Chance | (HH)..... | i, 1075* |
| Lampkins Lake, Ga. | O-331..... | i, 535 | Last Chance Crossing (HH): | | |
| Lamprey R., Me.: (See notes, ii, 2783.) | | | (See notes, ii, 2832.) | | |
| Lamprey R., N. H. | A-288..... | i, 29, 63 | Latania Lake, La. | S-777..... | i, 687 |
| Appro..... | | ii, 2288 | Latenache Bayou, La. | S-552..... | i, 686 |
| L'Anacoco Bayou, La. | T-2-c..... | i, 717 | Latimore Cr., Pa. | J-911..... | i, 337 |
| (See notes, ii, 2805.) | | | Latitude (see Longitude) | ii, 2041, 2122 | |
| Lanal Isld., Hawaii | YY-55..... | i, 1685 | Surveys, Colorado, Kan- sas, and California..... | ii, 2041, 2122 | |
| Lanal Isld., H. I.: (See notes, ii, 2846.) | | | Lathran R., Ga. | O-458..... | i, 536 |
| Lance Cr., S. Dak. | GG-859..... | i, 1031 | La Trappe Cr., Md. | J-316..... | i, 333, 352 |
| Lance Cr., S. Dak. and Wyo.: (See notes, ii, 2810, 2819.) | | | La Trappe R., Md.: Appro..... | | ii, 2291 |
| Lanceford Cr., Fla. | O-529..... | i, 537 | Lauderdale Co. | (HH)..... | i, 1075* |
| Lane Cr., Md. | J-1272..... | i, 340 | Lauderick Cr., Md. | J-971..... | i, 338 |
| Langdons Cr., Kans. | GG-1347..... | i, 1035 | Laughery Cr., Ind. | DD-493..... | i, 963 |
| (See notes, ii, 2823.) | | | Launches, gasoline, list | | ii, 2349 |
| Langford Cr., Md. | J-464..... | i, 334 | Launch (The), N. C. | L-247..... | i, 413 |
| Langs Cr., Fla. | P-93..... | i, 569 | Laupahoehoe Landing, H. I.: (See notes, ii, 2846.) | | |
| L'Anguille R., Ark. | Y-55..... | i, 818, 840 | Lauquedock Bayou, La. | S-532..... | i, 685 |
| Appro..... | Y-47-d..... | i, 838 | Laurel Branch, Ky. | DD-89..... | i, 959 |
| ..... |  | ii, 2295 | Laurel Br., Ky. | DD-105..... | i, 960 |
| Lansing | (HH)..... | i, 1075* | Laurel Cr., Ky. | DD-36..... | i, 959 |
| Lanan, P. I. | YY-112..... | i, 1686 | Laurel Cr., S. Dak.: (See notes, ii, 2819.) | | |
| Lancaster Cr., Va. | K-187..... | i, 374 | Laurel Cr., W. Va. | EE-53..... | i, 983 |
| Land Office Surveys | | ii, 2041, 2120 | EE-78..... | | i, 983 |
| Lands, Arid: Irrigation..... | | ii, 2040, 2087 | EE-145..... | | i, 984 |
| Lanes Cr., Va. | K-251..... | i, 375 | EE-175..... | | i, 984 |
| L'Anse, Mich. | LL-46..... | i, 1265 | Laurel Fork, Ky. | DD-80..... | i, 959 |
| Lapans B., Vt. | E-121..... | i, 178 | Laurel Fork, La. | S-264..... | i, 683 |
| La Perouse Landing, H. I.: (See notes, ii, 2846.) | | | Laurel Fork, W. Va. | DD-327..... | i, 961 |
| La Plaisance B., Mich. | PP-125..... | i, 1420, 1458 | Laurel or Zephyr Cr., S. Dak. | GG-879..... | i, 1032 |
| Appro..... | | ii, 2299 | Laurel R., Ky. | AA-279..... | i, 850 |
| Lapote, Tex.: Harbor lines..... | | ii, 2256 | Laurel Run, Md. | J-542..... | i, 335 |
| La Prele Cr., Wyo. | GG-1064..... | i, 1033 | Laurel Run, Pa. | J-722..... | i, 336 |
| (See notes, ii, 2820.) | | | J-898..... | | i, 337 |
| Laramie R., Wyo. and Colo. | GG-1071..... | i, 1033 | Laurier Bayou, La. | S-128..... | i, 682 |
| (See notes, ii, 2820.) | | | Lava Beds: Explorations..... | | ii, 2040, 2087 |
| Larb Cr., Mont.: (See notes, ii, 2816.) | | | Lavaca B., Tex.: Harbor lines..... | | ii, 2256 |
| Larchmont H., N. Y. | E-10..... | i, 177, 180 | Lavaca B., Tex., to Mata- gorda B. (channel be- tween) | U-56-a..... | i, 767 |
| Appro..... | | ii, 2289 | Lavaca R., Tex. | U-56..... | i, 735 |
| Large Nixon Cr., Mo.: (See notes, ii, 2824.) | | | Bridges..... | | ii, 2184 |
| Largo Sound, Fla. | P-181..... | i, 570 | Lawal B., Hawaii | YY-35..... | i, 1685 |
| La Rompe Bayou, La. | S-626..... | i, 686 | Lawns Cr., Va. | L-159..... | i, 412, 427 |
| Larose Bayou, La. | S-627..... | i, 686 | Lawrence Brook, Mass. | B-17..... | i, 69 |
| Larrabee Slough, Wash.: Bridges..... | | ii, 2184 | Lawrence Brook, N. J. | G-38..... | i, 247 |
| Larry Cr., Pa. | J-747..... | i, 336 | Lawrenceburg | (OC)..... | i, 910* |
| La Salle | (HH)..... | i, 1075* | Lawrence Cove, Va. | K-148..... | i, 374 |
| (See notes, ii, 2827.) | | | Lawrence Cr., La. | R-98-q..... | i, 647 |
| La Salle Cr., N. Y. | RR-23..... | i, 1403 | Lawrence Cr., Mont. | GG-580..... | i, 1029 |
| | | | (See notes, ii, 2816.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|----------------------|-------------------|----------------------------------|---------------------|-------------------|
| Lawrence Cr., Nebr.: | | | Lees Cr., La. | R-98-i | i, 647 |
| (See notes, ii, 2820.) | | | Lees Cr., N. C. | M-101 | i, 455 |
| Lawrence Pt., N. Y.: | | | Lees Cr., Va. | K-180 | i, 374 |
| Harbor lines | ii | 2256 | Lees R., Mass. | C-75 | i, 107 |
| Laws, Abstract of | | i, 9 | Bridges | | ii, 2184 |
| Corps of Engineers, affecting | ii, 2040, 2090, 2329 | | Lees Slough | Q-21-a | i, 616 |
| Lawson Cr., N. C. | M-181 | i, 455 | | Q-21-c | i, 618 |
| Lawson Lake, La. | S-163 | i, 682 | Legal proceedings | | i, 21 |
| Laws Swamp, S. C. | N-92 | i, 499 | Legionville | (CC) | i, 910* |
| Laws (Upper) Thorofare, | | | Legislation | | i, 21 |
| Md. | J-79 | i, 331 | Leipsic | (GG-2) | i, 1039* |
| Lawwal Cr., Idaho: | | | Leipsic R., Del. | I-64 | i, 299, 319 |
| Bridges | ii | 2156 | Appro. | | ii, 2290 |
| Lawyers Cove, Md. | J-478 | i, 334 | Bridges | | ii, 2184 |
| Lazaretto Cr., Ga. | O-83 | i, 533 | Wrecks | | ii, 2270 |
| Bridges | ii | 2184 | Leist Cr., Pa. | J-571 | i, 335 |
| Lazaretto Pt., Md.: | | | Leland | (HH) | i, 1076* |
| Fort | ii, 1804, 1914 | | Leland H., Mich. | OO-54-b | i, 1411 |
| Lazelles | (HH) | i, 1075* | L'Embarrass Bayou, La. | S-637 | i, 686 |
| L'Curse Bayou, La. | S-467 | i, 685 | Lemon B., Fla. | P-269 | i, 571 |
| (See notes, ii, 2804.) | | | Lemon B., Fla., and Gas- | | |
| Leadensham Cr., Md. | J-342 | i, 333 | parilla Sound, includ- | | |
| Leading Cr., W. Va. | EE-173 | i, 984 | ing cut-off | P-264-a | i, 596 |
| Lead Isld. | (HH) | i, 1075* | Lemon Cr., N. Y. | G-25 | i, 247, 253 |
| Leaf R., Minn. | KK-113 | i, 1248 | Lemons Cr., S. C. | N-253 | i, 501 |
| Leaf R., Miss. | R-67 | i, 646, 669 | Lemonweir R., Wis. | KK-19 | i, 1247 |
| Appro. | ii, 2294 | | Lennan Bayou, La.: | | |
| Bridges | ii, 2184 | | (See notes, ii, 2805.) | | |
| League Isld. Navy Yard, | | | Leonard Cove, Md. | J-319 | i, 333 |
| Pa.: | | | Leonard Pond, Md. | J-104 | i, 331 |
| Harbor lines | ii, 2256 | | Leonards Cr., N. J.: | | |
| Leatherwood Cr., Ky. | DD-69 | i, 959 | Bridges | | ii, 2184 |
| | DD-121 | i, 960 | Leonards Thoroughfare, | | |
| Leatherwood Cr., Miss. | R-98-a | i, 647 | N. J.: | | |
| Leatherwood Cr., Ohio | DD-357 | i, 932 | Bridges | | ii, 2184 |
| Leatherwood Cr., W. Va. | EE-140 | i, 984 | Leonardtown H., Md. | K-62 | i, 387 |
| Leau Bayou, La.: | | | Leonardtown, Md.: | | |
| (See notes, ii, 2804.) | | | Appro. | | ii, 2291 |
| Leau Bleu Bayou, La. | S-429 | i, 684 | Leopard Bayou, La. | S-670 | i, 687 |
| Leau Que Court R., Nebr. | GG-916 | i, 1032 | Leopards Cr., N. C. | M-252 | i, 456 |
| Leavenworth | (GG-2) | i, 1038* | Lemonds Cove, Me.: | | |
| Leavenworth, Fort, Kans.: | | | Harbor lines | | ii, 2256 |
| Engineer Depot | ii, 2039, 2045 | | Lery Bayou, La. | S-183 | i, 682 |
| Leavenworth Junction | (GG-2) | i, 1038* | Les Cheneaux Isld. Chan., | | |
| Leavenworth, Kans. | (GG-2) | i, 1037* | Mich. | PP-25 | i, 1419 |
| Leban Cr., Kans.: | | | Letitz Cr., Pa. | J-575 | i, 335 |
| (See notes, ii, 2822.) | | | Levees | (HH) | i, 1076* |
| Lebeau | (GG-2) | i, 1035* | Levels, Great Lakes (see | | |
| Lebeau, S. Dak. | (GG-2) | i, 1037* | Great Lakes). | | ii, 2041, 2121 |
| Lebo Cr., Mont. | GG-591 | i, 1029 | Levisa Fork, Ky., Big | | |
| Le Carpe Bayou, La. | S-469 | i, 685 | Sandy R. | DD-213-c | i, 972 |
| Lechmere Canal, Mass. | B-125 | i, 70 | | DD-227 | i, 960 |
| Le Claire | (HH) | i, 1075*, 1076* | Bridges | | ii, 2184 |
| Lecompte B., Md. | J-255 | i, 333 | Lewes Cr., Del.: | | |
| Lecompte Cr., Md. | J-256 | i, 333 | Bridges | | ii, 2184 |
| Le Compte Cr., S. Dak. | GG-363 | i, 1028 | Wrecks | | ii, 2270 |
| | GG-801 | i, 1031 | Lewes, Del. (Delaware | | |
| (See notes, ii, 2815, 2818.) | | | Breakwater). | I-74 | i, 299 |
| Leech Lake | (HH) | i, 1076* | Lewes, Del. (pier) | H-23-b | i, 292 |
| Leech Lake R., Minn.: | | | Lewis and Clark R., | | |
| Bridges | ii, 2184 | | Oreg. | (WW-2) | i, 1617* |
| Leech R. | (HH) | i, 1076* | | WW-5 | i, 1615, 1640 |
| Leech R., Minn. | KK-95 | i, 1248 | | WW-3-a | i, 1640 |
| Leeds Cr., Ma. | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|---------------------------------------|---------------------|-------------------|
| Lewis Cr., Colo. | GG-1080..... | i, 1033 | Lieutenants R., Conn. ... | D-28..... | i, 141 |
| (See notes, ii, 2820.) | | | Lighters, Steam: | | |
| Lewis Cr., Ga. | O-239..... | i, 534 | List..... | | ii, 2348 |
| Lewis Cr., Ky. | DD-81..... | i, 959 | Light: | | |
| Lewis Cr., N. C. | M-230..... | i, 456 | Fort..... | | ii, 1810 |
| | M-237..... | i, 456 | Lighting Knot Cove, Md. ... | J-197..... | i, 332 |
| Lewis Gut, Conn. | D-67..... | i, 141 | Lighting, Parks, D. C. | | ii, 2040, 2071 |
| Bridges..... | | ii, 2184 | Light-wood Log Cr., Ga. ... | O-24..... | i, 533 |
| Lewisport | (CC)..... | i, 910* | Lihue, Hawaii. | YY-33..... | i, 1685 |
| Lewis R. | (WW-2)..... | i, 1617* | Lillington R., N. C. | M-311..... | i, 456, 492 |
| Lewis R., East Fork, | | | Appro..... | | ii, 2292 |
| Wash..... | WW-45..... | i, 1615 | Lilliwaup R., Wash. | XX-54..... | i, 1655 |
| Lewis R., Wash. | WW-44..... | i, 1615, 1649 | Lilly Cr., Nebr. | GG-1257..... | i, 1034 |
| (See notes, ii, 2844.) | | | Lime Cr., Kans. | GG-1370..... | i, 1035 |
| Appro..... | | ii, 2300 | Limehouse Cr., Md. | J-1259..... | i, 340 |
| Bridges..... | | ii, 2184-2185 | Lime Pt., Cal.: | | |
| Lewis Thoroughfare, N. | | | Fort..... | | ii, 1801, 2005 |
| C..... | M-230-a..... | i, 472 | Limestone Cr., Ala. and | | |
| Lewiston | (WW-2)..... | i, 1617* | Tenn..... | AA-206..... | i, 850 |
| (See notes, ii, 2843.) | | | Limestone Cr., Ga. | O-262..... | i, 535 |
| Lexahatche R., Fla.: | | | | O-388..... | i, 535 |
| Bridges..... | | ii, 2185 | Limestone Cr., Ky. | DD-209..... | i, 960, 968 |
| Lexington | (GG-2)..... | i, 1039* | Linchester R., Md. | J-267..... | i, 352 |
| Lexington H., Mich. | PP-86..... | i, 1419, 1444 | Lincoln, Abraham (see | | |
| Wrecks..... | | ii, 2270 | Public Grounds and | | |
| Leyte Isld., P. I. | YY-114..... | i, 1686 | Buildings). | | |
| Leyte, P. I. | YY-119..... | i, 1686 | Lincoln Cr., Ga. | O-170..... | i, 534 |
| Liang B., P. I. | YY-155..... | i, 1686 | Lincolnvill H., Me. | A-141..... | i, 28, 42 |
| Libbie Branch, Mo. | GG-1537..... | i, 1037 | Lindsey Cr., Kans.: | | |
| Libby Br., Minn. | KK-83..... | i, 1247 | (See notes, ii, 2822.) | | |
| Liberty | (HH)..... | i, 1076* | Lindsey Slough, Cal. | UU-67..... | i, 1577 |
| Liberty Bayou, La. | S-11..... | i, 681 | Line Cr., Kans.: | | |
| | T-2-s..... | i, 717 | (See notes, ii, 2823.) | | |
| (See notes, ii, 2804, 2805.) | | | Line Cr., Mo. | GG-199..... | i, 1026 |
| Liberty Bend | (GG-2)..... | i, 1039* | (See notes, ii, 2814.) | | |
| (See notes, ii, 2825.) | | | Linekins B., Me. | A-196..... | i, 28 |
| Liberty Bend | (HH)..... | i, 1076* | Line Fork, Ky. | DD-127..... | i, 960 |
| Liberty Isld. | (HH)..... | i, 1076* | Lines, Harbor (see Harbor | | |
| Liberty, Mo. (HH): | | | lines)..... | | ii, 2041, 2109 |
| (See notes, ii, 2833.) | | | Lingayen, P. I. | YY-104..... | i, 1686 |
| Libertytown Branch, Md. | J-15..... | i, 331 | Lintment Cr., Mo. | GG-234..... | i, 1027 |
| Lick Branch, Ky. | DD-96..... | i, 959 | (See notes, ii, 2814.) | | |
| | DD-114..... | i, 960 | Link Horn B., Va. | L-207-a..... | i, 439 |
| Lick Branch, Mo. | GG-31..... | i, 1025 | Linkhorn B., Va. | L-213..... | i, 412 |
| Lick Cr., Ga. | O-299..... | i, 535 | Link R., Oreg. | VV-2-a..... | i, 1594 |
| Lick Cr., Ky. | DD-205..... | i, 960 | Lineman Cr., Ky. | DD-63..... | i, 959 |
| | DD-228..... | i, 960 | Linn Cr., Mo.: | | |
| Lick Cr., Mo. | GG-96..... | i, 1025 | (See notes, ii, 2824.) | | |
| | GG-180..... | i, 1026 | Linton (WW): | | |
| (See notes, ii, 2813.) | | | (See notes, ii, 2841, 2842.) | | |
| Lick Cr., Pa. | J-733..... | i, 336 | Linton | (WW-2)..... | i, 1617* |
| | J-735..... | i, 336 | Linwood | (HH)..... | i, 1076* |
| Lick Cr., Tenn. | AA-226..... | i, 850 | Listons Tree Pt., Dela- | | |
| | AA-237..... | i, 850 | ware R. | H-3-g..... | i, 282 |
| Lick Cr., Va. | DD-265..... | i, 961 | Little Abita R., La. | S-24..... | i, 681 |
| Licking Cr., Pa. | J-892..... | i, 337 | Little Alabama Bayou, | | |
| Licking R. | (CC)..... | i, 910* | La..... | S-543..... | i, 686 |
| Licking R., Ky. | DD-195..... | i, 960, 967 | Little Alligator R., N. C. ... | M-8..... | i, 454 |
| Appro..... | | ii, 2296 | Little Amite R., La. | S-114..... | i, 682 |
| Bridges..... | | ii, 2185 | Little Annemessex R., | | |
| Harbor lines..... | | ii, 2256 | Md..... | J-46..... | i, 331 |
| Licking R., Ohio. | DD-422..... | i, 962 | Little Arkansas R., Kans. | Y-15..... | i, 818 |
| Lick Run, Pa. | J-765..... | i, 336 | Little Atchafalaya R., La. | S-600..... | i, 686 |
| | J-803..... | i, 337 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Little Aughwick Cr., Pa. | J-890 | i, 337 | Little Bonne Femme Cr., Mo. | GG-82 | i, 1025 |
| Little Auglaize R. | QQ-11 | i, 1461 | (See notes, ii, 2813.) | | |
| Little Auxvasse Cr., Mo. | GG-72 | i, 1025 | Little Brazos R., Tex. | U-42 | i, 735 |
| (See notes, ii, 2813.) | | | Little Buffalo Cr., Mo.: | | |
| Little Badger Cr., Colo.: | | | (See notes, ii, 2824.) | | |
| (See notes, ii, 2820.) | | | Little Buffalo Cr., Pa. | J-895 | i, 337 |
| Little B. de Noche, Mich.: | | | Little Burnt Branch, Md. | J-105 | i, 331 |
| Appro. | | ii, 2298 | Little Caillou Bayou, La. | S-455 | i, 685, 701 |
| Little B., N. J.: | | | Little Calumet (NN): | | |
| Bridges. | | ii, 2185 | (See notes, ii, 2837.) | | |
| Little Bayou Castaign, | | | Little Calumet R., Ill. | NN-21 | i, 1349 |
| La. | S-18 | i, 681 | Bridges. | | ii, 2185 |
| Little B., Va. | K-168 | i, 374 | Little Cannon R., Minn. | JJ-32 | i, 1234 |
| Little B. de Noc, Mich. | MM-5 | i, 1297 | Little Canoochee, Ga. | O-153 | i, 534 |
| | MM-5-a | i, 1298 | Little Captina Cr., Ohio. | DD-337 | i, 961 |
| | MM-5-b | i, 1299 | Little Carlos Pass, Fla. | P-225 | i, 570 |
| Little B., La. | S-682 | i, 687 | Little Carters Cr., Va. | K-192 | i, 374 |
| Little B., N. C. | M-126 | i, 455 | Little Catawba R., S. C. | N-130 | i, 500 |
| Little Bayou Fordoche, | | | Little Chain. | (CC). | i, 910* |
| La. | S-599 | i, 686 | Little Chazy R., N. Y. | E-78 | i, 177 |
| Little Bayou, La. | S-476 | i, 685 | Little Chenier Bayou, La. | S-786 | i, 688 |
| | S-730 | i, 687 | Little Cheyenne R., S. | | |
| Little Bayou Sara, La. | S-274 | i, 683 | Dak. | GG-379 | i, 1028 |
| Little Bazile Cr., Nebr. | GG-935 | i, 1032 | (See notes, ii, 2815.) | | |
| Little Bear Cr., Ala. | AA-38 | i, 848 | Little Chiquesalunga Cr., Pa. | J-579 | i, 835 |
| Little Bear Cr., Mo. | GG-24 | i, 1025 | Little Choptank R., Md. | J-228 | i, 832 |
| Little Bear Cr., Ohio. | DD-437 | i, 962 | Little Chute, Wis.: | | |
| Little Bear Cr., Pa. | J-727 | i, 336 | Bridges. | | ii, 2185 |
| Little Beaver Cr., La. | S-81 | i, 681 | Little Clearfield R., Pa. | J-812 | i, 337 |
| Little Beaver Cr., N. Dak. | | | Little Coal R., W. Va. | EE-69 | i, 983 |
| and Mont. | GG-758 | i, 1031 | (EE-68-a) | | i, 994 |
| (See notes, ii, 2815, 2818.) | | | Little Cohas Brook, N. | | |
| Little Beaver Cr., S. Dak. | GG-291 | i, 1027 | H. | B-21 | i, 69 |
| Little Beaver or Pretty | | | Little Colly Cr., Ky. | DD-141 | i, 960 |
| Cr., N. Dak. | GG-769 | i, 1031 | Little Colorado R. | SS-4 | i, 1543 |
| Little Beaver R. | (CC). | i, 910* | Little Compton, R. I. | C-62 | i, 107 |
| Little Beaver R., Ohio | | | Little Compton, R. I. | | |
| and Pa. | FF-42 | i, 1003 | (breakwater). | C-62 | i, 119 |
| Little Berger Cr., Mo. | GG-1540 | i, 1037 | Little Conewago Cr., Pa. | J-913 | i, 338 |
| (See notes, ii, 2824.) | | | Little Connection Slough, | | |
| Little Big Horn or Greasy | | | Cal. | UU-43 | i, 1577 |
| Grass R., Mont. | GG-703 | i, 1030 | Little Contentnia Cr., N. | | |
| (See notes, ii, 2817.) | | | C. | M-173 | i, 452 |
| Little Birch R., W. Va. | EE-144 | i, 984 | Little Contentnia R., N. | | |
| Little Black R., Alaska. | XX-211 | i, 1656 | C. | M-173 | i, 469 |
| Little Black R., Ark. and | | | Little Conestoga Cr., Pa. | J-578 | i, 335 |
| Mo. | Y-30 | i, 818, 836 | Little Coquille B., La. | S-199 | i, 682 |
| Little Blackwater R., Md. | J-155 | i, 332 | Little Cottonwood R., | | |
| Little Blaine Cr., Ky. | DD-226 | i, 960 | Minn. | KK-160 | i, 1248 |
| Little Blue. | (GG-2) | i, 1039* | Little Cow Cr., Tex.: | | |
| Little Blue Reach. | (GG-2) | i, 1039* | (See notes, ii, 2806.) | | |
| (See notes, ii, 2825.) | | | Little Cr., Del. | I-67 | i, 320 |
| Little Blue R., Ind. | BB-16 | i, 891 | Wrecks. | | ii, 2270 |
| Little Blue R., Mo. | GG-1416 | i, 1036 | Little Cr., Kans. | GG-1405 | i, 1036 |
| (See notes, ii, 2823.) | | | (See notes, ii, 2823.) | | |
| Little Blue R., Nebr. and | | | Little Cr., Ky. | AA-289 | i, 850 |
| Kans. | GG-1262 | i, 1035 | DD-253 | | i, 961 |
| (See notes, ii, 2822.) | | | GG-1240 | | i, 1034 |
| Little Bluff Cr., Tenn. | AA-250 | i, 850 | (See notes, ii, 2821.) | | |
| Little Boeuf Cr., Mo. | GG-1545 | i, 1037 | Little Cross Cr., Kans. | | |
| Little Bogue Falia, La. | S-25 | i, 681 | (See notes, ii, 2821.) | | |
| Little Bohemia Cr., Md. | J-529 | i, 335 | Little Cr., Md. | J-87 | i, 331 |
| | | | Little Cr., Mass. | B-156 | i, 70 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|---------------------------------------|---------------------|-------------------|
| Little Cr., Mo. | GG-92..... | i, 1025 | Little Hocking R., Ohio. ... | DD-441..... | i, 962 |
| Little Cr., N. C. | M-61..... | i, 454 | Little Hog Bayou, La. | S-658..... | i, 686 |
| Little Cr., Va. | L-206..... | i, 412 | Little Hog Isld., Me.: | | |
| Little Cr., W. Va. | EE-20..... | i, 983 | Forts..... | | ii, 1841 |
| Little Darby Cr., Ohio. | DD-469..... | i, 962 | Little Hoquiam R., Wash.: | | |
| Little Deer Cr., Md. | J-929..... | i, 338 | Bridges..... | | ii, 2185 |
| Little Deer Cr., Miss. | X-24..... | i, 785 | Little Huff Cr., W. Va. | EE-24..... | i, 983 |
| Little Dry Cr., La. | S-832..... | i, 688 | Little Hunting Cr., Va. | K-93..... | i, 373 |
| Little Dry Fork, Mont. | GG-607..... | i, 1029 | Little Hurricane Cr., W. | | |
| (See notes, ii, 2817.) | | | Va..... | EE-67..... | i, 983 |
| Little Duckett Cr., Mo. | GG-4..... | i, 1025 | Little Indian Cr. | (CC)..... | i, 910* |
| (See notes, ii, 2813.) | | | Little Inlet, Va. | L-53..... | i, 411 |
| Little Ebenezer, Ga. | O-76..... | i, 533 | Little Isld., Mass.: | | |
| Little Egg H. B. and In- | | | Bridges..... | | ii, 2185 |
| let, including Great B., | | | Little Jordan Branch, Mo. ... | GG-228..... | i, 1026 |
| N. J. (harbor of refuge). ... | I-9-a..... | i, 301 | Little Juniata Cr., Pa. | J-896..... | i, 337 |
| (See notes, ii, 2794.) | | | Little Juniata R., Pa. | J-865..... | i, 337 |
| Appro. | | ii, 2290 | Little Kanawha | (CC)..... | i, 910* |
| Wrecks. | | ii, 2270 | Little Kanawha R. | | |
| Little Egg H. Inlet, N. J. ... | I-9..... | i, 299, 301 | (mouth), W. Va. (ice | | |
| Little Elk Cr., W. Va. | EE-123..... | i, 984 | harbor)..... | EE-157-c..... | i, 1000 |
| Little Elkhart R., Ind. | OO-5..... | i, 1377 | Little Kanawha R., W. | | |
| Little Elk R., Md. | J-540..... | i, 335 | Va..... | EE-157..... | i, 984, 997 |
| | J-523-a..... | i, 360 | | EE-157-a..... | i, 997 |
| Appro. | | ii, 2291 | (See notes, ii, 2811.) | | |
| Little Elk R., Minn. | KK-116..... | i, 1248 | Appro. | | ii, 2296 |
| Little Falls | (HH)..... | i, 1076* | Bridges | | ii, 2185, 2210 |
| Little Falls, Md. | J-1008..... | i, 338 | Navigation rules. | | ii, 2041, 2107 |
| Little Falls, Va. | K-90..... | i, 373 | Little Kanawha R., W. | | |
| Little Femme Osage Cr., | | | Va. (locks and dams, | | |
| Mo. | GG-7..... | i, 1025 | operating and care).... | EE-157-b..... | i, 999 |
| (See notes, ii, 2813.) | | | Little Kanawha R., West | | |
| Little Ferry, N. J.: | | | Fork, W. Va. | EE-163..... | i, 984 |
| Harbor lines | | ii, 2256 | | EE-164..... | i, 984 |
| Little Fishing Cr., Pa. | J-712..... | i, 336 | Little Kaw Cr., Kans.: | | |
| | J-831..... | i, 337 | (See notes, ii, 2821.) | | |
| Little Flatt Cr., N. C. | L-280..... | i, 413 | Little Kennebec B., Me. ... | A-17..... | i, 27 |
| Little Fork R., Minn. | KK-219..... | i, 1249 | Little Kettle Cr., Pa. | J-771..... | i, 336 |
| Bridges | | ii, 2185 | Little Kilbuck Cr., Ohio ... | DD-402..... | i, 932 |
| Little Fox Cr., Va. | DD-269..... | i, 961 | Little Kio Kee Cr., Ga. | O-50..... | i, 533 |
| Little Goddel, La. | S-517..... | i, 685 | Little Kniffe R., N. Dak. ... | GG-404..... | i, 1028 |
| Little Gunpowder Falls, | | | (See notes, ii, 2815.) | | |
| Md. | J-983..... | i, 338 | Little Lagoon, Ala. | R-2..... | i, 646 |
| Little Goose Cr., Ky. | DD-38..... | i, 959 | Little Lake George, Fla. ... | P-57..... | i, 569 |
| Little Goose Rapids | (WW-2)..... | i, 1617* | Little Lake, La. | R-98-cc..... | i, 647 |
| Little Guyandotte R., W. | | | | R-107..... | i, 647 |
| Va. | EE-61..... | i, 983 | | S-354..... | i, 684, 698 |
| Little H., Mass. | B-149..... | i, 70 | Little Lake Pass, La. | R-108..... | i, 647 |
| | C-19..... | i, 111 | Little Laramie R., Wyo.: | | |
| (See notes, ii, 2786.) | | | (See notes, ii, 2820.) | | |
| Appro. | | ii, 2288 | Little Leatherwood Cr., | | |
| Little H., N. H. | A-290..... | i, 29 | Ky. | DD-126..... | i, 960 |
| Appro. | | ii, 2288 | Little Le Sueur Cr., Minn. ... | KK-166..... | i, 1248 |
| Little H., Portsmouth, N. | | | Little Lost Cr., Mo. | GG-20..... | i, 1025 |
| H. | A-290..... | i, 64 | (See notes, ii, 2813.) | | |
| Little H., Woods Hole, | | | Little Lotts Cr., Ga. | O-146..... | i, 534 |
| Mass. | C-19..... | i, 107 | Little Loutre Cr., Mo. | GG-33..... | i, 1025 |
| Wrecks | | ii, 2270 | Little Loyal Sock Cr., Pa. ... | J-782..... | i, 336 |
| Little Heart R., N. Dak. ... | GG-778..... | i, 1031 | Little Lunches Cr., S. C. ... | N-70..... | i, 499 |
| (See notes, ii, 2818.) | | | Little Lyons Cr., Md. | K-19..... | i, 373 |
| Little Hell Gate, N. Y. | E-23..... | i, 177 | Little Machlas B., Me. | A-11..... | i, 27 |
| Bridges | | ii, 2185 | Little Machipongo Inlet, | | |
| Little Hickory Pass, Fla. ... | P-222..... | i, 570 | Va. | L-15..... | i, 411 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-----------------------------------|---|---------------------|---|
| Little Magothy R., Md. | J-1201 | i, 340 | Little Narragansett B., Conn. and R. I. | C-106 | i, 108, 137 (See notes, ii, 2787, 2788.) |
| Little Manatee R., Fla. | P-302 | i, 571 | Appro. | | ii, 2288 |
| Little Manistee R., Mich. | OO-49 | i, 1377 | Little Narragansett B., R. I. | C-105 | i, 137 |
| Little Maquoketa R., Iowa. | JJ-62 | i, 1234 | Little Natalbany R., La. | S-55 | i, 681 |
| Little Marco Pass, Fla. | P-216 | i, 570 | Little Neck B., N. Y. | F-7 | i, 215, 217 |
| Little Marles Cr., Mo.: (See notes, ii, 2824.) | | | Little Nemaha R., Nebr. | GG-1126 | i, 1033 (See notes, ii, 2821.) |
| Little Marietta to mouth of Scioto R., Ohio R. | DD-484 | i, 963 | Little Nesenkeag Brook, N. H. | B-18 | i, 69 |
| Little Medicine Bow R., Wyo. | GG-1052 | i, 1033 (See notes, ii, 2820.) | Little Nestucca R., Oreg. | VV-59 | i, 1593 |
| Little Medicine Cr., S. Dak. | GG-375 | i, 1028 (CC) | Little Nlangua R., Mo.: (See notes, ii, 2824.) | | |
| Little Miami | | i, 910* | Little Necedah R., Wis. | KK-18 | i, 1247 |
| Little Miami R., Ohio. | DD-488 | i, 963 | Little Northeast Cr., Md. | J-549 | i, 335 |
| Little Mill Cr., La. | S-817 | i, 688 | Little North Fork, Ark. and Mo. | Y-39 | i, 818 |
| Little Mill, N. Y.: Harbor lines | | ii, 2256 | Little Ocmulgee R., Ga. | O-327 | i, 535 |
| Little Minim Cr., S. C. | N-102 | i, 499 | Little Ogeechee R., Ga. | O-123 | i, 534 |
| Little Missouri | (GG-2) | i, 1039* | Little Olive Green Cr., Ohio. | DD-346 | i, 961 |
| Little Missouri R., Ark. | X-39 | i, 785, 810 Appro. | Little Osage R., Mo. and Kans. | GG-1488 | i, 1036 (See notes, ii, 2824.) |
| Little Missouri R., N. Dak. | (GG-2) | i, 1037* | Little Otter Cr., Vt. | E-112 | i, 178 |
| Little Missouri R., N. Dak., Mont., and Wyo. | GG-754 | i, 1031 (See notes, ii, 2818.) | Little Paint, Ky. | DD-233 | i, 961 |
| Little Monegaw Cr., Mo. | GG-1470 | i, 1036 (See notes, ii, 2824.) | Little Papillion Cr., Nebr.: (See notes, ii, 2819.) | | |
| Little Monie Cr., Md. | J-86 | i, 331 | Little Pass, Clearwater H., Fla. | P-321 | i, 571 |
| Little Monteau Cr., Mo. | GG-1449 | i, 1036 (See notes, ii, 2823.) | Little Patuxent R., Md. | K-22 | i, 373 |
| Little Monte B., N. Y.: (See notes, ii, 2792.) | | | Little Paw Cr., Kans. | GG-1187 | i, 1034 |
| Little Monte or French B., N. Y. | E-83 | i, 177 | Little Pecan Bayou, La. | S-749 | i, 687 |
| Little Monty B., N. Y.: (See notes, ii, 2792.) | | | Little Peconic B., N. Y. | F-36 | i, 215 |
| Little Moreau Cr., S. Dak.: (See notes, ii, 2818.) | | | Little Pedee R., S. C. and N. C. | N-26 | i, 499, 506 Appro. |
| Little Moreau R., S. Dak. | GG-803 | i, 1031 | Little Pigeon and French Broad Rs., N. C. and Tenn. | AA-112 | i, 872 |
| Little Morgan Run, Md. | J-1142 | i, 339 | Little Pigeon and French Broad Rs., Tenn. | AA-112-c | i, 873 |
| Little Moshannon Cr., Pa. | J-820 | i, 337 | Little Pigeon Bayou, La. | S-605 | i, 686 |
| Little Muddy Cr., Kans. | GG-1230 | i, 1034 (See notes, ii, 2821.) | Little Pigeon R., Tenn. | AA-116 | i, 849 |
| Little Muddy Cr., Mont. | GG-411 | i, 1028 GG-500 | Little Pigeon Rs., Tenn. and N. C.: Appro. | | ii, 2296 |
| (See notes, ii, 2815, 2816.) | | | Little Pine Cr., Pa. | J-749 | i, 336 |
| Little Muddy R., N. Dak.: (See notes, ii, 2815.) | | | Little Piney Cr., Mo. | GG-1529 | i, 1037 (See notes, ii, 2824.) |
| Little Mud R., Ga. | O-197 | i, 534 O-223 | Little Platte | (GG-2) | i, 1039* |
| Little Munuscong R., Mich. | PP-18 | i, 1419 | Little Platte Bend | (GG-2) | i, 1039* |
| Little Muskegon R., Mich. | OO-37 | i, 1377 | Little Platte R., Iowa and Mo. | GG-200 | i, 1026 (See notes, ii, 2814.) |
| Little Muskingum, Ohio. | DD-339 | i, 961 | Little Platte R., Wis. | KK-3 | i, 1247 |
| Little Nahant: (See notes, ii, 2784, 2785.) | | | Little Pomme de Terre R., Mo.: (See notes, ii, 2824.) | | |
| | | | Little Porcupine Cr., Mont. | GG-422 | i, 1028 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Little Porcupine Cr., Mont. | | | Little R., S. C. (contd.) | N-176..... | i, 500 |
| (continued) | GG-643..... | i, 1030 | | O-10..... | i, 533 |
| (See notes, ii, 2815, 2817.) | | | Little R., Tenn. | AA-110..... | i, 849 |
| Little Pottsburg Cr., Fla. | P-80..... | i, 569 | Little R., Tex. | U-44..... | i, 735 |
| Bridges | | ii, 2185 | Little R., Va. | EE-103..... | i, 984 |
| Little Powder R., Mont. | | | Little R., Wash. | XX-44..... | i, 1655 |
| and Wyo | GG-737..... | i, 1030 | Little Roanoke R., Va. | L-369..... | i, 414 |
| (See notes, ii, 2818.) | | | Little Rock | (HH)..... | i, 1076* |
| Little Prater Cr., Va. | DD-274..... | i, 981 | Little Rock, Ark. | Y-2-c..... | i, 820 |
| Little Prickly Pear Cr., | | | Wrecks..... | | ii, 2270 |
| Mont. | GG-508..... | i, 1029 | Little Rock, Ark., district. | Y (with map)..... | i, 815, 818 |
| (See notes, ii, 2816.) | | | (See notes, ii, 2808.) | | |
| Little Queenstown Cr., | | | Appro. | | ii, 2295 |
| Md. | J-421..... | i, 334 | Little Rock Cr., Minn. | KK-71..... | i, 1247 |
| Little Red R., Ark. | Y-45..... | i, 818, 836 | Little Rock Cr., Mont. | GG-467..... | i, 1028 |
| | Y-23..... | i, 827 | Little Rock Cr., Iowa. | GG-282..... | i, 1027 |
| | Y-23-a..... | i, 827 | Little Rock R., Iowa and | | |
| Appro. | | ii, 2295 | Minn.: | | |
| Bridges | | ii, 2185 | (See notes, ii, 2814.) | | |
| Wrecks | | ii, 2270 | Little Rock to mouth of | | |
| Little Rice R., Wis. | KK-12..... | i, 1247 | Arkansas R. | Y-2-i..... | i, 824 |
| Little Rigolets, La. | S-7..... | i, 681 | Little Rocky Cr., Mont.: | | |
| Little R., Ala. | Q-68..... | i, 611 | (See notes, ii, 2816.) | | |
| Little R., Ark. | T-12..... | i, 728 | Little Romney Cr., Md. | J-946..... | i, 338 |
| Bridges | | ii, 2185-2186 | Little Round B. Cr., Md. | J-1228..... | i, 340 |
| Little R., Ark. and Mo. | Y-52..... | i, 818 | Little Round B., Md. | J-1227..... | i, 340 |
| (See notes, ii, 2808.) | | | Little Sable R., Mich. | OO-45..... | i, 1377 |
| Appro. | | ii, 2295 | Little Sac Cr., Mo.: | | |
| Logs, floating of | | ii, 2041, 2109 | (See notes, ii, 2824.) | | |
| Little R., Ark. and Mo. | | | Little Sage Cr., Wyo. | GG-1020..... | i, 1033 |
| (from Homersville to its | | | (See notes, ii, 2820.) | | |
| junction with the St. | | | Little St. Marks R., Fla. | Q-10..... | i, 611 |
| Francis). | Y-52..... | i, 839 | Bridges | | ii, 2186, 2228 |
| Little R., Ark. and Okla. | T-12..... | i, 717 | Little St. Marys R., Fla. | O-520..... | i, 537 |
| Little R., Cal. | TT-144..... | i, 1556 | Little Salem Cr., N. J. | I-44..... | i, 299, 309 |
| Little R., Conn.: | | | Little Saline Cr., Mo.: | | |
| Bridges | | ii, 2186 | (See notes, ii, 2824.) | | |
| Little R., Del. | I-67..... | i, 299, 320 | Little Salkehatchie R., S. | | |
| Appro. | | ii, 2290 | C. | N-251..... | i, 501 |
| Little R., Fla. | P-164..... | i, 570 | Little Salmon R., N. Y. | RR-50..... | i, 1493 |
| Little R., Ga. | O-41..... | i, 533 | Little Saluda R., S. C. | N-191..... | i, 500 |
| | O-302..... | i, 535 | Little Sandy Cr. | GG-474..... | i, 1028 |
| | O-330..... | i, 535 | Little Sandy Cr., Ind. | BB-18..... | i, 891 |
| Little R. Inlet, S. C. | N-2..... | i, 499 | Little Sandy Cr., La. | S-85..... | i, 682 |
| Little R., Ky. | AA-317..... | i, 850, 888 | Little Sandy Cr., Mont.: | | |
| | AA-239..... | i, 878 | (See notes, ii, 2816.) | | |
| Little R., La. | S-137..... | i, 682 | Little Sandy Cr., Ohio. | DD-377..... | i, 962 |
| | S-847..... | i, 688 | Little Sandy Cr., W. Va. | EE-150..... | i, 984 |
| | X-42..... | i, 785, 812 | Little Sandy, Ky. | DD-212..... | i, 960 |
| Appro. | | ii, 2295 | Little Sarasota B., Fla. | P-278..... | i, 571 |
| Bridges | | ii, 2185-2186 | Little Sarasota Pass, Fla. | P-277..... | i, 571 |
| Little R., Me. | A-10..... | i, 27 | Little Satilla R., Ga. | O-459..... | i, 536 |
| Bridges | | ii, 2186 | Little Scioto R., Ohio. | DD-445..... | i, 962 |
| Little R., Mass. | B-70..... | i, 69 | | DD-461..... | i, 962 |
| | B-110..... | i, 70 | Little Shamokin Cr., Pa. | J-613..... | i, 335 |
| | C-57..... | i, 107 | Little Sheepscot R., Me. | A-215..... | i, 28 |
| Bridges | | ii, 2186 | Little Shickshinny Cr., | | |
| Little R., N. C. | L-282..... | i, 413 | Pa. | J-700..... | i, 336 |
| Little R., N. C. and Va. | EE-99..... | i, 983 | Little Shoal Cr., Mo. | GG-193..... | i, 1026 |
| Little R., S. C. | N-3..... | i, 499 | (See notes, ii, 2814.) | | |
| | N-48..... | i, 499, 507 | Little Shoals R., Minn.: | | |
| | N-109..... | i, 500 | Bridges | | ii, 2145, 2186 |
| | N-150..... | i, 500 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| Little Silver Cr., N. J. | G-54 | i, 247 | Little Vermillion Lake, Minn. and Canada | KK-227 | i, 1249 |
| Little Sioux R., Iowa | GG-264 | i, 1027 | Little Vermillion R., Ill. | JJ-12 | i, 1234 |
| (See notes, ii, 2814.) | | | | NN-10 | i, 1349 |
| Little Six Mile Cr., La. | S-823 | i, 688 | Little Vermillion, S. Dak. | GG-297 | i, 1027 |
| Little Sixteenmile Cr., W. Va. | EE-63 | i, 983 | (See notes, ii, 2814.) | | |
| Little Sloop Chan., Va. | L-19 | i, 411 | Little Wabash R., Ill. | BB-36 | i, 891, 903 |
| Little Slough Cr., Kans. | GG-1207 | i, 1034 | | BB-23 | i, 898 |
| (See notes, ii, 2821.) | | | Bridges | | ii, 2186 |
| Little Snake Cr., Fla. | P-183 | i, 570 | Little Wakenda Cr., Mo. | GG-155 | i, 1026 |
| Little Sniabar Cr., Mo. | GG-1422 | i, 1036 | (See notes, ii, 2814.) | | |
| (See notes, ii, 2823.) | | | Little Walker Cr., Va. | EE-88 | i, 983 |
| Little Snow Cr., Mont. | GG-605 | i, 1029 | Little Walnut Cr., Ohio | DD-455 | i, 962 |
| Little Sodus B. H., N. Y. | RR-46 | i, 1524 | Little Wapwallopen Cr., Pa. | J-623 | i, 335 |
| Little Sodus B., N. Y. | RR-46 | i, 1493 | Little Wax Bayou, La. | S-652 | i, 686 |
| Appro. | | ii, 2299 | Little White Lake, La. | S-731 | i, 687 |
| Little Soldier Cr., Kans. | GG-1234 | i, 1034 | Little White Oak Cr., Tex. | | |
| (See notes, ii, 2821.) | | | (See notes, ii, 2805.) | | |
| Little Spice Cr., Mo. | GG-1446 | i, 1036 | Little Wicomlico R., Va. | K-136 | i, 374, 397 |
| (See notes, ii, 2823.) | | | Little Wicomisco Cr., Pa. | J-605 | i, 335 |
| Little State Cr., W. Va. | DD-307 | i, 961 | Little Willow Cr., Mont. | GG-497 | i, 1029 |
| Little Stillwater Cr., Ohio | DD-367 | i, 962 | Little Willow R., Minn. | KK-100 | i, 1248 |
| Little Sugar Cr., Mo. | GG-1483 | i, 1036 | Little Wind R., Wyo. | GG-689 | i, 1030 |
| (See notes, ii, 2824.) | | | (See notes, ii, 2817.) | | |
| Little Sunflower R., Miss. | X-21 | i, 785 | Little Wolf R., Wis. | MM-18 | i, 1297 |
| Bridges | | ii, 2186 | Little Yellow Cr., Mo. | | |
| Little Sur R., Cal. | TT-3 | i, 1555 | (See notes, ii, 2813.) | | |
| Little Sustna R., Alaska | XX-150 | i, 1656 | Live Oak B., La. | S-166 | i, 682 |
| Little Swatora Cr., Pa. | J-586 | i, 335 | Liverman Cr., N. C. | L-323 | i, 413 |
| | J-589 | i, 335 | Livingston Cr., N. C. | M-320 | i, 456, 493 |
| Little Swift Cr., N. C. | M-171 | i, 455 | Livingstone Chan., Mich. | PP-116 | i, 1420 |
| Little Tabo Cr., Mo. | GG-1426 | i, 1036 | Livingstone Cr., Kans. | | |
| (See notes, ii, 2823.) | | | (See notes, ii, 2822.) | | |
| Little Tallapoosa R., Ala. and Ga. | Q-51 | i, 611 | Livingstone Cr., Ky. | AA-320 | i, 850 |
| Little Tarkio Cr., Mo. | GG-241 | i, 1027 | Livingstone Cr., N. C. | | |
| (See notes, ii, 2814.) | | | Bridges | | ii, 2186 |
| Little Tavern Cr., Mo. | GG-48 | i, 1025 | Livingstone Cr., N. Y. | E-46 | i, 177 |
| | GG-1505 | i, 1036 | Livingstone Pt. | (CC) | i, 910* |
| | GG-1552 | i, 1037 | Livingston, Fort, La. | | ii, 1803, 1976 |
| (See notes, ii, 2813, 2823, 2824.) | | | Lizard Cr., La. | S-57 | i, 681 |
| Little Tennessee R., Tenn. | AA-18 | i, 855 | Llano R., Tex. | U-51 | i, 735 |
| | AA-90 | i, 871 | Lloyd B., Va. | L-92 | i, 412 |
| Appro. | | ii, 2296 | Lloyd Cr., Md. | J-381 | i, 334 |
| Bridges | | ii, 2186 | | J-510 | i, 334 |
| Little Tennessee R., Tenn., N. C., and Ga. | AA-90 | i, 849 | Lloyds H. and Cold Spring B., N. Y. (channel be- tween) | F-15-a | i, 219 |
| Little Tensas Bayou, La. | S-602 | i, 686 | Lloyds H., N. Y. | F-15 | i, 215 |
| Little Thorofare, Va. | J-43 | i, 331 | Loaag, P. I. | YY-107 | i, 1686 |
| Little Thoroughfare, Me. | A-125 | i, 28 | Loatak R., Alaska | XX-246 | i, 1657 |
| Little Timber Cr., Mont. | GG-660 | i, 1030 | Loddell Cr., Ohio | DD-429 | i, 962 |
| Little Traverse B., Mich. | OO-61 | i, 1377 | Loblolly Cove, Mass. | B-81 | i, 69 |
| Little Traverse B., Mich. (harbor of refuge near Petoskey) | OO-61 | i, 1413 | Lobster Cove, Mass. | B-73 | i, 69 |
| Little Trinidad R., Cal. | TT-185 | i, 1556 | Lochiel Cr., Nebr. | | |
| Little Trout R., Mich. | PP-45 | i, 1419 | (See notes, ii, 2822.) | | |
| Little Turkey Cr., Kans. | GG-1181 | i, 1034 | Lock Fork, Mo. | GG-1521 | i, 1037 |
| (See notes, ii, 2821.) | | | Lockies Cr., Va. | K-229 | i, 374 |
| Little Two Rs., Minn. | KK-120 | i, 1248 | (See notes, ii, 2795.) | | |
| Little Verdigris R., Okla. and Kans. | Y-13 | i, 818 | Lock Lane Cr., Kans. | GG-1218 | i, 1034 |
| | | | (See notes, ii, 2821.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Lockles Cr., Va.: | | | Long Bayou, La. (contd.) | S-610..... | i, 686 |
| (See notes, ii, 2795.) | | | | S-681..... | i, 687 |
| Wrecks..... | ii, 2270 | | Long Beach B., N. Y. | F-32..... | i, 215, 223 |
| Lockport..... | (HH)..... | i, 1076* | Long Beach, Cal. | SS-18..... | i, 1543, 1547 |
| Lockport, Ill., to St. | | | Long Beach Chan., N. Y.: | | |
| Louis, Mo. | NN-1-c..... | i, 1353 | Bridges..... | ii, 2186 | |
| (See notes, ii, 2827.) | | | Long Beach Inlet to Ja- | | |
| Appro. | ii, 2283 | | malca B., N. Y. | F-80..... | i, 230 |
| Locks, Bishops | ii, 2041, 2106 | | Appro. | ii, 2289 | |
| Lockwoods Folly R., N. | | | Long Beach, Mass. | B-168..... | i, 70 |
| C. | M-328..... | i, 456, 494 | Longboat Cr., Va. | L-60..... | i, 411 |
| Appro. | ii, 2292 | | Longboat Inlet, Fla. | P-284..... | i, 571 |
| Locust Cove, Md. | J-1179..... | i, 340 | Long Branch, Iowa and | | |
| Locust Cr., Iowa and Mo. | GG-137..... | i, 1026 | Mo. | GG-129..... | i, 1026 |
| (See notes, ii, 2813.) | | | Long Branch, Mo. | GG-93..... | i, 1025 |
| Locust Fork, Ala., Black | | | (See notes, ii, 2813.) | | |
| Warrior | R-28..... | i, 646 | Long Branch, Nebr. | GG-1143..... | i, 1034 |
| Bridges..... | ii, 2186 | | (See notes, ii, 2821.) | | |
| Locust Run, Md. | J-1121..... | i, 339 | Long Branch, N. Y. | G-58..... | i, 247 |
| Lodge Branch, Va. | K-127..... | i, 374 | Long Branch, N. J. | | |
| Lodge Pole Cr., Mont. | GG-599..... | i, 1029 | (breakwater)..... | G-58..... | i, 266 |
| Lodge Pole Cr., Colo., | | | Long Branch Cr., Md. | J-949..... | i, 338 |
| Nebr., and Wyo. | GG-1078..... | i, 1033 | Long Cove, Conn. | D-12..... | i, 141 |
| (See notes, ii, 2817, 2820.) | | | Long Cove, Me. | A-135..... | i, 28, 41 |
| Lofton Cr., Fla. | P-7..... | i, 569 | | A-151..... | i, 28 |
| Logan Cr., Mo. | GG-51..... | i, 1025 | | A-176..... | i, 28 |
| (See notes, ii, 2813.) | | | Long Cove, Md. | J-472..... | i, 334 |
| Logan Cr., Nebr.: | | | | J-479..... | i, 334 |
| (See notes, ii, 2819.) | | | | J-497..... | i, 334 |
| Log Cabin Rapids | (WW-2)..... | i, 1617* | | J-1170..... | i, 339 |
| Loggy Bayou, La. | X-46..... | i, 785, 812 | Long Cr., Ga. | O-92..... | i, 533 |
| Appro. | ii, 2295 | | | O-134..... | i, 534 |
| Bridges..... | ii, 2186 | | | O-138..... | i, 534 |
| Logs, floating: | | | | O-499..... | i, 536 |
| Regulations..... | ii, 2041, 2109 | | Long Cr., La. | S-851..... | i, 688 |
| Logstown | (CC)..... | i, 910* | Long Cr., Md. | J-214..... | i, 332 |
| Logstown Bar | (CC)..... | i, 910* | | J-536..... | i, 335 |
| Logstown, Pa.: | | | Long Cr., Mass. | B-184..... | i, 70 |
| Wrecks..... | ii, 2270 | | Long Cr., N. C. | M-109..... | i, 455 |
| Lohff Cr., Kans. and | | | | M-198..... | i, 455 |
| Nebr. | GG-1312..... | i, 1035 | Long Cr., S. Dak. | GG-294..... | i, 1027 |
| (See notes, ii, 2822.) | | | (See notes, ii, 2814.) | | |
| Loiselle Cr., S. Dak. | GG-872..... | i, 1031 | Long Cr., Va.: | | |
| (See notes, ii, 2819.) | | | Bridges..... | ii, 2186 | |
| Lolza R., P. R. | YY-4..... | i, 1685 | Long Dike | (HH)..... | i, 1076* |
| London, Tenn. | AA-18..... | i, 855 | Long Fork, Ky. | DD-251..... | i, 961 |
| Lone Chan., Va. | L-35..... | i, 411 | Long Green Cr., Md. | J-995..... | i, 338 |
| Lone Oak Chan., N. C. | L-226..... | i, 413 | Long Haul Cr., Md. | J-368..... | i, 333 |
| Loneragan Cr., Nebr. | GG-986..... | i, 1032 | Long Isld., N. Y.: | | |
| (See notes, ii, 2820.) | | | Forts..... | ii, 1881 | |
| Lone Tree Cr., Mass. | B-191..... | i, 70 | Harbor lines..... | ii, 2256 | |
| Lone Tree Cr., Mont. | GG-627..... | i, 1030 | Long Isld. City, N. Y.: | | |
| (See notes, ii, 2817.) | | | Harbor lines..... | ii, 2256 | |
| Lone Tree Cr., South | | | Long Isld. Head, Mass.: | | |
| Branch, S. Dak. | GG-345..... | i, 1027 | Battery..... | ii, 1805, 1855 | |
| Lone Tree Cr., S. Dak. | GG-344..... | i, 1027 | Long Isld. Sound, N. Y. | | |
| (See notes, ii, 2815.) | | | and Conn. | E..... | i, 177 |
| Lone Tree Lake, Iowa | GG-259..... | i, 1027 | | F-2..... | i, 215 |
| (See notes, ii, 2814.) | | | Defenses..... | ii, 1823 | |
| Long B., N. C. | M-224..... | i, 455 | Wrecks..... | ii, 2270, 2274 | |
| Long Bayou, Fla. | P-316..... | i, 571 | Longitude (see Latitude). | ii, 2041, 2122 | |
| Long Bayou, La. | S-189..... | i, 682 | Long Key Chan., Fla. | P-188..... | i, 570 |
| | S-507..... | i, 685 | Long Knife Cr., N. Dak. | GG-392..... | i, 1028 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|----------------------|-------------------|--------------------------------------|---------------------|----------------------|
| Long Lake | (HH)..... | i, 1076* | Los Angeles R., Cal. | SS-19..... | i, 1543, 1547 |
| Long Lake Cr., N. Dak. ... | GG-391..... | i, 1028 | Lossmans R., Fla. | P-205..... | i, 570 |
| (See notes, ii, 2815.) | | | Lost Cr., Kans.: | | |
| Long Lake, Ga. | O-488..... | i, 536 | (See notes, ii, 2822.) | | |
| Long Marsh Ditch, Md. ... | J-297..... | i, 333 | Lost Cr., Ky. | DD-155..... | i, 960 |
| Long Pine Cr., Nebr. | GG-929..... | i, 1032 | Lost Cr., La. | S-252..... | i, 683 |
| (See notes, ii, 2819.) | | | Lost Cr., Mo. | GG-19..... | i, 1025 |
| Long Pt. Bayou, La. | S-762..... | i, 687 | (See notes, ii, 2813.) | | |
| Long Pt. Cr., Md. | J-407..... | i, 334 | Lost Cr., Nebr. | GG-1289..... | i, 1035 |
| Long Pole Cr., W. Va. | DD-318..... | i, 961 | Lost Cr., Pa. | J-859..... | i, 337 |
| Long Pond, N. Y. | RR-36..... | i, 1493 | Lost Cr., Tenn. | AA-168..... | i, 849 |
| Longport, N. J.: | | | Lost Cr., Wyo. | GG-1057..... | i, 1033 |
| Wrecks..... | | ii, 2270 | Lost Horse Cr., Mont. | GG-588..... | i, 1029 |
| Long Prairie R. and its | | | Lost Lake, La. | S-481..... | i, 685 |
| source, Minn..... | KK-115..... | i, 1253 | Lost Park Cr., Colo. | GG-1093..... | i, 1033 |
| Long Prairie R., Minn. ... | KK-115..... | i, 1248 | Lots Cr., Ky. | DD-148..... | i, 960 |
| Long Quarter Branch, | | | Louis Bayou, La.: | | |
| Md..... | J-1043..... | i, 338 | Bridges..... | | ii, 2186 |
| Long Reach, Me. | A-252..... | i, 29 | Louisiana | (HH)..... | i, 1076* |
| Longrell Cr., Md. | J-135..... | i, 332 | Forts..... | | ii, 1803, 1816, 1976 |
| Long Run, Pa. | J-834..... | i, 337 | Louisiana and Texas wa- | | |
| Long Sault Isld., N. Y. ... | RR-63-c..... | i, 1534 | ters (removing the water | | |
| Longs Cr., Ky. | DD-67..... | i, 959 | hyacinth)..... | P-1-d..... | i, 573 |
| Longs Cr., Va. | K-157..... | i, 374 | Louisiana Bend (HH): | | |
| Longs Cr., Wyo. | GG-1006..... | i, 1033 | (See notes, ii, 2832.) | | |
| Long Shoal Cr., Ky. | DD-61..... | i, 959 | Louisiana district water- | | |
| Long Shoal R., N. C. | M-29..... | i, 454 | ways tributary to the | | |
| Long Soldier Cr., N. Dak. | GG-788..... | i, 1031 | Mississippi..... | S..... | i, 683 |
| (See notes, ii, 2818.) | | | Louisiana district water- | | |
| Long Tom R., Oreg. | WW-36..i, 1615, 1648 | | ways west of the Missis- | | |
| (See notes, ii, 2844.) | WW-30-b..... | i, 1642 | sippi..... | S..... | i, 683 |
| Appro..... | | ii, 2300 | Louisiana waters | S-2..... | i, 681 |
| Bridges..... | | ii, 2186 | (See notes, ii, 2799.) | | |
| Longwood | (HH)..... | i, 1076* | Bridges..... | | ii, 2186 |
| Lonnau Bayou, La. | T-2-gg..... | i, 717 | Hyacinth removal..... | | ii, 2293 |
| Looking Glass Cr., N. C. ... | L-392..... | i, 414 | Louisiana waterways east | | |
| Looking Glass R., Mich. ... | OO-30..... | i, 1377 | of the Mississippi..... | S..... | i, 681 |
| Lookout Cr., Tenn., Ga., | | | Louisiana waters (water- | | |
| and Ala..... | AA-62..... | i, 848 | hyacinth removal)..... | P-1-b, e..... | i, 572 |
| Loomis Pass, La. | S-224..... | i, 683 | P-1-c..... | | i, 573 |
| Loon Lake, Minn. and | | | S-2-a..... | | i, 688 |
| Canada..... | KK-230..... | i, 1249 | Louisiana watercourses | | |
| Loon R., Minn. and Can- | | | (remarks on improve- | | |
| ada..... | KK-229..... | i, 1249 | ment)..... | S-2..... | i, 688 |
| Loop Cr., W. Va. | EE-76..... | i, 983 | Louisville | (CC)..... | i, 910* |
| Loosacoona R., Miss. | X-9..... | i, 785, 789 | (See notes, ii, 2819.) | (HH)..... | i, 1076* |
| Loosahatchie R., Tenn. ... | AA-3..... | i, 848 | Louisville and Portland | | |
| Loose Cr., Mo. | GG-1511..... | i, 1036 | Canal: | | |
| (See notes, ii, 2824.) | | | Bridges..... | | ii, 2186 |
| Lorain H., Ohio | QQ-22..... | i, 1461, 1475 | Navigation rules..... | | ii, 2041, 2107 |
| Appro..... | | ii, 2299 | Louisville, Ga., to Savan- | | |
| Harbor lines..... | | ii, 2256 | nah, Ga. (waterway).... | O-2-h..... | i, 547 |
| Navigation rules..... | | ii, 2041, 2107 | Louisville, Ky. | BB-15..... | i, 891 |
| Wrecks..... | | ii, 2270 | DD-2..... | | i, 959 |
| Lords Cove, Conn. | D-29..... | i, 141 | Louisville, Ky., district ... | BB(with map)..... | i, 889 |
| Los Angeles, Cal., district. | SS (with map)..... | i, 1541 | | | 891 |
| (See notes, ii, 2839.) | | 1543 | (See notes, ii, 2810.) | | |
| Appro..... | | ii, 2300 | Appro..... | | ii, 2296 |
| Los Angeles H., Cal. | SS-20..... | i, 1543, 1547 | Loup R., Nebr. | GG-968..... | i, 1032 |
| Appro..... | | ii, 2287, 2300 | (See notes, ii, 2819.) | | |
| Bridges..... | | ii, 2186 | Lourse Bayou, La. | S-410..... | i, 684 |
| Harbor lines..... | | ii, 2256 | S-422..... | | i, 684 |
| | | | (See notes, ii, 2804.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Louse Cr., N. Dak. | GG-781..... | i, 1031 | Lucas Chan., La. | S-203..... | i, 682 |
| (See notes, ii, 2818.) | | | Lucca Loop | (HH)..... | i, 1076* |
| Loutre R., Dry Fork, Mo. | GG-44..... | i, 1025 | Luce Cr., Md. | J-1234..... | i, 340 |
| Loutre R., Mo. | GG-92..... | i, 1025 | Luckiamute R., Oreg. | WW-34..... | i, 1615 |
| (See notes, ii, 2813.) | | | Luco Slough, Cal. | TT-89..... | i, 1555 |
| Lovejoys Narrows, Me. | A-225..... | i, 28 | Lucy Cove, Md. | J-485..... | i, 334 |
| Lovely Cove, Md. | J-469..... | i, 334 | Lucy Cr., La. | S-275..... | i, 683 |
| Lovely Cr., Nebr. | GG-1295..... | i, 1035 | Ludington H., Mich. | OO-43..... | i, 1377, 1402 |
| (See notes, ii, 2822.) | | | Appro..... | ii, 2298 | |
| Loves Cr., Tenn. | AA-150..... | i, 849 | Bridges..... | ii, 2186 | |
| Lower Atchafalaya R., La. | S-493..... | i, 685 | Navigation rules..... | ii, 2041, 2107 | |
| Lower Bad Cr., Ky. | DD-83..... | i, 959 | Ludlams Thoroughfare, | | |
| Lower Cedar Pt., Md. | K-46-e..... | i, 380 | N. J.: | | |
| Lower Chain | (HH)..... | i, 1076* | Bridges..... | ii, 2186 | |
| Lower Deer Cr., Mont. | GG-668..... | i, 1030 | Ludley Cr., La. | S-72..... | i, 681 |
| (See notes, ii, 2817.) | | | Ludlow | (CC)..... | i, 910* |
| Lower Devil Cr., Ky. | DD-170..... | i, 960 | Luffie Waltz Cr., Cal. | TT-186..... | i, 1556 |
| Lower Duck Cr., N. C. | M-165..... | i, 455 | Lula | (HH)..... | i, 1076* |
| Lower Dugout Cr., Nebr. | GG-990..... | i, 1032 | Lumber R., N. C. and S. | | |
| Lower Dowrey Cr., N. C. | M-57..... | i, 454 | C. | N-31..... | i, 499, 507 |
| Lower Howards Cr., Ky. | DD-182..... | i, 960 | Appro..... | ii, 2292 | |
| Lower Laurel Cr., Ky. | DD-223..... | i, 960 | Bridges..... | ii, 2186 | |
| Lower Leading Cr., W. | | | Luna | (HH)..... | i, 1076* |
| Va. | EE-177..... | i, 984 | Luxora | (HH)..... | i, 1076* |
| Lower Lighthouse Bayou, | | | Luxora Crossing (HH): | | |
| La. | S-243..... | i, 683 | (See notes, ii, 2832.) | | |
| Lower Machodoc Cr., Va. | K-119..... | i, 374, 396 | Luzon Isld., P. I. | YY-87..... | i, 1686 |
| Appro..... | ii, 2291 | | Lyconing Cr., Pa. | J-741..... | i, 336 |
| Lower Mississippi: | | | Lynches Lake, S. C. | N-71..... | i, 499 |
| (See Mississippi.) | | | Lynches R., S. C. | N-61..... | i, 499 |
| Lower Narrows, Me. | A-172..... | i, 28 | Lynch R., S. C. | N-61..... | i, 508 |
| Lower New York B. (See | | | N-61-a. | i, 508 | |
| New York H.), N. Y.: | | | Appro..... | ii, 2292 | |
| Wrecks..... | ii, 2270 | | Bridges..... | ii, 2186 | |
| Lower Pt. Pleasant | (HH)..... | i, 1076* | Lynn Haven B. to East- | | |
| Lower Pt. Pleasant Cross- | | | ern Branch, Elizabeth | | |
| ing (HH): | | | R., Va. | L-207-c..... | i, 440 |
| (See notes, ii, 2832.) | | | Lynn Haven B., Va. | L-207-a..... | i, 439 |
| Lower R. | (GG-2)..... | i, 1039* | Lynn Haven B., Va. (har- | | |
| Lower Sevenmile Cr., | | | bor of refuge) | L-207-b..... | i, 439 |
| Mont.: | | | Lynn H., Mass. | B-108..... | i, 70, 82 |
| (See notes, ii, 2817.) | | | (See notes, ii, 2784.) | | |
| Lower Sisters Cr., Fla. | O-523..... | i, 537 | Appro..... | ii, 2288 | |
| Lower Spring Cr., N. C. | M-114..... | i, 455 | Wrecks..... | ii, 2271 | |
| Lower Teges Cr., Ky. | DD-31..... | i, 959 | Lynn Haven H.: | | |
| Lower Thorofare, Md. | J-80..... | i, 331 | Wrecks..... | ii, 2271 | |
| Lower Thoroughfare, Md. | J-80..... | i, 343 | Lynnhaven Inlet, Va. | L-207..... | i, 412 |
| Lower Twin Cr., Ky. | DD-102..... | i, 960 | Bridges..... | ii, 2186 | |
| Lower White R., Ark. | Y-23-h..... | i, 832 | Lynnhaven R., Va. | L-208..... | i, 412 |
| (See notes, ii, 2808.) | | | L-210..... | i, 412 | |
| Lower Willamette R. | | | L-211..... | i, 412 | |
| (WW): | | | Lynxville | (HH)..... | i, 1076* |
| (See notes, ii, 2842.) | | | Lyons | (HH)..... | i, 1076* |
| Lowy Cove, Md. | J-318..... | i, 333 | Lyons B., Fla. | P-276..... | i, 571 |
| Loyalhanna Cr., Pa. | FF-22..... | i, 1003 | Lyons Cr., Kans. | GG-1368..... | i, 1035 |
| Loyal Sock Cr., Pa. | J-725..... | i, 336 | (See notes, ii, 2823.) | | |
| Lubec Chan., Me. | A-9..... | i, 27, 31 | Lyons Cr., Md. | K-21..... | i, 373 |
| Appro..... | ii, 2287 | | Lyons Cr., Minn. | KK-162..... | i, 1248 |
| Lubec, Me.: | | | Lyons Cr., Tenn. | AA-123..... | i, 849 |
| Harbor lines..... | ii, 2256 | | AA-151..... | i, 849 | |
| Lucas | (HH)..... | i, 1076* | Lyons Cr., Va. | L-159..... | i, 427 |

M.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|----------------------------|
| Maalea B., Hawaii | YY-66..... | i, 1685 | Madison, Fort, Md. | | ii, 1804 |
| Maalea Landing, H. I.: (See notes, ii, 2846.) | | | Madison H., Conn. | D-47..... | i, 141, 156 |
| Maasin, P. I. | YY-116..... | i, 1686 | (See notes, ii, 2790.) | | |
| Mabseo Cr., Va.: Bridges..... | | ii, 2187, 2214 | Madison, Ind., Ohio R. | DD-495..... | i, 965 |
| Macajalar B., P. I. | YY-177..... | i, 1686 | Madison R. | (GG-2)..... | i, 1039* |
| Macfarland Cr., Ky. | AA-292..... | i, 850 | Madison R., Mont. and Wyo. | GG-525..... | i, 1028 |
| Machias B., Me. | A-12..... | i, 27 | (See notes, ii, 2816.) | | |
| Machias R., Me. | A-14..... | i, 27, 32 | Mad R., Cal. | TT-184..... | i, 1556 |
| (See notes, ii, 2783.) | | | Mad R. Slough, Cal. | TT-183..... | i, 1556 |
| Appro..... | | ii, 2287 | Bridges..... | | ii, 2187 |
| Bridges..... | | ii, 2187 | Magazille Bayou, La. | S-508..... | i, 685 |
| Machias H., Mich. | PP-29..... | i, 1430 | Magnetic Lake, Minn. and Canada. | KK-242..... | i, 1246 |
| Machodoc Cr., Va.: Appro..... | | ii, 2291 | Magnolia H., Mass. | B-87..... | i, 66 |
| Machotank Cr., Va. | L-82..... | i, 411 | Magothy B., Va. | L-57..... | i, 411 |
| Macles Cr., Ky. | DD-120..... | i, 960 | Magothy Narrows, Md. | J-1180..... | i, 346 |
| Mack Arch, Oreg. | VV-4-a..... | i, 1595 | Magothy R., Md. | J-1183..... | i, 346 |
| Mackays Cr., N. C. | M-2..... | i, 454, 457 | Mahanoy Cr., Pa. | J-611..... | i, 335 |
| Appro..... | | ii, 2292 | Mahantango Cr., Pa. | J-606..... | i, 335 |
| Bridges..... | | ii, 2187 | Mahon H., Del. | I-66..... | i, 326 |
| Wrecks..... | | ii, 2271 | Mahoning Cr., Pa. | FF-27..... | i, 1006 |
| Mackenzies Cr., Minn. | JJ-30..... | i, 1234 | Bridges..... | FF-20..... | i, 1016 |
| Mackerel Cove, Me. | A-71..... | i, 27 | Mahoning R., Ohio. | FF-41..... | i, 1021 |
| Mackerel Cove, Mass. | B-91..... | i, 69 | Mahoning R., Ohio and Pa. | FF-41..... | i, 1006 |
| Mackeys Cr., Ala. | R-35..... | i, 646 | Mahonning Cr., Pa. | J-714..... | i, 336 |
| Mackeys Cr., N. C.: Bridges..... | | ii, 2139 | Mahon R., Del. | I-66..... | i, 299, 326 |
| Mackeys R., Ga. | O-422..... | i, 536 | Wrecks..... | | ii, 2271 |
| Mackinac H., Mich. | PP-29..... | i, 1419 | Mahukona H., Hawaii | YY-70..... | i, 1686 |
| PP-30..... | | i, 1419 | Mahukona Landing, H. I.: (See notes, ii, 2846.) | | |
| Appro..... | | ii, 2299 | Maillard Bayou, La. | S-576..... | i, 686 |
| Mackinac Straits, Mich.: Wrecks..... | | ii, 2271 | Main Cr., Md. | J-1177..... | i, 336 |
| Mackinaw R., Ill. | JJ-5..... | i, 1234 | Main Cr., Va. | L-189..... | i, 412 |
| NN-3..... | | i, 1349 | Maine: Forts..... | | ii, 1796, 1804, 1816, 1841 |
| Mackintosh Cr., Ky. | DD-93..... | i, 959 | "Maine": Removal of wreck of, Habana, Cuba..... | | ii, 2041, 2117 |
| Macks Cr., Ga. | O-36..... | i, 533 | Main Pass. | (HH)..... | i, 1076* |
| Macomb, Fort. | | ii, 1803, 1976 | Main Pass, La. | S-206..... | i, 685 |
| Macon Bayou, Ark. and La. | X-33..... | i, 785 | Main Ship Chan., N. Y. | F-105-c, d, f..... | i, 236 |
| Macon Bayou, La. | X-30..... | i, 805 | Main Ship Chan., Va. | L-49..... | i, 411 |
| X-30-a..... | | i, 805 | Maintenance: Appro..... | | ii, 2276 |
| X-30-b..... | | i, 806 | Major Moore Cr., Ga. | O-514..... | i, 537 |
| Appro..... | | ii, 2295 | Makena H., Hawaii | YY-65..... | i, 1685 |
| Macon, Fort, N. C. | | ii, 1807, 1935 | Malabang, P. I. | YY-163..... | i, 1686 |
| Macon to Rome, Ga. (Georgia Canal). | O-326-b..... | i, 557 | Malden R., Mass. | B-121..... | i, 70, 91 |
| Maum Cr., Md. | J-414..... | i, 334 | (See notes, ii, 2785.) | | |
| Maddins Cr., N. C. | M-246..... | i, 456 | Appro..... | | ii, 2285 |
| Mad Horse Cr., N. J. | I-40..... | i, 299 | Bridges..... | | ii, 2187 |
| Madison. (CC)..... | | i, 910* | | | |
| Madison B., Md. | J-236..... | i, 332 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Malheur R., Oreg.: (See notes, ii, 2841.) | | | Manitowoc Co., Wis. (see Centerville Cr.). | | |
| Mallard B., La. S-752..... | i, 687 | | Manitowoc H., Wis. MM-30..... | i, 1326 | |
| (See notes, ii, 2804.) | | | Appro..... | ii, 2298 | |
| Mallards Cr., Ala. AA-45..... | i, 848 | | Harbor lines..... | ii, 2256 | |
| Mallard Slough, Cal. TT-48..... | i, 1555 | | Navigation rules..... | ii, 2041, 2107 | |
| TT-69..... | i, 1555 | | Wrecks..... | ii, 2271 | |
| Mallet Bayou, La. S-765..... | i, 687 | | Manitowoc R., Wis. MM-30..... | i, 1297 | |
| Malletts B., Vt. E-117..... | i, 178 | | Bridges..... | ii, 2187 | |
| Mallows B., Md. K-78..... | i, 373 | | Harbor lines..... | ii, 2256 | |
| Malones Cr., Ala. AA-36..... | i, 848 | | Manitowoc, Wis.: | | |
| Mamaroneck H., N. Y. E-6..... | i, 177, 179 | | Reef..... | ii, 2041, 2133 | |
| Appro..... | ii, 2289 | | Man of War H., Fla.: | | |
| Mamaroneck R., N. Y. E-9..... | i, 177 | | Wrecks..... | ii, 2271 | |
| Mammoth Cave, Ky BB-7..... | i, 892 | | Manokin R., Md. J-64..... | i, 331 | |
| Mamselle Bayou, La. S-597..... | i, 686 | | Appro..... | ii, 2291 | |
| Manahawken B., N. J.: | | | Wrecks..... | ii, 2271 | |
| Bridges..... | ii, 2187 | | Manoplknak, Alaska. XX-186..... | i, 1656 | |
| Man and Boy Chan, Va. L-44..... | i, 411 | | (See notes, ii, 2845.) | | |
| Manasquan R., N. J. G-80..... | i, 247, 266 | | Manor Cr., Md. J-531..... | i, 335 | |
| Appro..... | ii, 2290 | | Manskers. (HH)..... | i, 1076* | |
| Bridges..... | ii, 2187 | | Manskers Cr., Tenn. AA-307..... | i, 850 | |
| Manatee Cr., Fla. P-130..... | i, 570 | | Mantanzas Inlet, Fla. P-94..... | i, 569 | |
| Manatee R., Fla. P-296..... | i, 571, 600 | | Mantua Cr., N. J. I-47..... | i, 299, 310 | |
| Appro..... | ii, 2293 | | Appro..... | ii, 2290 | |
| Bridges..... | ii, 2187 | | Bridges..... | ii, 2187, 2230 | |
| Manchac Bayou, La. S-103..... | i, 682 | | Wrecks..... | ii, 2271 | |
| S-62-a..... | i, 693 | | Many Berries Cr., Mont. GG-443..... | i, 1028 | |
| Appro..... | ii, 2294 | | Manapla, P. I. YY-137..... | i, 1686 | |
| Manchac, La.: | | | Manchac Bayou (HH)..... | i, 1071* | |
| Bridges..... | ii, 2187 | | Manele B., Hawaii. YY-57..... | i, 1685 | |
| Manchester H., Mass. B-89..... | i, 69, 80 | | Manokin R., Md. J-64..... | i, 342 | |
| Appro..... | ii, 2288 | | Manteo B., N. C. M-21..... | i, 458 | |
| Bridges..... | ii, 2187 | | Appro..... | ii, 2292 | |
| Mandan (GG-2)..... | i, 1039* | | Manufactures: | | |
| Mandan Lake, N. Dak. GG-772..... | i, 1031 | | Encouragement by pur- chase of war material..... | ii, 1824 | |
| (See notes, ii, 2818.) | | | Manitou (South) H., Mich.: | | |
| Mandeville Bayou, La. S-186..... | i, 682 | | Wrecks..... | ii, 2271 | |
| Manele B., H. I.: (See notes, ii, 2846.) | | | Many Berries Cr., Mont. and Canada: (See notes, ii, 2815.) | | |
| Mangrove Bayou, La. S-796..... | i, 688 | | Maple Cr., Cal. TT-190..... | i, 1556 | |
| Manhasset B., N. Y. F-8..... | i, 215 | | Maple Cr., Nebr. GG-964..... | i, 1032 | |
| Wrecks..... | ii, 2271 | | (See notes, ii, 2819.) | | |
| Manhasset H., N. Y. F-8..... | i, 215, 217 | | Maple Cr., S. Dak. and N. Dak. GG-321..... | i, 1027 | |
| Manila B., P. I. YY-100..... | i, 1686 | | Maple Isld. (HH)..... | i, 1076* | |
| Forts..... | ii, 1823 | | Maple R., Iowa: (See notes, ii, 2814.) | | |
| Manila H., P. I. YY-100-a..... | i, 1691 | | Maple R., Mich. OO-31..... | i, 1377 | |
| Appro..... | ii, 2301 | | Maple R., N. Dak. KK-187..... | i, 1248 | |
| Engineer Depot..... | ii, 2039, 2045 | | Maple R., N. Dak. and S. Dak.: (See notes, ii, 2815.) | | |
| Mines, submarine..... | ii, 1815 | | Maple Suck, Ga. O-485..... | i, 536 | |
| Work in the field..... | ii, 2040, 2086 | | Mapping, surveys. | ii, 2041, 2120 | |
| Manistee Co., Mich. (har- bor of refuge). OO-51..... | i, 1407 | | Maps. | i, 14, 21 | |
| Manistee H., Mich. OO-47..... | i, 1377, 1404 | | Frontispiece map of U. S. and Engineer districts..... | Frontispiece. | |
| Appro..... | ii, 2298 | | (See notes, ii, 2782.) | | |
| Navigation rules..... | ii, 2041, 2107 | | Panama Canal | ii, 2357 | |
| Manistee R., Mich. OO-48..... | i, 1377 | | | | |
| Bridges..... | ii, 2187 | | | | |
| Manistee R., South Branch, Mich. OO-50..... | i, 1377 | | | | |
| Manistique H., Mich. MM-2-a..... | i, 1297 | | | | |
| Appro..... | ii, 2298 | | | | |
| Manistique R., Mich. MM-2..... | i, 1297 | | | | |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Maps, Geological | ii | 2040, 2088 | Maron Bayou, La | S-766..... | i, 68 |
| Maps, making | ii | 2041, 2123 | Marquette B., Mich.: | | |
| Maps, Military | ii | 2040, 2088 | (See notes, ii, 2836.) | | |
| Mapso Cr., Va | L-135..... | i, 412 | Appro..... | | ii, 226 |
| Maps Cr., Va | L-74..... | i, 411 | Marquette B., Mich. (har- | | |
| Maquam B., Vt. | E-122..... | i, 178 | bor of refuge)..... | LL-54-b..... | i, 129 |
| Maquoit B., Me. | A-258..... | i, 29 | Marquette H., Mich. | LL-54..... | i, 1265, 129 |
| Maquoketa R. | (HH)..... | i, 1076* | (See notes, ii, 2836.) | | |
| Maquoketa R., Iowa | J-63..... | i, 1234 | Appro..... | | ii, 229 |
| Marais Cr., Mo | GG-1510..... | i, 1036 | Harbor lines..... | | ii, 225 |
| Marais R. | (GG-2)..... | i, 1039* | Marrowbone Cr., Ky. | AA-290..... | i, 85 |
| Maramec (HH): | | | DD-256..... | | i, 96 |
| (See notes, ii, 2832.) | | | Marrowbone Cr., W. Va. | DD-328..... | i, 96 |
| Marblehead H., Mass | B-107..... | i, 70 | Marshall Cr., Kans. | GG-1176..... | i, 108 |
| Marblehead Light, Ohio: | | | (See notes, ii, 2821.) | | |
| Wrecks..... | | ii, 2271 | Marsh Bayou, La. | S-839..... | i, 68 |
| Marblehead, Mass | B-107..... | i, 82 | Marsh Cr., Md | J-269..... | i, 33 |
| Appro..... | | ii, 2288 | Marsh Cr., Pa. | J-758..... | i, 33 |
| Forts..... | | ii, 1855 | Marsh Cr., S. Dak. | J-827..... | i, 33 |
| Marcus | (WW-2)..... | i, 1617* | GG-307..... | | i, 102 |
| Marcus Hook H., Pa. | H-3-j..... | i, 283 | (See notes, ii, 2815.) | | |
| Marcus Hook Ice H., Pa.: | | | Marsh R., Me. | A-106..... | i, 4 |
| Wrecks..... | | ii, 2271 | Bridges..... | | ii, 218 |
| Mardiella Branch, Md. | J-1117..... | i, 339 | Wrecks..... | | ii, 227 |
| Mare Branch, N. C. | L-338..... | i, 413 | Marsh R., Minn. | KK-196..... | i, 124 |
| Mare Isld. Strait, Cal. | TT-105..... | i, 1556, 1565 | Marsh R., West Branch, | | |
| Harbor lines..... | | ii, 2256 | Me..... | A-106..... | i, 2 |
| Wrecks..... | | ii, 2271 | Marshy Cr., Md. | J-397..... | i, 33 |
| Marengo Bend | (HH)..... | i, 1076* | Marshyhope Cr., Md. | J-127..... | i, 33 |
| Mare Pt. B., Me. | A-257..... | i, 29 | Marshy Pt., N. J.: | | |
| Maria Sanches Cr., Fla. | P-88..... | i, 569 | Harbor lines..... | | ii, 225 |
| Marias R., Mont. | GG-476..... | i, 1028 | Marthas Vineyard, Ed- | | |
| (GG-2)..... | | i, 1037* | gartown H., Mass..... | C-30..... | i, 10 |
| (See notes, ii, 2816, 2824.) | | | Marthas Vineyard, Mass. | C-30..... | i, 11 |
| Maricaoquant Bayou, La. | S-643..... | i, 686 | (See notes, ii, 2786.) | | |
| Maries Cr., Mo.: | | | Appro..... | | ii, 228 |
| (See notes, ii, 2824.) | | | Wrecks..... | | ii, 2267, 227 |
| Marietta | (CC)..... | i, 910* | Martin Cr., Kans. | GG-1393..... | i, 103 |
| Marietta, Ohio (Muskini- | | | (See notes, ii, 2823.) | | |
| gum R. mouth)..... | DD-439..... | i, 962 | Martin Cr., Pa. | J-634..... | i, 33 |
| Marine City H., Mich | PP-92..... | i, 1419 | Martinez, Cal.: | | |
| Appro..... | | ii, 2299 | Harbor lines..... | | ii, 225 |
| Harbor lines..... | | ii, 2256 | Martinez Cr., Tex.: | | |
| Wrecks..... | | ii, 2271 | (See notes, ii, 2805.) | | |
| Marine City, Mich. (ice | | | Martin Fork, Ky. | DD-44..... | i, 95 |
| harbor of refuge)..... | PP-92..... | i, 1447 | Martin Isld. or Martins | | |
| Marine Park: | | | Slough..... | (WW-2)..... | i, 1617 |
| Harbor lines..... | | ii, 2256 | Martin Isld. Slough, | | |
| Marinette H., Mich. | MM-10..... | i, 1297 | Wash..... | WW-46..... | i, 161 |
| Marinette, Wis | MM-9-c..... | i, 1302 | Martins Bluff | (WW-2)..... | i, 1617 |
| Marinoguin Bayou, La. | S-537..... | i, 685 | Martins Branch, Mo. | GG-42..... | i, 102 |
| Marion | (GG-2)..... | i, 1039* | (See notes, ii, 2813.) | | |
| Marion City | (HH)..... | i, 1076* | Martins Cove, Md. | J-1210..... | i, 34 |
| Marion, Fort, Fla. | ii, 1802, 1955 | | Martins Cr., Ohio | DD-399..... | i, 96 |
| Marion Isld. | (GG-2)..... | i, 1039* | Martins Landing | (HH)..... | i, 1076 |
| Marks Cr., S. C. | N-46..... | i, 499 | Martins Slough or Mar- | | |
| Marley Cr., Md. | J-1160..... | i, 339 | tin Isld..... | (WW-2)..... | i, 1617 |
| Marmaton R., Mo. and | | | Marvin Cr., Pa. | J-674..... | i, 33 |
| Kans.: | | | Maryland: | | |
| (See notes, ii, 2824.) | | | Forts..... | | ii, 1804, 181 |
| Marmiton R., Mo. and | | | Maryland Steel Co., Md.: | | |
| Kans..... | GG-1491..... | i, 1036 | Harbor lines..... | | ii, 225 |
| Marmotte Bayou, Ala. | R-46..... | i, 646 | Mary Sanders Cr., N. C. | L-254..... | i, 41 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------------|---|---------------------|-------------------|
| Marys R., Oreg. | WW-35..... | i, 1615 | Mattaponi R., Va. | K-305..... | i, 375, 405 |
| Marysville, Wash.: | | | Appro..... | | ii, 2291 |
| Harbor lines..... | | ii, 2256 | Bridges..... | | ii, 2188 |
| Masbate Isld., P. I. | YY-109..... | i, 1686 | Wrecks..... | | ii, 2271 |
| Mascot Bayou, La. | S-683..... | i, 687 | Mattawoman Cr., Md. | K-80..... | i, 373 |
| Mashpee R., Mass. | C-14..... | i, 107 | Mattawoman Cr., Va. | L-67..... | i, 411 |
| Bridges..... | | ii, 2187 | Matthews Bend (HH): | | |
| Mason Branch, Md. | J-296..... | i, 333 | (See notes, ii, 2827.) | | |
| Mason Cr., Va. | L-255..... | i, 412 | Mattituck B., N. Y. | F-26..... | i, 215, 222 |
| Bridges..... | | ii, 2187 | Mattituck Cr., N. Y.: | | |
| Mason, Fort: | | | Bridges..... | | ii, 2188 |
| Engineer depot..... | | ii, 2039, 2045 | Wrecks..... | | ii, 2271 |
| Forts..... | | ii, 2005 | Mattituck H., N. Y. | F-26..... | i, 215, 222 |
| Mason Isld. (HH) | | i, 1076* | Appro..... | | ii, 2289 |
| Maspeh Cr., N. Y. | F-112..... | i, 216 | Mattole R., Cal. | TT-168..... | i, 1556 |
| Massachusetts: | | | Mattox Cr., Va. | K-114..... | i, 374, 395 |
| Forts..... | | ii, 1796, 1805, 1816, 1866 | Maui Isld., Hawaii. | YY-58..... | i, 1685 |
| Massachusetts Ave., D. | | | (See notes, ii, 2846.) | | |
| C.: | | | Mauldin Cr., Mo. | GG-220..... | i, 1026 |
| Bridge..... | | ii, 2039, 2064 | (See notes, ii, 2814.) | | |
| Massac R., Ill. | BB-39..... | i, 891 | Maumee B., Ohio. | QQ-3..... | i, 1461 |
| Massalona Bayou, Fla.: | | | Appro..... | | ii, 2299 |
| Bridges..... | | ii, 2187 | Wrecks..... | | ii, 2271 |
| Massapomock Cr., Va. | K-209..... | i, 374 | Maumee R. (above Toledo, Ohio) | QQ-4..... | i, 1464 |
| Massas Cr., Mo. | GG-21..... | i, 1025 | Maumee R., Ohio. | QQ-4..... | i, 1461 |
| (See notes, ii, 2813.) | | | Appro..... | | ii, 2299 |
| Massena, N. Y. | RR-75..... | i, 1538 | Bridges..... | | ii, 2188 |
| Appro..... | | ii, 2299 | Harbor lines..... | | ii, 2256 |
| Massena Power Canal, N. Y. | RR-74..... | i, 1493 | Maumee Valley: | | |
| Mass Pond, Md. | J-1203..... | i, 340 | Examination..... | | ii, 2040, 2088 |
| Massy Branch, Mo. | GG-38..... | i, 1025 | Maunaloa H., H. I.: | | |
| Masters Bayou, La. | S-809..... | i, 688 | (See notes, ii, 2846.) | | |
| Matadequin Cr., Va. | K-315..... | i, 375 | Maurice R., N. J. | I-32..... | i, 299, 305 |
| Matagorda B. and Brazos R. (channel between) ... | U-38-e..... | i, 759 | Appro..... | | ii, 2290 |
| Matagorda B., Tex. | U-47..... | i, 735, 766 | Bridges..... | | ii, 2188 |
| Harbor lines..... | | ii, 2256 | Wrecks..... | | ii, 2271 |
| Matagorda B., Tex., Alligator Head H. | U-47-a..... | i, 766 | Maxent Bayou, La. | S-147..... | i, 682 |
| Matagorda B. to Lavaca B., Tex. (channel between) | U-56-a..... | i, 767 | (See notes, ii, 2804.) | | |
| Matagorda B. to Palacios, Tex. (channel) | U-53-a..... | i, 766 | Maxmore Cr., Md. | J-329..... | i, 333 |
| Matalacha Pass, Fla. | P-253..... | i, 571 | Mayaguez H., P. R. | YY-20..... | i, 1685, 1687 |
| Matamoros (CC) | | i, 910* | (See notes, ii, 2846.) | | |
| Matanuska R., Alaska. | XX-149..... | i, 1656 | Wrecks..... | | ii, 2271 |
| Matanzas Pass, Fla. | P-229..... | i, 570 | Mayano Cr., Kans. | GG-1241..... | i, 1034 |
| Matanzas R., Fla. | P-87..... | i, 569 | May Bluff Cr., Ga. | O-498..... | i, 536 |
| Bridges..... | | ii, 2188 | Mayersville (HH) | | i, 1076* |
| Matawan Cr., N. J. | G-44..... | i, 247, 263 | Mayfield Cr., Ky. | AA-16..... | i, 848 |
| Appro..... | | ii, 2290 | Mayflower (HH) | | i, 1076* |
| Mate Cr., W. Va. | DD-321..... | i, 961 | May Hall, Ga. | O-223..... | i, 534 |
| Matecumbe Chans., Fla. | P-187..... | i, 570 | Mayhew Cr., Minn. | KK-70..... | i, 1247 |
| Material, War (see War Material). | | | Mayners Cr., Ga. | O-421..... | i, 536 |
| Matthews Bend (HH) | | i, 1076* | Maynot Cr., Cal. | TT-199..... | i, 1556 |
| Matinicus H., Me. | A-117..... | i, 28, 40 | Mayo B., P. I. | YY-157..... | i, 1686 |
| Appro..... | | ii, 2287 | Mayradlers Cr., Mont. | GG-635..... | i, 1030 |
| Mat Run, Va. | K-307..... | i, 375 | (See notes, ii, 2817.) | | |
| Mattapolsett H., Mass. | C-49..... | i, 107 | Maysville (CC) | | i, 910* |
| Mattapolsett R., Mass. | C-50..... | i, 107 | Mazon R., Ill. | JJ-7..... | i, 1234 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| McCargoe Cove, Lake Su- perior, Mich..... | LL-63..... | i, 1265, 1294 | Meadow Cr., Ky..... | DD-54..... | i, 959 |
| (See notes, ii, 2835.) | | | Meadow Cr., Mo..... | GG-1452..... | i, 1036 |
| McClary, Fort, Me..... | ii, 1804, 1851 | | (See notes, ii, 2823.) | | |
| McClellanville, S. C. (op- posite), Alligator Cr..... | N-202-b..... | i, 518 | Meadow Cr., S. Dak..... | GG-805..... | i, 1031 |
| McClure Cr., Va..... | DD-264..... | i, 981 | Meadow R., W. Va..... | EE-116..... | i, 984, 996 |
| McCLURE, JOHN: Compiler, Index, Re- ports, Chief of Engi- neers, 1866-1900, and 1866-1912..... | | i, 1, 9, 10, 13 | Meads Cr., N. Y..... | J-665..... | i, 336 |
| McCoys..... | (HH)..... | i, 1076* | Mears Cr., Md..... | K-13..... | i, 373 |
| McCoys Cr., Fla..... | P-24..... | i, 569 | Medicine Bow R., Wyo..... | GG-1051..... | i, 1033 |
| McCoy Slough, Cal..... | TT-94..... | i, 1555 | (See notes, ii, 2820.) | | |
| McCreskie Cr., Mo..... | GG-158..... | i, 1026 | Medicine Cr., Kans.: (See notes, ii, 2822.) | | |
| McDonald Cr., Mont..... | GG-577..... | i, 1029 | Medicine Cr., Mo.: (See notes, ii, 2813.) | | |
| (See notes, ii, 2816.) | | | Medicine Cr., S. Dak..... | GG-862..... | i, 1031 |
| McDonald Lake..... | (WW-2)..... | i, 1617* | GG-875..... | | i, 1032 |
| McDougalds Cr., Ga..... | O-59..... | i, 533 | (See notes, ii, 2815, 2819.) | | |
| McDougall Lake, Minn.: Dams, private..... | ii, 2249 | | Medleys..... | (HH)..... | i, 1076* |
| McDowell Cr., Kans..... | GG-1372..... | i, 1035 | Medoc Bar..... | (CC)..... | i, 910* |
| (See notes, ii, 2823.) | | | Medomak R., Me..... | A-166..... | i, 46 |
| McElhatton Cr., Pa..... | J-835..... | i, 337 | Medomak R., Me..... | A-166..... | i, 28, 46 |
| McFarlings Cove, Me..... | A-185..... | i, 28 | Meduncook R., Me..... | A-158..... | i, 28 |
| McGarvey Cr., Cal..... | TT-194..... | i, 1556 | Medway R., Ga..... | O-171..... | i, 534 |
| McGill Branch, Mo..... | GG-103..... | i, 1026 | Meed Cr., Va..... | K-220..... | i, 374 |
| (See notes, ii, 2813.) | | | Meekers Isld..... | (HH)..... | i, 1076* |
| McGill Cr., Mo..... | GG-157..... | i, 1026 | Meekin Cr., Md..... | J-160..... | i, 332 |
| McGirts Cr., Fla..... | P-26..... | i, 569 | Meeting House Branch, Ky..... | DD-58..... | i, 959 |
| Bridges..... | ii, 2188 | | Mee-ye-ro Cr., Wyo.: (See notes, ii, 2817.) | | |
| McGregor..... | (HH)..... | i, 1076* | Meherrin R., N. C..... | L-322..... | i, 413, 445 |
| McGulres Fork, Ohio..... | DD-372..... | i, 962 | Appro..... | ii, 2291 | |
| McHenry, Fort, Md..... | ii, 1804, 1914 | | Mehoapany Cr., Pa..... | J-691..... | i, 336 |
| Wrecks..... | ii, 2268 | | Meigs Cr., Ohio..... | DD-347..... | i, 961 |
| McIntosh Branch, Mo..... | GG-32..... | i, 1025 | Melheur R., Oreg..... | VV-88..... | i, 1593 |
| McIntyre Cr., Kans..... | GG-1250..... | i, 1034 | Mellow Bayou, La..... | S-506..... | i, 685 |
| (See notes, ii, 2821.) | | | (See notes, ii, 2804.) | | |
| McKeesport, Pa..... | FF-6-a..... | i, 1003 | Melozitna R., Alaska..... | XX-223..... | i, 1657 |
| Harbor lines..... | ii, 2256 | | Memorial Arch, Valley Forge, Pa..... | ii, 2040, 2096 | |
| McKenzie Cr., S. Dak..... | GG-821..... | i, 1031 | Memorial Bridge, D. C..... | ii, 2039, 2064 | |
| (See notes, ii, 2818.) | | | Memorials, D. C..... | ii, 2040, 2069 | |
| McKenzie R., Oreg..... | WW-37..... | i, 1615 | Memphis..... | (CC)..... | i, 910* |
| McKinney Branch, Mo..... | GG-61..... | i, 1025 | (HH)..... | | i, 1076* |
| McKowen Cr., La..... | S-250..... | i, 683 | (See notes, ii, 2831, 2832.) | | |
| McLean Pt..... | (HH)..... | i, 1076* | Memphis, Tenn., district (1st and 2d M. R. C.)... X..... | | i, 841 |
| McLeod Lake, Cal..... | UU-38..... | i, 1577 | Mendocino B., Cal..... | TT-145..... | i, 1556, 1569 |
| McLeouds Lake, Ga..... | O-323..... | i, 535 | Menemsha (Bite or Bight) H., Mass..... | C-26..... | i, 107, 112 |
| McMahan Cr., Ohio..... | DD-336..... | i, 961 | Menemsha H., Mass..... | C-26..... | i, 107, 112 |
| McMillan Memorial Fountain, D. C..... | ii, 2040, 2069 | | Menominee Canal, Wis.: Bridges..... | ii, 2188 | |
| McMillan Park Reservoir, D. C..... | ii, 2040, 2085 | | Menominee H. and R., Mich. and Wis..... | MM-9..... | i, 1300 |
| McNells B., Vt..... | E-113..... | i, 178 | MM-9-c..... | | i, 1302 |
| McNultys Slough, Cal..... | TT-174..... | i, 1556 | Appro..... | ii, 2298 | |
| McQueens..... | (GG-2)..... | i, 1039* | Menominee H., Mich. and Wis..... | MM-9-a..... | i, 1300 |
| McRee, Fla.: (See notes, ii, 2801.) | | | Navigation rules..... | ii, 2041, 2107 | |
| McRee, Fort, Fla..... | ii, 1802, 1965 | | Menominee R., Mich. and Wis..... | MM-9..... | i, 1297 |
| McTyler Cr., S. C..... | N-241..... | i, 501 | MM-9-b..... | | i, 1301 |
| Meachin Cr., Va..... | K-228..... | i, 374 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|----------------------|------------------------------------|---------------------|-------------------|
| Menominee R., Wis. | MM-34..... | i, 1297 | Meyano Cr., Kans.: | | |
| Bridges..... | | ii, 2188 | (See notes, ii, 2821.) | | |
| Menset Cr., Mass. | B-180..... | i, 70 | Miakka R., Fla. | P-263..... | i, 571 |
| Menunketesuck R., | | | Miami | (GG-2)..... | i, 1039* |
| Conn..... | D-43..... | i, 141 | Miami Cr., Mo. | GG-1472..... | i, 1036 |
| Bridges..... | | ii, 2188, 2233 | (See notes, ii, 2824.) | | |
| Meramec R. | (HH)..... | i, 1076* | Miami, Fla. | P-159..... | i, 587 |
| (See notes, ii, 2832.) | | | Appro..... | | ii, 2293 |
| Meramec R., Mo. | II-10..... | i, 1229 | Forts..... | | ii, 1955 |
| Meramecot Cr., Md. | J-36..... | i, 331 | Miami R., Conn. | D-95..... | i, 172 |
| Merced R., Cal. | UU-31..... | i, 1577, 1584 | Miami R., Fla. | P-165..... | i, 570 |
| Mercer Cr., Ga. | O-268..... | i, 535 | Bridges..... | | ii, 2188 |
| Merchants Row, Me. | A-88..... | i, 27 | Miami R., Oreg. | VV-68..... | i, 1593 |
| "Merchant Vessels of the | | | Milanus R., Conn. and | | |
| United States": | | | N. Y..... | D-96..... | i, 141 |
| Used in checking Index | | | (See notes, ii, 2792.) | | |
| matter..... | | i, 13 | Appro..... | | ii, 2289 |
| Mercler Bayou, La. | S-146..... | i, 682 | Michaels Landing | (HH)..... | i, 1076* |
| Merediths Cove, Md. | J-1206..... | i, 340 | Michigan: | | |
| Meridian, 100th: | | | Forts..... | | ii, 1805, 1816 |
| Explorations..... | | ii, 2040, 2089 | Michigan and Illinois Ca- | | |
| Mermentau, La., to | | | nal. | NN-12..... | i, 1349 |
| Franklin (Inland water- | | | Michigan City H., Ind. | NN-23..... | i, 1349, 1368 |
| way)..... | S-696-c..... | i, 710 | (See notes, ii, 2837.) | | |
| Mermentau R. and tribu- | | | Appro..... | | ii, 2298 |
| taries, La. | S-745..... | i, 711 | Bridges..... | | ii, 2188 |
| | S-745..... | i, 687 | Navigation rules..... | | ii, 2041, 2107 |
| | S-746..... | i, 687 | Wrecks..... | | ii, 2271 |
| | S-748..... | i, 687 | Michigan, Lake Superior | | |
| | S-754..... | i, 687 | Power Co.: | | |
| Appro..... | | ii, 2294 | Water power..... | | ii, 2041, 2115 |
| Bridges..... | | ii, 2188 | Michigan R., Colo. | GG-1040..... | i, 1033 |
| Locks and dams..... | | ii, 2249 | (See notes, ii, 2820.) | | |
| Mermentau R. to Sabine | | | Middle Cr., Mo. | GG-70..... | i, 1025 |
| R., La. and Tex. (water- | | | Middle B., Casco B., Me. .. | A-256..... | i, 29 |
| way)..... | S-696-d..... | i, 710 | Middle Bayou, La. | S-48..... | i, 681 |
| Mermenton R. and tribu- | | | | S-590..... | i, 686 |
| taries, La. | S-745..... | i, 711 | Middle Bend | (GG-2)..... | i, 1039* |
| Merriman Bar | (CC)..... | i, 910* | Middle Branch | JJ-56..... | i, 1234 |
| Merrimac R., Mass. and | | | Middle Branch, Kans.: | | |
| N. H. | B-3..... | i, 69, 72 | (See notes, ii, 2823.) | | |
| Appro..... | | ii, 2288 | Middle Branch, Ohio. | DD-417..... | i, 962 |
| Bridges..... | | ii, 2188 | Middle Branch, Pa. | J-643..... | i, 335 |
| Merryman Branch, Md. | J-1039..... | i, 338 | Middle Bros. Isld. | (CC)..... | i, 910* |
| Merrymeeting B., Me. | A-228..... | i, 29 | Middle Chute | (CC)..... | i, 910* |
| Meshoppen Cr., Pa. | J-637..... | i, 335 | Middle Collyett Bayou, La. | S-65..... | i, 681 |
| Metaline | (WW-2)..... | i, 1617* | Middle Cr., Kans.: | | |
| Metedeconk R., N. J. | I-4..... | i, 299 | (See notes, ii, 2824.) | | |
| Meteorology, Great Lakes | | ii, 2041, 2124, 2132 | Middle Cr., Ky. | DD-236..... | i, 961 |
| Metering, Water Supply, | | | Middle Cr., N. C. | M-31..... | i, 454 |
| D. C. | | ii, 2040, 2084 | Middle Cr. No. 2, N. C. ... | M-32..... | i, 454 |
| Methow Rapids | (WW-2)..... | i, 1617* | Middle Cr., Pa. | J-572..... | i, 335 |
| (See notes, ii, 2841.) | | | | J-849..... | i, 337 |
| Methow R., Wash. | XX-117..... | i, 1656 | Middle Cr., Tenn. | AA-188..... | i, 849 |
| Meto Bayou, Ark. | Y-3..... | i, 818, 825 | Middle Cr., W. Va. | EE-121..... | i, 984 |
| Metomkin B., Va. | L-2..... | i, 411 | | EE-139..... | i, 984 |
| Metomkin Inlet, Va. | L-1..... | i, 411 | | EE-188..... | i, 984 |
| Metre Bayou, Ark. | Y-3..... | i, 825 | (See notes, ii, 2811.) | | |
| Metropolis | (CC)..... | i, 910* | Middle Fabius R., Mo. | JJ-75..... | i, 1234 |
| Mexican Cr., S. Dak. | GG-852..... | i, 1031 | Middle Fork | DD-4-a..... | i, 963 |
| Mexican Frontier | | ii, 2041, 2120 | Middle Fork, Alaska. | XX-218..... | i, 1656 |
| Mexico B., N. Y. | RR-50..... | i, 1493 | Middle Fork, Holston R., | | |
| | RR-50-a..... | i, 1531 | Va. | AA-135..... | i, 849 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Middle For't, Ky. | DD-201..... | i, 960 | Mifflin, Fort, Pa. |ii, | 1807, 1903 |
| Middle Fork, Kentucky | | | Mike Chan., Va. | L-45..... | i, 411 |
| R., Ky. | DD-59..... | i, 959 | Milan Section, Ill., Illinois | | |
| Middle Fork, La. | S-256..... | i, 683 | and Mississippi Canal. | JJ-20-f..... | i, 1240 |
| Middle Fork, Mo. | GG-126..... | i, 1026 | Mile Cr., Iowa | G-G-240..... | i, 1027 |
| | GG-171..... | i, 1026 | (See notes, ii, 2814.) | | |
| (See notes, ii, 2813, 2814.) | | | Miles Cr., Md. | J-308..... | i, 333 |
| Middle Fork, Mo. and | | | Miles R., Md. | J-366..... | i, 333, 355 |
| Iowa: | | | Milford H., Conn. | D-61..... | i, 141, 160 |
| (See notes, ii, 2814.) | | | (See notes, ii, 2790.) | | |
| Middle Fork, Mud R., W. | | | Appro. |ii, | 2289 |
| Va. | EE-54..... | i, 983 | Harbor lines. |ii, | 2256 |
| Middle Fork R., Tenn. | AA-9..... | i, 848 | Milford Haven, Va. | K-250..... | i, 375, 403 |
| | AA-12..... | i, 848 | Appro. |ii, | 2291 |
| Middle Fork, Salt Cr., | | | Milhomme Bayou, La.: | | |
| Ohio. | DD-450..... | i, 962 | (See notes, ii, 2804.) | | |
| Middle Fork, Saluda R., | | | Milken (HH): | | |
| S. C. | N-180..... | i, 500 | (See notes, ii, 2829.) | | |
| Middle Fork, W. Va. | EE-21..... | i, 983 | Military Defenses: | | |
| Middle Ground Bar, | | | Surveys, and appro. |ii, | 2279 |
| Hampton Roads, Va. | L-99..... | i, 417 | Military Laws |ii, | 2329 |
| Appro. |ii, | 2291 | Military Maps |ii, | 2040, 2088 |
| Middle Ground B., La. | S-237..... | i, 683 | Military Works, Maumee | | |
| (See notes, ii, 2811.) | | | Valley. |ii, | 2040, 2088 |
| Bridges. |ii, | 2188 | Militia, Equipment of. |ii, | 1814, 2041, 2133 |
| Middle Loup R., Nebr. | GG-974..... | i, 1032 | Milk R. | (GG-2)..... | i, 1039* |
| (See notes, ii, 2820.) | | | Milk R., Mich. | PP-104..... | i, 1420 |
| Middle Neebish Chan., | | | Milk R., Mont. | GG-423..... | i, 1028 |
| Mich. | PP-16..... | i, 1419 | (GG-2)..... |i, | 1037* |
| Middle Neck Branch, | | | Milk R., Mont. and Can- | | |
| Md. | J-102..... | i, 331 | ada: | | |
| Middle Nodaway R., Iowa. | GG-238..... | i, 1027 | (See notes, ii, 2815, 2824.) | | |
| (See notes, ii, 2814.) | | | Milk R., North and South | | |
| Middle North R., Ga.: | | | Branches, Mont. | GG-444..... | i, 1029 |
| Bridges. |ii, | 2188 | ..... | GG-445..... | i, 1029 |
| Middleport. | (CC)..... | i, 910* | Millbank Cr., Va. | K-198..... | i, 374 |
| Middle Prong, N. C. | M-122..... | i, 455 | Mill Bayou, La. | X-32..... | i, 785 |
| Middle Quarter Cove, | | | Mill Bottom. | (CC)..... | i, 910* |
| Md. | J-434..... | i, 334 | Mill Branch, Mo. | GG-25..... | i, 1025 |
| Middle R., Ala. | R-14..... | i, 646 | Mill Branch, S. C. | N-91..... | i, 499 |
| Middle R., Cal. | UU-25..... | i, 1577 | Millbridge, Me.: | | |
| Bridges. |ii, | 2188 | Wrecks. |ii, | 2271 |
| Middle R., Fla. | P-153..... | i, 570 | Mill Brook, Md. | J-934..... | i, 338 |
| Middle R., Ga. | O-417..... | i, 536 | Mill Cove, Me. | A-247..... | i, 29 |
| Middle R., Iowa. | JJ-71..... | i, 1234 | Mill Cr. | (CC)..... | i, 910* |
| Middle R., La. | R-98-dd..... | i, 647 | (WW-2)..... |i, | 1617* |
| | R-103..... | i, 647 | Mill Cr., Conn.: | | |
| Middle R., Md. | J-1056..... | i, 339 | Bridges. |ii, | 2189 |
| Middle R., Mo. | GG-68..... | i, 1025 | Mill Cr., Ga. | O-257..... | i, 535 |
| (See notes, ii, 2813.) | | | Mill Cr., Iowa. | GG-265..... | i, 1027 |
| Middle R., Minn. | KK-203..... | i, 1248 | (See notes, ii, 2814.) | | |
| Middle R., N. C. | L-353..... | i, 414 | Mill Cr., Kans. | GG-1155..... | i, 1034 |
| Middle Run, Md. | J-1138..... | i, 339 | ..... | GG-1180..... | i, 1034 |
| | J-1139..... | i, 339 | ..... | GG-1270..... | i, 1035 |
| Middle Slough, Cal. | TT-72..... | i, 1555 | ..... | GG-1278..... | i, 1035 |
| Middle Spring, Pa. | J-904..... | i, 337 | ..... | GG-1378..... | i, 1035 |
| Middletown Branch, Md. | J-143..... | i, 332 | ..... | GG-1404..... | i, 1036 |
| Middleton Cr., N. C. | L-295..... | i, 413 | (See notes, ii, 2821, 2822, 2823.) | | |
| Mid Oconee Cr., Ga. | O-283..... | i, 535 | Mill Cr., Ky. | DD-64..... | i, 959 |
| Midshipman Slough, Cal. | TT-118..... | i, 1556 | ..... | DD-157..... | i, 960 |
| Midway Isld., Welles H. | YY-65-b..... | i, 1691 | ..... | DD-180..... | i, 960 |
| | | | Mill Cr., La. | R-98-x..... | i, 647 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|---------------------|-------------------------------------|---------------------|-------------------|
| Mill Cr., La. (continued) ... | S-258..... | i, 683 | Millers Cr., W. Va. | DD-322..... | i, 961 |
| | S-816..... | i, 688 | Millers Isld. to North Pt., | | |
| | T-2-v..... | i, 717 | Md. | J-1081-a..... | i, 365 |
| Mill Cr., Me.: | | | Millers Lake, Ga. | O-244..... | i, 535 |
| Bridges..... | | ii, 2189 | Millers R., Mass. | B-124..... | i, 70 |
| Mill Cr., Md. | J-279..... | i, 333 | Millers Cr., Va. | K-269..... | i, 375 |
| | J-386..... | i, 334 | Mill Flour Slough, Ore. ... | VV-51..... | i, 1593 |
| | J-514..... | i, 335 | Mill Fork, Ohio | DD-421..... | i, 962 |
| | J-555..... | i, 335 | Millcan Cr., Tenn. | AA-117..... | i, 849 |
| | J-917..... | i, 338 | Milliken (HH): | | |
| | J-1197..... | i, 340 | (See notes, ii, 2829.) | | |
| | J-1208..... | i, 340 | Mill Neck Cr. Inlet, N. Y.: | | |
| | K-8..... | i, 373 | Bridges..... | | ii, 2189 |
| | K-41..... | i, 373 | Mill Pond Cr., Va. | K-285..... | i, 375 |
| Mill Cr., Mass. | B-54..... | i, 69 | Mill R., Conn. | D-59..... | i, 141 |
| | B-178..... | i, 70 | (See notes, ii, 2788.) | | |
| Mill Cr., Mo. | GG-1418..... | i, 1036 | Bridges..... | | ii, 2189 |
| (See notes, ii, 2823.) | | | Mill R., Conn. and N. Y. ... | D-77..... | i, 141 |
| Mill Cr., Mont. | GG-665..... | i, 1030 | | D-94..... | i, 141 |
| (See notes, ii, 2817.) | | | Mill R., Mass. | B-71..... | i, 69 |
| Mill Cr., Nebr. | GG-946..... | i, 1032 | | C-72..... | i, 107 |
| (See notes, ii, 2819.) | | | Mill Run, Pa. | J-755..... | i, 336 |
| Mill Cr., N. C. | L-289..... | i, 413 | Mills Branch, Md. | J-453..... | i, 334 |
| | L-345..... | i, 414 | Mills Cr., N. Y.: | | |
| | M-162..... | i, 455 | Bridges..... | | ii, 2189 |
| | M-272..... | i, 456 | Mill Slough, Ore. | VV-19..... | i, 1593 |
| | M-296..... | i, 456 | Millstone Cr., Ga. | O-35..... | i, 533 |
| Mill Cr. No. 2, N. C. | M-163..... | i, 455 | Millstone Cr., Ky. | DD-134..... | i, 960 |
| Mill Cr., N. J. | G-9..... | i, 247 | Millstone Cr., Va. | L-14..... | i, 411 |
| Mill Cr., N. Y. | E-5..... | i, 177, 179 | Milltail Cr., N. C. | M-14..... | i, 454 |
| | F-93..... | i, 216 | Bridges..... | | ii, 2189 |
| Mill Cr., Ohio. | DD-396..... | i, 962 | Milton Branch, La. | S-70..... | i, 681 |
| | DD-466..... | i, 962 | Milton H., N. Y. | E-4..... | i, 177, 179 |
| | DD-489..... | i, 963 | Milwaukee and Rock R. | | |
| Mill Cr., Pa. | J-568..... | i, 335 | Canal, Wis. | MM-33-e..... | i, 1337 |
| | J-676..... | i, 336 | Milwaukee B., Wis.: | | |
| | J-737..... | i, 336 | Wrecks..... | | ii, 2271 |
| | J-863..... | i, 337 | Milwaukee B., Wis. (har- | | |
| Mill Cr., R. I. | C-94..... | i, 108 | bor of refuge) | MM-33-b..... | i, 1335 |
| Mill Cr., S. C. | N-112..... | i, 500 | Milwaukee H. (inner), | | |
| | N-145..... | i, 500 | Wis. | MM-33-d..... | i, 1337 |
| Mill Cr., Tenn. | AA-251..... | i, 850 | Milwaukee H., Wis. | MM-33-a..... | i, 1333 |
| Mill Cr., Tex.: | | | | MM-33-d..... | i, 1337 |
| (See notes, ii, 2805, 2806.) | | | Milwaukee H., Wis. (har- | | |
| Mill Cr., Va. | K-126..... | i, 374 | bor of refuge) | MM-33-c..... | i, 1336 |
| | K-143..... | i, 374 | Milwaukee R., Wis. | MM-33..... | i, 1297, 1333 |
| | K-212..... | i, 374 | Bridges..... | | ii, 2189 |
| | K-230..... | i, 374 | Wrecks..... | | ii, 2271 |
| | K-240..... | i, 375 | Milwaukee, Wis.: | | |
| | L-100..... | i, 412 | Appro..... | | ii, 2298 |
| Bridges..... | | ii, 1927, 2188-2189 | Bridges..... | | ii, 2189 |
| Mill Cr., Wash. | WW-58..... | i, 1615 | Harbor lines..... | | ii, 2256 |
| Mill Cr., W. Va. | DD-331..... | i, 961 | Navigation rules..... | | ii, 2041, 2107 |
| | EE-58..... | i, 983 | Milwaukee, Wis., district. | MM..... | i, 1295 |
| Mill Cr., W. Va. | (HH)..... | i, 1076* | (See notes, ii, 2836.) | | |
| Miller Cr., Md. | J-436..... | i, 334 | Appro..... | | ii, 2298 |
| Miller Run, Md. | J-1112..... | i, 339 | Mindanao Isld., P. I. | YY-152..... | i, 1686 |
| Millers Cr., Kans. | GG-1319..... | i, 1035 | Mindanao R., P. I. | YY-162..... | i, 1686 |
| (See notes, ii, 2822.) | | | Mindoro Isld., P. I. | YY-108..... | i, 1686 |
| Millers Cr., Ky. | DD-176..... | i, 960 | Minebank Run, Md. | J-1046..... | i, 339 |
| Millers Cr., La. | R-98-n..... | i, 647 | Mine Cr., Md. | J-65..... | i, 331 |
| Millers Cr., Mo. | GG-77..... | i, 1025 | Mine Cr., Mo. | GG-1484..... | i, 1036 |
| (See notes, ii, 2813.) | | | Mine Cr., Mo. and Kans.: | | |
| | | | (See notes, ii, 2824.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|------------------------|-------------------|--|---------------------|-------------------------------------|
| Miners Bend | (GG-2)..... | i, 1039* | Misery Bayou, La. | S-582..... | i, 686 |
| Miners Slough, Cal. | UU-63..... | i, 1577 | Misham Pt., Mass.: | | |
| Mines, Submarine | 1797, 1814, 1824, 1837 | ii, 1796, | Wrecks..... | | ii, 2271 |
| Insular defenses..... |ii, 1815 | | Mispillon Cr., Del. | I-70..... | i, 322 |
| Minette Bayou, Ala. | R-12..... | i, 646 | Appro..... | | ii, 2290 |
| Mingo Branch, Md. | J-1026..... | i, 338 | Mispillon R., Del. | I-70..... | i, 299, 322 |
| Mingo Cr., S. C. | N-76..... | i, 499, 510 | (See notes, ii, 2794.) | | |
| Appro..... |ii, 2292 | | Wrecks..... | | ii, 2271 |
| Bridges..... |ii, 2189 | | Missionary Cr., Ala. | AA-204..... | i, 850 |
| Mingo, Ohio: | | | Mission Cr., Kans. | GG-1388..... | i, 1036 |
| Harbor lines..... |ii, 2256 | | (See notes, ii, 2823.) | | |
| Minim Cr., S. C. | N-104..... | i, 499 | Mission Cr., Mo.: | | |
| Minim-Estherville Cr. Ca- | | | (See notes, ii, 2814.) | | |
| nal, S. C. | N-101..... | i, 511 | Mission Cr., S. Dak.: | | |
| Mining débris |ii, 2041, 2108 | | (See notes, ii, 2819.) | | |
| (See Fortification, Mining.) | | | Mission Cr., Wash. | XX-58..... | i, 1655 |
| Mining, forts |ii, 1799 | | Mission Rock, Cal.: | | |
| Mining: | | | Harbor lines..... | | ii, 2256 |
| Sutro Tunnel..... |ii, 2040, 2090 | | Missisquoi B., Vt. | E-124..... | i, 178 |
| Minisceongo R., N. Y. | E-70..... | i, 177, 201 | Bridges..... | | ii, 2189 |
| Mink Cr., Ala. | AA-198..... | i, 849 | Missisquoi R., Vt. | E-126..... | i, 178, 211 |
| Minneapolis | (HH)..... | i, 1076* | Mississinewa R., Ind. | BB-30..... | i, 891 |
| (See notes, ii, 2827, 2833.) | | | Mississippi: | | |
| Minnechaduga Cr., Nebr. | | | Forts..... | | ii, 1805, 1816, 1970 |
| and S. Dak..... | GG-911..... | i, 1032 | Mississippi and Illinois | | |
| Minnechaduga R., Nebr. | | | Canal, Ill..... | JJ-20..... | i, 1234, 1235 |
| and S. Dak.: | | | JJ-20-c..... | | i, 1237 |
| (See notes, ii, 2819.) | | | Mississippi Basin | (HH)..... | i, 1076* |
| Minnehaha | (HH)..... | i, 1076* | Mississippi Bayou, La. | S-121..... | i, 682 |
| Minnehaha Cr. | (HH)..... | i, 1076* | S-217..... | | i, 682 |
| (See notes, ii, 2827.) | | | Mississippi Canal, Illinois | | |
| Minnehaha Cr., Minn. | KK-136..... | i, 1248 | and (see Illinois and | | |
| Minneiska | (HH)..... | i, 1076* | Mississippi Canal). | | |
| (See notes, ii, 2827.) | | | Mississippi City H., Miss., | | |
| Minnesota | (HH)..... | i, 1076* | to Ship Isld..... | R-86-a..... | i, 671 |
| Minnesota Pt., Minn. | LL-18-a..... | i, 1275 | Mississippi coast: | | |
| (See notes, ii, 2835.) | | | Appro..... | | ii, 2294 |
| Harbor lines..... |ii, 2256 | | Forts..... | | ii, 1970 |
| Minnesota Pt., Wls.: | | | Mississippi coast harbors | | |
| (See notes, ii, 2835.) | | | (dredge for)..... | R-1-a..... | i, 647 |
| Harbor lines..... |ii, 2256 | | Mississippi, lower | (HH)..... | i, 1076* |
| Minnesota R., Minn. | KK-137..... | i, 1248, 1254 | (See notes, ii, 2827.) | | |
| (See notes, ii, 2829, 2834.) | | | Mississippi R. | (CC)..... | i, 910* |
| Appro..... |ii, 2297 | | (GG-2)..... | | i, 1039* |
| Bridges..... |ii, 2189 | | (HH)..... | | i, 777, 1076* |
| Snag boats and dredges..... |ii, 2285 | | (See notes, ii, 2813, 2827, 2834.) | | |
| Minnesota - North and | | | Appro..... | | i, 1090; ii, 2279, 2283, 2287, 2297 |
| South Dakota State | | | Boards..... | | i, 1081 |
| line | KK-189..... | i, 1248 | Bridges, ii, 2189, 2190, 2191, 2192, 2193, 2194, | | 2195, 2196, 2197. |
| Minnewauken Shoals, N. | | | Commission (M. R. C.), i, 1082, 1142; ii, 2041, 2108 | | (see notes, ii, 2828, 2830). |
| Dak..... | KK-186-a..... | i, 1259 | Dams, private..... | | ii, 2249, 2250 |
| Minns Cr., N. C. | L-291..... | i, 413 | Districts (see notes, ii, 2832, 2830, 2831). | | |
| Mintons | (HH)..... | i, 1076* | Engineers, i, 1082, 1083, 1084, 1085; and see | | notes, ii, 2828, 2830, 2832. |
| Mink Isld. B., Va. | L-54..... | i, 411 | Forts..... | | ii, 1823, 1976 |
| Misamis, P. I. | YY-175..... | i, 1686 | Gauges (see notes, ii, 2829). | | |
| Miscellaneous Reports, | | | Harbor lines..... | | ii, 2256, 2257 |
| etc..... |i, 13; ii, 2035 | | Headwaters (see notes, ii, 2829). | | |
| Miscellaneous Works: | | | Navigation rules..... | | ii, 2041, 2107 |
| Appro..... |ii, 2279 | | | | |
| Misere Bayou, La. | S-780..... | i, 687 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------------------------|---|---------------------|-------------------|
| Mississippi R.—Continued. | | | Missouri R. system | | i, 777 |
| Physical characteristics..... | | i, 1085 | Missouri R. (lower): | | |
| Projects..... | | i, 1086 | (See notes, ii, 2827.) | | |
| Reservoirs (see notes, ii, 2829). | | | Missouri R. Valley | GG-2) | i, 1039* |
| South Pass, appro..... | | ii, 2279 | Mitchell Cr., Cal. | TT-148 | i, 1556 |
| Survey..... | | ii, 2041, 2108 | Mitchell Cr., S. Dak. | GG-861 | i, 1031 |
| Wrecks..... | | ii, 2271, 2274 | (See notes, ii, 2819.) | | |
| Mississippi R., at Donaldsonville, La., to Rio Grande, Tex. | U-38-g | i, 759 | Mitchell R., Mass. | B-220 | i, 70 |
| Mississippi R. to Atlantic Ocean: | | | Mitchell Run, Md. | J-271 | i, 333 |
| Appro..... | | ii, 2296 | Mitchels Lake, Ga. | O-321 | i, 535 |
| Mississippi R. to Lake Superior (canal) | LL-19-b | i, 1280 | Mittigly Chan., Va. | L-36 | i, 411 |
| Appro..... | | ii, 2298 | Mixons Cr., N. C. | M-69 | i, 454 |
| Mississippi R. tributaries: | | | Mix Run, Pa. | J-793 | i, 337 |
| Appro..... | | ii, 2285 | Mizpah R., Mont. | GG-722 | i, 103 |
| Mississippi R. (upper) (HH) | | i, 1076* | (See notes, ii, 2818.) | | |
| (See notes, ii, 2827.) | | | Mobile, Ala. | R-48 | i, 6460 |
| Mississippi R., Watertown (Hennepin Canal, Illinois R.) | JJ-20-b | i, 1236 | | R-21 | i, 648 |
| Mississippi Sound, Ala., and Mobile B. (channel connecting) | R-52-a | i, 664 | (See notes, ii, 2803.) | | |
| Appro..... | | ii, 2294 | Appro..... | | ii, 2287 |
| Bridges..... | | ii, 2199 | Forts..... | | ii, 1796 |
| Forts..... | | ii, 1796 | Harbor lines..... | | ii, 2257 |
| Mississippi Sound, Ala. and La. | R-55 | i, 646 | Navigation rules..... | | ii, 2041, 2107 |
| Mississippi Sound, Miss. and La. | S-3 | i, 681 | Wrecks..... | | ii, 2271 |
| Mississippi to Atlantic ("Transportation Routes to Seaboard") | AA-18-k | i, 869 | Mobile, Ala., district | R (with map) | i, 643, 646 |
| Mississippi, Valley of. (HH) | | i, 1076* | (See notes, ii, 2803.) | | |
| Missoula R. (WW-2) | | i, 1617* | Appro..... | | ii, 2294 |
| Missouri: | | | Mobile Bar, Ala. | R-3 | i, 647 |
| Field services in..... | | ii, 2039, 2048 | (See notes, ii, 2803.) | | |
| Missouri Chute (HH) | | i, 1076* | Appro..... | | ii, 2294 |
| Missouri City Bend (GG-2) | | i, 1039* | Mobile Bar Chan., Ala. | R-3 | i, 646 |
| Missouri Cr., S. Dak. | GG-855 | i, 1031 | Mobile B., Ala. | R-4 | i, 646 |
| Missouri, Department of: | | | Appro..... | | ii, 2294 |
| Work in the field..... | | ii, 2040, 2086 | Bridges..... | | ii, 2199 |
| Missouri Junction (GG-2) | | i, 1039* | Forts..... | | ii, 1823, 1970 |
| Missouri (lower) (HH) | | i, 1076* | Wrecks..... | | ii, 2271 |
| Missouri R. (CC) | | i, 910* | Mobile B. and Mississippi Sound, Ala. (channel connecting) | R-52-a | i, 664 |
| | | (HH).....i, 1076* | Bridges..... | | ii, 2199 |
| | | GG-2.....i, 1023, 1025, 1037, 1038* | Mobile Chute (HH) | | i, 1076* |
| (See notes, ii, 2813, 2824, 2825, 2827, 2832, 2833.) | | | Mobile Co., Ala.: | | |
| Appro..... | | ii, 2287, 2297 | Bridges..... | | ii, 2199 |
| Bridges..... | | ii, 2197, 2198, 2199 | Mobile Pt.: | | |
| Commission (Missouri R. Comm.)..... | | ii, 2041, 2108 | Forts..... | | ii, 1801 |
| Dams, private..... | | ii, 2250 | Mobile R., Ala. | R-21 | i, 646, 648 |
| Harbor lines..... | | ii, 2257 | (See notes, ii, 2803.) | | |
| Six-foot channel..... | | ii, 2041, 2110 | Bridges..... | | ii, 2199 |
| Wrecks..... | | ii, 2271 | Harbor lines..... | | ii, 2257 |
| Missouri R. Branch of Mississippi R. system | GG | i, 1023 | Wrecks..... | | ii, 2272 |
| | | | Mobile R., Ala. (junction) | R-20 | i, 646 |
| | | | Mobile R. and H., Ala.: | | |
| | | | Appro..... | | ii, 2294 |
| | | | Moback B., Va. | K-262 | i, 375 |
| | | | Wrecks..... | | ii, 2272 |
| | | | Moccasin Cr., S. Dak. | GG-323 | i, 1027 |
| | | | (See notes, ii, 2815.) | | |
| | | | Moccasin R., N. C. (see Contentna Cr.): | | |
| | | | Bridges..... | | ii, 2199 |
| | | | Moccasin Run, Pa. | J-796 | i, 337 |
| | | | Moccasin Springs (HH) | | i, 1076* |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---|-------------------|
| Moclips R., Wash. | XX-28..... | i, 1655 | Monongahela R., Pa. and W. Va.—Continued. | | |
| Mode Cr., Cal. | TT-120..... | i, 1556 | Appro. | ii, 2290 | |
| Modes Cr., N. C. | M-115..... | i, 455 | Bridges..... | ii, 2199, 2200, 2201, 2217 | |
| Modoc Campaign: | | | Harbor lines..... | ii, 2256, 2257 | |
| Explorations..... | ii, 2040, 2087 | | Navigation rules..... | ii, 2041, 2107 | |
| Modoc Cr., Mo. | GG-46..... | i, 1025 | Monongahela R., Pa. and W. Va., Ls. and Ds. on (operating and care).... | FF-6-h..... | i, 1009 |
| (See notes, ii, 2813.) | | | Monongahela R., Pa. and W. Va. (purchase of slack-water system of Monongahela Naviga- tion Co.)..... | FF-6-e..... | i, 1006 |
| Mohawk R., N. Y. | E-54..... | i, 177, 198 | Monongahela R., W. Va. | FF-6-g..... | i, 1008 |
| Bridges..... | ii, 2199 | | Monroe B., Mich.: | | |
| Mohican R., Ohio | DD-407..... | i, 962 | Wrecks..... | ii, 2272 | |
| Mokelumne R., Cal. | UU-45..... | i, 1577, 1584 | Monroe Cr., Pa. | J-588..... | i, 335 |
| (See notes, ii, 2840.) | | | Monroe Cr., Va. | K-113..... | i, 374 |
| Appro. | ii, 2300 | | Monroe, Fort, Va. | ii, 1808, 1927 | |
| Bridges..... | ii, 2199 | | Monroe H., Mich. | PP-124..... | i, 1420, 1457 |
| Mokelumne R., North Fork, Cal. | UU-45..... | i, 1577 | Appro. | ii, 2299 | |
| Molalla R., Oreg. | WW-39..... | i, 1615 | Montana R., Alaska | XX-154..... | i, 1656 |
| Molasses Bayou, Tex.: | | | Montauk, N. Y., Fort Pond B. and H. | F-44..... | i, 226 |
| (See notes, ii, 2806.) | | | Montauk Pt., N. Y. | F-46..... | i, 215 |
| Moline | (HH)..... | i, 1076* | Monte B., N. Y. | E-84..... | i, 177 |
| Moline, Ill.: | | | (See notes, ii, 2792.) | | |
| Harbor lines..... | ii, 2257 | | Monterey B., Cal. | TT-6..... | i, 1555 |
| Moll Clark R., Ga. | O-194..... | i, 534 | Appro. | ii, 2300 | |
| Moll Cr., Kans.: | | | Monterey B. and H., Cal. | TT-6..... | i, 1557 |
| (See notes, ii, 2822.) | | | Monterey, Cal.: | | |
| Molokai Isld., Hawaii | YY-50..... | i, 1685 | Appro. | ii, 2300 | |
| (See notes, ii, 2846.) | | | Monuments..... | ii, 2040, 2093 | |
| Moncrief Cr., Fla. | P-20..... | i, 569 | Monterey H., Cal. | TT-7..... | i, 1555 |
| Monday Cr., Va. | K-296..... | i, 375 | Montezuma | (HH)..... | i, 1076* |
| Moneys Cr., Md. | J-522..... | i, 335 | Montezuma Cr., Cal. | TT-74..... | i, 1555 |
| Monhegan Isld. H., Me. | A-156..... | i, 28, 46 | Montezuma Crossing | | |
| Monie B., Md. | J-85..... | i, 331 | (HH): | | |
| Monie Cr., Md. | J-88..... | i, 331 | (See notes, ii, 2832.) | | |
| Moniteau Cr., Mo. | GG-102..... | i, 1025 | Montezuma Slough, Cal. | TT-84..... | i, 1555 |
| GG-1448..... | i, 1036 | | Bridges..... | ii, 2201 | |
| (See notes, ii, 2813, 2823.) | | | Montgomery, Ala., dis- trict. | Q (with map) i, 609, | 611 |
| Monks Cr., Md. | J-970..... | i, 338 | (See notes, ii, 2800.) | | |
| Monomoy Beach, Mass.: | | | Appro. | ii, 2293 | |
| Wrecks..... | ii, 2272 | | Montgomery Branch, Ky. | DD-161..... | i, 960 |
| Monomoy Isld., Mass.: | | | Montgomery Cr., Pa. | J-805..... | i, 337 |
| Wrecks..... | ii, 2272 | | Montgomery, Fort, N. Y. | ii, 1806, 1998 | |
| Monomoy, Mass.: | | | Montpellier | (HH)..... | i, 1076* |
| Wrecks..... | ii, 2272 | | Montreal R., Wis. and Mich. | LL-34..... | i, 1265 |
| Monomoy Pt., Mass.: | | | Montrose | (HH)..... | i, 1077* |
| Wrecks..... | ii, 2272, 2277 | | Montswag B., Me. | A-207..... | i, 28 |
| Monongahela and Alle- gheny Rs. (junction with Ohio R. at Pitts- burgh, Pa.)..... | FF-5..... | i, 1003 | Montswag Cr., Me. | A-208..... | i, 28 |
| Monongahela City, Pa. | FF-6-a..... | i, 1003 | Monumental Rapids | (WW-2)..... | i, 1617* |
| Monongahela R. | (CC)..... | i, 910* | Monument and Black Rs., Mass.: | | |
| Monongahela R., L. and D. No. 6 (purchase of) .. | FF-6-d..... | i, 1006 | Bridges..... | ii, 2201 | |
| Monongahela R., Pa. | FF-6..... | i, 1003 | Monument R., Mass. | C-37..... | i, 107 |
| FF-6-f..... | i, 1006 | | Monuments | ii, 2040, 2070, 2091, 2092, 2093, 2094, 2095, 2096 | |
| Monongahela R., Pa., L. and D. No. 7 (purchase of)..... | FF-6-e..... | i, 1006 | | | |
| Monongahela R., Pa. and W. Va. | FF-6..... | i, 1003 | | | |
| FF-6-b..... | i, 1004 | | | | |
| (See notes, ii, 2812.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Moodna Cr., N. Y. | E-66..... | i, 177 | Moro Isld. | (HH)..... | i, 1077* |
| Bridges..... | | ii, 2201 | Morris and Cumings | | |
| Moon Cr., Mo. | GG-1431..... | i, 1036 | Chan., Tex.: | | |
| (See notes, ii, 2823.) | | | Bridges..... | | ii, 2201 |
| Mooney Swamp, S. C. | N-11..... | i, 499 | Morris Canal, N. Y. | E-72..... | i, 177 |
| Moons B., Md. | J-58..... | i, 331 | Morris Cr., S. Dak. | GG-334..... | i, 1027 |
| Moore's Bayou, La. | S-551..... | i, 686 | Morris Cr., Tex.: | | |
| Moore's Branch, Md. | J-1099..... | i, 339 | (See notes, ii, 2805.) | | |
| Moore's Cr., Colo. and | | | Morris Cr., Va. | K-254..... | i, 375 |
| Wyo. | GG-1079..... | i, 1033 | | L-131..... | i, 412 |
| (See notes, ii, 2820.) | | | Morrison Chan., Mich.: | | |
| Moore's Cr., N. C. | M-139..... | i, 455 | Bridges..... | | ii, 2201 |
| | M-313..... | i, 456 | Morris Prong, Md. | J-95..... | i, 331 |
| Moore's Cr., Va. | K-238..... | i, 375 | Morristown H., N. Y. | RR-70..... | i, 1493, 1535 |
| Moore's H., Me. | A-91..... | i, 27 | Morse and Sprague Rs., | | |
| Moore's Run, Md. | J-1075..... | i, 339 | Me.: | | |
| Moosabec Bar, Me. | A-22-a..... | i, 32 | Bridges..... | | ii, 2201 |
| (See notes, ii, 2783.) | | | Morse Cr., N. J. | G-31..... | i, 247 |
| Appro..... | | ii, 2287 | Harbor lines..... | | ii, 2257 |
| Mooseabec Reach, Me. | A-22..... | i, 27 | Morse R., Me. | A-240..... | i, 29 |
| Wrecks..... | | ii, 2272 | Mortar Batteries (see | | |
| Moose Rapids | (HH)..... | i, 1077* | Fortifications). | | |
| Moose R., Minn. | KK-225..... | i, 1249 | Moser Chan., Fla. | P-190..... | i, 570 |
| Moose R., Wis. | KK-56..... | i, 1247 | Moses Cr., Fla. | P-91..... | i, 569 |
| Morattico Cr., Va. | K-188..... | i, 374, 400 | Moses Cr., W. Va. | EE-5..... | i, 983 |
| Moravian Run, Pa. | J-815..... | i, 337 | Moses Old R., Ga. | O-259..... | i, 535 |
| Moreau Bayou, La. | S-415..... | i, 684 | Moshannon Cr., Pa. | J-817..... | i, 337 |
| | S-557..... | i, 686 | Mosleys Cr., N. C. | M-174..... | i, 455 |
| Moreau R. | (GG-2)..... | i, 1039* | Mosquito Bayou, La. | S-489..... | i, 685 |
| Moreau R., Mo. | GG-1455..... | i, 1036 | Mosquito Br., Minn. | KK-106..... | i, 1243 |
| Moreau R., Mo. and S. | | | Mosquito Cr., Ga. | O-337..... | i, 535 |
| Dak.: | | | | O-432..... | i, 536 |
| (See notes, ii, 2823, 2824.) | | | Mosquito Cr., Iowa. | GG-254..... | i, 1027 |
| Moreau R., S. Dak. | GG-802..... | i, 1031 | (See notes, ii, 2814.) | | |
| Morehead City, N. C. | M-276..... | i, 456 | Mosquito Cr., Kans. | GG-1157..... | i, 1034 |
| Appro..... | | ii, 2292 | | GG-1221..... | i, 1034 |
| Morehead City, N. C. | | | (See notes, ii, 2821.) | | |
| (harbor)..... | M-276-a..... | i, 481 | Mosquito Cr., Md. | J-943..... | i, 338 |
| Morehead City, N. C. | | | Mosquito Cr., Nebr. | GG-1255..... | i, 1034 |
| (sound near)..... | M-276-b..... | i, 481 | Mosquito Cr., Pa. | J-799..... | i, 337 |
| Mores Cr., Ga. | O-27..... | i, 533 | Mosquito Cr., S. C. | N-103..... | i, 499 |
| Morgan Canal, Tex. | U-25..... | i, 735 | | N-243..... | i, 501 |
| Navigation rules..... | | ii, 2041, 2107 | Mosquito Cr., S. C. | | |
| Morgan Canal, Tex. (op- | | | (South Edisto to Ashe- | | |
| erating and are). | U-26-d..... | i, 745 | poo Rs.) | N-243..... | i, 527 |
| Morgan Cr., Md. | J-454..... | i, 334 | Mosquito Cr., S. Dak. | GG-354..... | i, 1027 |
| Morgan Cr., Minn. | KK-161..... | i, 1248 | (See notes, ii, 2815.) | | |
| Morgan Cr., Mont.: | | | Mosquito Cr., Va. | K-173..... | i, 374 |
| (See notes, ii, 2817.) | | | Mosquito H., Me. | A-153..... | i, 28 |
| Morgan, Fort | | ii, 1801, 1970 | Mosquito Inlet, Fla. | P-95..... | i, 569 |
| Morgan Run, Md. | J-1141..... | i, 339 | Mosquito Inlet, Fla. | | |
| Morgans B., Me. | A-65..... | i, 27 | (channel to New Smyr- | | |
| Morgans Cut, Tex.: | | | na) | P-95..... | i, 584 |
| Navigation rules..... | | ii, 2041, 2107 | Mosquito Lagoon, Fla. | P-107..... | i, 570 |
| Morgans H., La. | S-168..... | i, 682 | Moss Cr., Mo. | GG-168..... | i, 1026 |
| Morgans Pass, Fla. | P-211..... | i, 570 | (See notes, ii, 2814.) | | |
| Morgantown, W. Va. | FF-6-a..... | i, 1003 | Moss Lake, La. | S-801..... | i, 688 |
| Morganza Reach | (HH)..... | i, 1077* | Mott, Fort, N. J. | | i, 1903 |
| Moriches B., N. Y. | F-52..... | i, 215 | Mott Haven Canal, N. Y. | E-25..... | i, 177 |
| Mormon Chan., Cal. | UU-37..... | i, 1577 | Moullee Cr., Mich. | PP-120..... | i, 1420 |
| Bridges..... | | ii, 2201 | Moultrie Cr., Fla. | P-90..... | i, 569 |
| Mormon Cr., Mo.: | | | Moultrie, Fort, S. C. | | ii, 1808, 1940 |
| (See notes, ii, 2824.) | | | | | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|---|---------------------|-------------------|
| Mound City | (CC)..... | i, 910* | Mud Cr., Tenn | AA-179..... | i, 849 |
| | (HH)..... | i, 1077* | Muddy Cr., Kans | GG-1229..... | i, 1034 |
| | J-969..... | i, 338 | (See notes, ii, 2821.) | | |
| Mountain Branch, Md ... | | | Muddy Cr., Ky | DD-18..... | i, 959 |
| Mountain Cr., Kans.: | | | Muddy Cr., Md | J-60..... | i, 331 |
| (See notes, ii, 2821.) | | | | J-311..... | i, 333 |
| Mountain Cr., Nebr | GG-1260..... | i, 1035 | | J-416..... | i, 334 |
| Mountain Cr., Pa | J-906..... | i, 337 | | J-1268..... | i, 340 |
| Mountain Cr., S. C | N-47..... | i, 499 | Muddy Cr., Md. and Pa. | J-1017..... | i, 338 |
| Mountain Cr., Tenn | AA-186..... | i, 849 | Muddy Cr., Mass | B-213..... | i, 70 |
| Mountainview Slough, | | | Muddy Cr., Mo | GG-186..... | i, 1026 |
| Cal..... | TT-32..... | i, 1555 | | GG-1467..... | i, 1036 |
| Mount Carmel, Ill | BB-23..... | i, 898 | | GG-1487..... | i, 1036 |
| Mount Cr., Va | K-210..... | i, 374 | (See notes, ii, 2813, 2814, 2823, 2824.) | | |
| Mount Desert Narrows, | | | Muddy Cr., Mont | GG-492..... | i, 1029 |
| Me..... | A-51..... | i, 27 | | GG-710..... | i, 1030 |
| Bridges..... | | ii, 2201 | (See notes, ii, 2816.) | | |
| Mount Desert to Porcu- | | | Muddy Cr., Nebr | GG-1136..... | i, 1034 |
| pine Isld., Me. (break- | | | | GG-1142..... | i, 1034 |
| water) | A-52..... | i, 35 | | GG-1303..... | i, 1035 |
| Mount Eden Slough, | | | (See notes, ii, 2821, 2822.) | | |
| Cal..... | TT-53..... | i, 1555 | Muddy Cr., N. C | M-112..... | i, 455 |
| Mount Hope B., Mass ... | C-68..... | i, 107 | | M-297..... | i, 456 |
| | C-70..... | i, 107, 124 | Muddy Cr., N. Dak | GG-408..... | i, 1028 |
| Harbor lines..... | | ii, 2257 | Muddy Cr., Pa | J-570..... | i, 335 |
| Mount Landing Cr., Va ... | K-217..... | i, 374 | | J-920..... | i, 338 |
| Mount Pleasant, and Sul- | | | Muddy Cr., S. C | N-72..... | i, 499 |
| livans Isld., S. C.: | | | Muddy Cr., Tenn | AA-119..... | i, 849 |
| Bridges..... | | ii, 2201 | | AA-153..... | i, 849 |
| Mount Rainier National | | | Muddy Cr., Va | K-205..... | i, 374 |
| Park | | ii, 2041, 2118 | | L-55..... | i, 411 |
| Mount Sheep Rapids | (WW-2)..... | i, 1617* | | L-236..... | i, 413 |
| Mount Sinai H., N. Y | F-24..... | i, 215, 222 | Muddy Cr., W. Va | EE-113..... | i, 984 |
| Mount Vernon | (HH)..... | i, 1077* | Muddy Cr., Wyo | GG-687..... | i, 1030 |
| Mount Vernon Chan., | | | | GG-1001..... | i, 1032 |
| Potomac R., Md..... | K-46-f..... | i, 380 | | GG-1012..... | i, 1033 |
| Mount Vernon, Ind | (CC)..... | i, 910* | | GG-1055..... | i, 1033 |
| Mount Vernon to Aque- | | | (See notes, ii, 2817, 2820.) | | |
| duct Br., D. C.: | | | Muddy Fork, Ohio | DD-408..... | i, 962 |
| Road..... | | ii, 2040, 2075 | Muddy Gut, Md | J-1068..... | i, 339 |
| Moury Slough, Cal | TT-41..... | i, 1555 | Muddy R. | (HH)..... | i, 1077* |
| Mousam R., Me | A-276..... | i, 29 | Muddy R., Me | A-232..... | i, 29 |
| Mouse H., N. C | M-124..... | i, 455 | Muddy Run, Pa | J-565..... | i, 335 |
| Morahala Cr., Ohio | DD-430..... | i, 962 | | J-717..... | i, 336 |
| Mud Branch, Mo | GG-147..... | i, 1026 | Mud Fork, W. Va | EE-17..... | i, 983 |
| Mud Cr., Ala | AA-195..... | i, 849 | Mud Lake | (HH)..... | i, 1077* |
| Mud Cr., Iowa | GG-285..... | i, 1027 | Mud Lake Chan., Mich ... | PP-21..... | i, 1419 |
| (See notes, ii, 2814.) | | | Mud Lake, La | S-684..... | i, 687 |
| Mud Cr., Kans | GG-1201..... | i, 1034 | | S-746..... | i, 687 |
| | GG-1217..... | i, 1034 | | S-862..... | i, 688 |
| | GG-1354..... | i, 1035 | (See notes, ii, 2804.) | | |
| (See notes, ii, 2821, 2823.) | | | Mud Lake, Mo. (outlet) .. | GG-232..... | i, 1026 |
| Mud Cr., Ky | DD-246..... | i, 961 | (See notes, ii, 2814.) | | |
| Mud Cr., Md | J-324..... | i, 333 | Mud Lick, Ky | DD-232..... | i, 961 |
| | K-32..... | i, 373 | Mud R., Ga | O-203..... | i, 534 |
| Mud Cr., Mass | B-55..... | i, 69 | | O-457..... | i, 536 |
| Mud Cr., Mont | GG-433..... | i, 1028 | Mud R., Ky.: | | |
| (See notes, ii, 2815.) | | | Bridges..... | | ii, 2201 |
| Mud Cr., Nebr | GG-975..... | i, 1032 | Mud R., Minn | KK-80..... | i, 1247 |
| (See notes, ii, 2820.) | | | Mud R., S. C | O-5..... | i, 533 |
| Mud Cr., N. C | L-311..... | i, 413 | Mud R., W. Va | EE-49..... | i, 983 |
| Mud Cr., S. Dak | GG-313..... | i, 1027 | | | |
| (See notes, ii, 2815.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page |
|---|---------------------|-------------------|---|----------------------|------------------|
| Mud R., W. Va., Left Fork..... | EE-52..... | i, 983 | Muscle Shoals Canal- Tennessee R., Tenn. (operating and care).... | AA-18-g..... | i, 887 |
| Mud R., W. Va., Middle Fork..... | EE-54..... | i, 983 | Muscongus B., Me..... | A-157..... | i, 28 |
| Mud R., W. Va., Trace Fork..... | EE-55..... | i, 983 | Muscongus H., Me..... | A-174..... | i, 28 |
| Mud Run, Pa..... | J-912..... | i, 338 | Muscongus Sound, Me..... | A-173..... | i, 28 |
| Mud Slough, Cal..... | TT-39..... | i, 1555 | Musies Ferry..... | (GG-2)..... | i, 1039* |
| | TT-80..... | i, 1555 | Muskeget Chan., Mass.: Wrecks..... | | ii, 2272 |
| Mulberry Cr., Ark..... | Y-7..... | i, 818 | Muskegon H., Mich..... | OO-35..... | i, 1377, 1395 |
| Mulberry Cr., Kans..... | GG-1379..... | i, 1035 | Appro..... | | ii, 2298 |
| (See notes, ii, 2822, 2823.) | | | Bridges..... | | ii, 2202 |
| Mulberry Cr., Mo..... | GG-1473..... | i, 1036 | Navigation rules..... | ii, 2041, 2107 | |
| (See notes, ii, 2824.) | | | Muskegon Lake, Mich.: Bridges..... | ii, 2201 | |
| Mulberry Cr., N. C..... | M-217..... | i, 455 | Muskegon R., Mich..... | OO-36..... | i, 1377, 1397 |
| Mulberry Cr., Tenn..... | AA-97..... | i, 849 | Bridges..... | ii, 2201 | |
| Mulberry Cr., Va..... | K-186..... | i, 374 | Muskingum R..... | (CC)..... | i, 910* |
| Mulberry Fork, Ala., Black Warrior..... | R-31..... | i, 646 | Muskingum R. Canal, Ohio: Bridges..... | ii, 2202 | |
| Mulberry Fork, Ga..... | O-291..... | i, 535 | Muskingum R. (mouth), Marietta, Ohio..... | DD-439..... | i, 962 |
| Mulchatna R., Alaska..... | XX-164..... | i, 1656 | Muskingum R., Ohio..... | DD-341..... | i, 961, 974 |
| Mule Cr., Wyo..... | GG-1054..... | i, 1033 | | DD-341-a..... | 974 |
| Mules Cr., Ga..... | O-518..... | i, 537 | Appro..... | ii, 2296 | |
| Mullet Cr., Fla..... | P-114..... | i, 570 | Bridges..... | ii, 2201, 2202, 2210 | |
| Mullet Lake, Mich..... | PP-33..... | i, 1419 | Harbor lines..... | ii, 2257 | |
| Mullea B., N. J..... | I-14..... | i, 299 | Navigation rules..... | ii, 2041, 2107 | |
| Muncas Cr., Mo..... | GG-127..... | i, 1026 | Muskingum R., Ohio, Ls. and Ds. (operating and care)..... | DD-341-b..... | i, 976 |
| (See notes, ii, 2813.) | | | Muskrat Cr., Wyo..... | GG-997..... | i, 1032 |
| Muncie Cr., Kans.: (See notes, ii, 2821.) | | | Musselshell R..... | (GG-2)..... | i, 1039* |
| Muncy Cr., Pa..... | J-721..... | i, 336 | Musselshell R., Mont..... | GG-569..... | i, 1029 |
| Mundys Landing..... | (HH)..... | i, 1077* | | (GG-2)..... | i, 1037* |
| Municipalities, appro- priations by: Improvement, waterway..... | | ii, 2041, 2109 | (See notes, ii, 2816.) | | |
| Munising H., Mich..... | LL-57..... | i, 1293 | Mustapha Isld..... | (CC)..... | i, 910* |
| (See notes, ii, 2835.) | | | Muster Cr., Mont..... | GG-639..... | i, 1030 |
| Munising, Mich..... | LL-57..... | i, 1265 | (See notes, ii, 2817.) | | |
| Munsey Cr., Kans..... | GG-1179..... | i, 1034 | Muster Ground Cr., La..... | R-98-c..... | i, 647 |
| Munuscong R., Mich..... | PP-19..... | i, 1419 | Mu-ye-ro Cr., Wyo..... | GG-685..... | i, 1030 |
| Murderers Cr., N. Y..... | E-59..... | i, 177 | Myakka R., Fla.: Bridges..... | ii, 2202 | |
| Bridges..... | | ii, 2201 | Myer Cr., Va..... | K-181..... | i, 374 |
| Murderkill R., Del..... | I-69..... | i, 299, 321 | Myers Branch, Mo..... | GG-50..... | i, 1025 |
| Appro..... | | ii, 2290 | My Ladys Manor Branch, Md..... | J-1006..... | i, 338 |
| Murfordville, Ky..... | BB-7..... | i, 892 | Myrick..... | (GG-2)..... | i, 1039* |
| Murphy Run, Md..... | J-1022..... | i, 338 | Myrtle Bayou, La..... | S-661..... | i, 686 |
| Murray Bend..... | (GG-2)..... | i, 1039* | Myrtle Pt. to Coquille City, Coquille R., Oreg..... | VV-12-b..... | i, 1598 |
| Murrays Bend, Missouri II: (See notes, ii, 2824, 2825.) | | | Mystic R., Conn..... | D-5..... | i, 141, 145 |
| Muscatine..... | (HH)..... | i, 1077* | (See notes, ii, 2788.) | | |
| Muscatine, Iowa: Harbor lines..... | | ii, 2257 | Appro..... | ii, 2289 | |
| Muscle Cr., Mo..... | GG-130..... | i, 1026 | Bridges..... | ii, 2202 | |
| Muscle Ridge Chan., Me..... | A-147..... | i, 28 | Mystic R., Mass..... | B-119..... | i, 70, 90, 91 |
| Muscle Shoals..... | (CC)..... | i, 910* | | B-122..... | i, 70 |
| Muscle Shoals Canal, Ala..... | AA-18..... | i, 855 | (See notes, ii, 2785.) | | |
| (See notes, ii, 2809.) | | | Appro..... | ii, 2288 | |
| Navigation rules..... | | ii, 2041, 2107 | Bridges..... | ii, 2202 | |
| Muscle Shoals Canal, Ala. (lower, head of)..... | AA-210..... | i, 850 | Dams, private..... | ii, 2250 | |
| | | | Harbor lines..... | ii, 2257 | |

N.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|---------------------------------------|---------------------|-------------------|
| Nabbs Cr., Md. | J-1188..... | i, 339 | Napa B., Cal. | TT-106..... | i, 1556, 1566 |
| Nadina R., Alaska. | XX-139..... | i, 1656 | Appro. | | ii, 2300 |
| Nags Head, N. C. | L-219-b..... | i, 440 | Bridges..... | | ii, 2203 |
| | M-22-a..... | i, 459 | Harbor lines..... | | ii, 2257 |
| Naguabo R., P. R. | YY-6..... | i, 1685 | Wrecks..... | | ii, 2272 |
| Naked Cr., S. C. | N-44..... | i, 499 | Napa Slough, Cal. | TT-116..... | i, 1556 |
| Namacagon R., Wis. | KK-54..... | i, 1247 | Napeague R., N. Y. | F-43..... | i, 215 |
| Namekan Lake, Minn. | | | Napoleon. | (GG-2)..... | i, 1039* |
| and Canada..... | KK-224..... | i, 1249 | Napoopoo H., Hawaii. | YY-82..... | i, 1686 |
| Namekan R., Minn. | KK-226..... | i, 1249 | Narragansett B. Chan., | | |
| Namskaket Cr., Mass. | B-196..... | i, 70 | R. I..... | C-87..... | i, 107, 130 |
| Nandua Cr., Va. | L-76..... | i, 411, 415 | Narragansett B., mouth | | |
| Appro..... | | ii, 2291 | of Narrow R., R. I..... | C-99..... | i, 132 |
| Nanjemoy Cr., Md. | K-77..... | i, 373 | Narragansett B., R. I. | C-78..... | i, 107 |
| Nannacatucket R., R. I. | C-95..... | i, 108 | | C-79..... | i, 107 |
| Nanneys Cr., Va. | L-237..... | i, 413 | | C-99..... | i, 108 |
| (See notes, ii, 2795.) | | | | C-81..... | i, 125 |
| Nansemond R., Va. | L-165..... | i, 412, 428 | (See notes, ii, 2787.) | | |
| (See notes, ii, 2796.) | | | Bridges..... | | ii, 2203 |
| Appro..... | | ii, 2291 | Forts..... | | ii, 1823, 1866 |
| Bridges..... | | ii, 2203 | Wrecks..... | | ii, 2272 |
| Navigation rules..... | | ii, 2041, 2107 | Narragansett B., R. I. | | |
| Wrecks..... | | ii, 2272 | (Ohio Reef in east pas- | | |
| Nantahala R., N. C. | AA-101..... | i, 849 | sage of)..... | C-79..... | i, 125 |
| Nanticoke Cr., N. Y. | J-657..... | i, 336 | Narragansett Pier, R. I. | C-100..... | i, 108, 132 |
| Nanticoke R., Del. and | | | Narraguagus B., Me. | A-29..... | i, 27 |
| Md..... | J-109..... | i, 346 | Wrecks..... | | ii, 2272 |
| Appro..... | | ii, 2291 | Narraguagus R., Me. | A-30..... | i, 27, 33 |
| Bridges..... | | ii, 2203 | Appro..... | | ii, 2287 |
| Nanticoke R., Md. | J-109..... | i, 331 | Bridges..... | | ii, 2203 |
| Nantucket H., Mass. | C-31..... | i, 107, 114 | Narrow B., N. Y.: | | |
| (See notes, ii, 2786.) | | | Bridges..... | | ii, 2203 |
| Appro..... | | ii, 2288 | Narrow R., R. I. | C-99..... | i, 108, 132 |
| Wrecks..... | | ii, 2272 | Narrows, Lake Cham- | | |
| Nantucket Isld., Mass.: | | | plain, N. Y. and Vt..... | E-105..... | i, 206 |
| Wrecks..... | | ii, 2272 | Narrows (The), Fla. | P-324..... | i, 571 |
| Nantucket Light, Mass.: | | | | Q-37..... | i, 611 |
| Wrecks..... | | ii, 2272 | Narrows (The), Md. | J-486..... | i, 334 |
| Nantucket, Mass. (bar at | | | Narrows (The), N. Y. and | | |
| entrance to harbor)..... | C-32..... | i, 107, 116 | Vt..... | E-105..... | i, 178 |
| Nantucket, Mass. (break- | | | Nasawaddox Cr., Va. | L-70..... | i, 411 |
| water at Great Pt.)..... | C-33..... | i, 107, 116 | Nasel R., Wash. | XX-3..... | i, 1655, 1657 |
| Nantucket Shoals, Mass.: | | | Appro..... | | ii, 2301 |
| Wrecks..... | | ii, 2272 | Bridges..... | | ii, 2203 |
| Nantucket Sound, Mass. | C-1..... | i, 107 | Nash, Gen. Francis: | | |
| | C-2..... | i, 107, 108 | Monument..... | | ii, 2040, 2091 |
| | C-3..... | i, 107, 108 | Nashua R., N. H. and | | |
| (See notes, ii, 2786.) | | | Mass..... | B-40..... | i, 69 |
| Appro..... | | ii, 2288 | Nashville | (HH)..... | i, 1077* |
| Wrecks..... | | ii, 2272 | Nashville (above), Cum- | | |
| Nantuxent Cr., N. J. | I-35..... | i, 299 | berland R..... | AA-239-d..... | i, 882 |
| Napa No. 1 Slough, Cal. | TT-112..... | i, 1556 | Nashville (below), Cum- | | |
| Napa No. 2 Slough, Cal. | TT-113..... | i, 1556 | berland R..... | AA-239-c..... | i, 880 |
| | | | Nashville, Tenn. | AA-239..... | i, 878 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|----------------------|---|---------------------|-------------------|
| Nashville, Tenn., district.. | AA | i, 843, 848 | Neabsico Cr., Va. | K-103 | i, 374 |
| (See notes, ii, 2809.) | | | Neacoxie R., Oreg. | VV-75 | i, 1593 |
| Naskeag H., Me. | A-77 | i, 27 | Neah B., Wash. | XX-39-b | i, 1663 |
| Nasketucket B., Mass. | C-51 | i, 107 | Neals Sound, Md. | K-71 | i, 373 |
| Nasketucket R., Mass. | C-52 | i, 107 | Nearman Bend. | (GG-2) | i, 1039* |
| Nassau R., Fla. | P-6 | i, 569 | Nebraska City. | (GG-2) | i, 1039* |
| | P-10-a | i, 576 | Nebraska City, Nebr. | (GG-2) | i, 1037* |
| Bridges. | | ii, 2203 | Nebraska City Reach. | (GG-2) | i, 1039* |
| Nassau Sound, Fla. | P-5 | i, 569 | Nebraska Shore. | (GG-2) | i, 1039* |
| Nassawaddox Cr., Va. | L-70 | i, 415 | Necanicum R., Oreg. | VV-73 | i, 1593 |
| Nassawaddox R., Va. | L-70 | i, 415 | Neches and Sabine Ca- nal, Tex. | T-7 | i, 717 |
| Nassawango Cr., Md. | J-29 | i, 331 | (See notes, ii, 2805, 2806.) | | |
| Natalbany R., La. | S-52 | i, 681, 692 | Neches and Sabine Rs., Tex. (mouths of), to Port Arthur Canal (channel from). | T-3-a | i, 717 |
| Natches R., Wash. | XX-121 | i, 1656 | Neches R., Tex. | T-6 | i, 717 |
| Natchez. | (HH) | i, 1077* | (See notes, ii, 2806.) | | |
| Natchez - Sabine Canal, Tex.: | | | Appro. | ii, 2294 | |
| Navigation rules. | | ii, 2041, 2107 | Bridges. | ii, 2204 | |
| National Academy of Sciences: | | | Neches R., Tex. (includ- ing survey of Angelina R., Tex.). | T-6 | i, 721 |
| Surveys. | | ii, 2041, 2120 | Neches R. to Beaumont, Tex. | T-3-b | i, 719 |
| National Defense: | | | Neches-Sabine Canal, in- cluding Sabine R. to Orange and Neches R. to Beaumont, Tex. | T-3-b | i, 719 |
| Appro. | | ii, 1809, 1810 | Neebish Chan., Mich. | PP-12 | i, 1419 |
| National Parks. | | ii, 2040, 2097 | | PP-3-b | i, 1427 |
| National Waterways Commission: | | | Wrecks. | ii, 2272 | |
| Appro. | | ii, 2286 | Neely Landing. | (HH) | i, 1077* |
| Nation R., Alaska. | XX-208 | i, 1656 | Nesenkeag Brook, N. H. | B-19 | i, 69 |
| Natrona, Pa.: | | | Neglistcook Cr., Wash. | WW-58 | i, 1615 |
| Harbor lines. | | ii, 2257 | Nehalem B., Bar, and R., Oreg. | VV-69 | i, 1610 |
| Nats Cr., Ky. | DD-289 | i, 961 | Appro. | ii, 2300 | |
| Natty Pt. Cove, Va. | K-147 | i, 374 | Nehalem R., Oreg.: | | |
| Naugatuck R., Conn. | D-65 | i, 141 | Bridges. | ii, 2204 | |
| Nauset H., Mass. | B-209 | i, 70 | Nellghs. | (GG-2) | i, 1039* |
| Wrecks. | | ii, 2272 | Nelson Branch, Md. | J-988 | i, 338 |
| Naushon Isld., Mass. | C-24 | i, 107, 112 | Nelson Isld. Cr., Mass. | B-56 | i, 69 |
| Wrecks. | | ii, 2272 | Nelsons B., N. C. | M-234 | i, 456 |
| Nauvoo. | (HH) | i, 1077* | Nemadji R., Wis. | LL-23 | i, 1265, 1280 |
| Navarro R., Cal. | TT-142 | i, 1556, 1569 | | LL-23-b | i, 1281 |
| Navasota R., Tex. | U-41 | i, 735 | Bridges. | ii, 2204 | |
| Navesink, N. Y.: | | | Nemah R., Wash. | XX-5 | i, 1655 |
| Harbor lines. | | ii, 2257 | Nenena R., Alaska. | XX-198 | i, 1656 |
| Navesink R., N. J. | G-49 | i, 247 | Neosho R., Kans. | Y-9 | i, 825 |
| Navidad R., Tex. | U-57 | i, 735 | Neosho R., Okla. | Y-2-c | i, 820 |
| Navigable Waters (see Logs, Dams): | | | Neosho R., Okla. and Kans. | Y-9 | i, 818 |
| Bridges. | | ii, 2041, 2105 | Neponset R., Mass. | B-134 | i, 70 |
| Rules and regulations. | | ii, 2041, 2107 | | B-134 | i, 92 |
| Structures in. | | ii, 2041, 2105, 2115 | (See notes, ii, 2785.) | | |
| Navigation, International Congresses of. | | ii, 2041, 2110, 2283 | Appro. | ii, 2288 | |
| Navy, Secretary of: | | | Bridges. | ii, 2204 | |
| Pearl Harbor. | | ii, 2282 | Nepperhan R., N. Y. | E-29 | i, 177 |
| Navy Yard Slough, Cal. | TT-114 | i, 1556 | Nequally Cr., Wash. | WW-57 | i, 1615 |
| Nawiliwila Landing, Ha- waii. | YY-32 | i, 1685 | Nescopeck Cr., Pa. | J-261 | i, 335 |
| Nawiliwili B., H. I.: | | | Neshaminy Cr., Pa. | H-15 | i, 271 |
| (See notes, ii, 2846.) | | | Bridges. | ii, 2204 | |
| Nawneys Cr., Va.: | | | | | |
| (See notes, ii, 2795.) | | | | | |
| Neabsco Cr., Va. | K-103 | i, 392 | | | |
| (See notes, ii, 2795.) | | | | | |
| Appro. | | ii, 2291 | | | |
| Bridges. | | ii, 2204 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------|---|---------------------|----------------------|
| Nesplem Canyon..... | (WW-2)..... | i, 1617* | Newbern, N. C. (Wilmington, N. C., district) (dredge for Neuse R. and adjacent waters)... | M-a..... | i, 457 |
| Nesplem R..... | (WW-2)..... | i, 1617* | Newberry Isld..... | (CC)..... | i, 910* |
| Nesplem R., Wash..... | XX-115..... | i, 1656 | New Boston..... | (HH)..... | i, 1077* |
| Nestucca B., Oreg..... | VV-57..... | i, 1593 | New Brunswick: | | |
| Nestucca R., Oreg..... | VV-58..... | i, 1593, 1608 | Harbor lines..... | | ii, 2257 |
| Appro..... | | ii, 2300 | New Buffalo H., Mich..... | NN-25..... | i, 1349, 1372 |
| Netarts B., Oreg..... | VV-60..... | i, 1593 | Appro..... | | ii, 2298 |
| Nettles Cr., Va..... | L-120..... | i, 412 | Newburyport H., Mass..... | B-2..... | i, 69, 71 |
| Neuse R., N. C..... | L-173-i..... | i, 434 | (See notes, ii, 2784.) | | |
| | M-144..... | i, 455, 465 | Appro..... | | ii, 2288 |
| Appro..... | | ii, 2292 | Wrecks..... | | ii, 2272 |
| Bridges..... | | ii, 2204 | New Castle H., Delaware | | |
| Harbor lines..... | | ii, 2257 | R..... | H-3-i..... | i, 282 |
| Neuse R., N. C., and ad- jacent rivers (dredge for)..... | M-a..... | i, 457 | Harbor lines..... | | ii, 2257 |
| Neuse R., N. C. thoroughfare from Cedar Isld. B..... | M-231-a..... | i, 472 | Newcomb Cr., Md..... | J-371..... | i, 333 |
| Neversink R., N. Y., N. J., and Pa. R..... | H-3-q..... | i, 287 | New Cut, Fla..... | P-155..... | i, 570 |
| Neville Isld..... | (CC)..... | i, 910* | Newells Cr., Ga..... | O-166..... | i, 534 |
| Nevills Cr., Ga..... | O-142..... | i, 534 | New Fort Preble, Me..... | | ii, 1841 |
| Nevils Cr., N. C..... | M-98..... | i, 455 | New Found H., Fla..... | P-116..... | i, 570 |
| New Albany, Ind..... | (CC)..... | i, 910* | Newfound R., N. H..... | B-30..... | i, 69 |
| New Amsterdam, Ind..... | (CC)..... | i, 910* | New Frankford..... | (G-G-2)..... | i, 1039* |
| Newark B., N. J. and N. Y..... | G-4..... | i, 247 | New Hampshire: | | |
| (See notes, ii, 2793.) | | | Forts..... | | ii, 1796, 1805, 1816 |
| Appro..... | | ii, 2290 | Negros Isld., P. I..... | YY-126..... | i, 1686 |
| Bridges..... | | ii, 2204 | New H., Me..... | A-177..... | i, 28, 46 |
| Harbor lines..... | | ii, 2257 | Appro..... | | ii, 2287 |
| Wrecks..... | | ii, 2272 | New Haven, Conn.: | | |
| Newark, N. J. (above)..... | G-16-a..... | i, 248 | (See notes, ii, 2790.) | | |
| | G-16-b..... | i, 249 | Appro..... | | ii, 2289 |
| Newark, N. J. (below)..... | G-16-c..... | i, 250 | Bridges..... | | ii, 2204 |
| Newark Slough, Cal..... | TT-43..... | i, 1555 | Forts..... | | ii, 1874 |
| Bridges..... | | ii, 2204 | Harbor lines..... | | ii, 2257 |
| New Astoria, Oreg.: | | | Wrecks..... | | ii, 2272 |
| Harbor lines..... | | ii, 2257 | New Haven, Conn. (break- water)..... | D-57..... | i, 141, 159 |
| New Baltimore to Cox- sackie, N. Y..... | E-28-e..... | i, 196 | Appro..... | | ii, 2289 |
| New Baltimore, N. Y.: | | | New Haven H., Conn..... | D-56..... | i, 141, 156 |
| Harbor lines..... | | ii, 2257 | | D-56-a..... | i, 156 |
| New Barney Cut..... | (HH)..... | i, 1077* | | D-56-c..... | i, 158 |
| New Basin Canal, La..... | S-133..... | i, 682 | New Iberia, La.: | | |
| New Bedford..... | (HH)..... | i, 1077* | (See notes, ii, 2804.) | | |
| New Bedford Bend (HH): | | | New Iberia Southern | | |
| (See notes, ii, 2832.) | | | Drainage Canal, La..... | S-706..... | i, 687 |
| New Bedford H., Mass..... | C-53..... | i, 107, 117 | New Inlet, N. J..... | I-11..... | i, 299 |
| (See notes, ii, 2786.) | | | (See notes, ii, 2794.) | | |
| Appro..... | | ii, 2288 | New Inlet, Va..... | L-46..... | i, 411 |
| Forts..... | | ii, 1805, 1823, 1866 | New Jersey: | | |
| Harbor lines..... | | ii, 2257 | Forts..... | | ii, 1806, 1816 |
| Newbegun Cr., N. C..... | L-278..... | i, 413 | New Jersey and Staten Isld. (channel between)..... | G-27..... | i, 253 |
| Newbern and Beaufort, N. C., waterway..... | M-271..... | i, 456 | | G-27-c..... | i, 255 |
| | M-257-f..... | i, 477 | Harbor lines..... | | ii, 2257 |
| | M-196..... | i, 455 | New Jersey Inland Wa- terways: | | |
| (See notes, ii, 2797.) | | | Wrecks..... | | ii, 2289 |
| Appro..... | | ii, 2292 | New Liberty, Ill..... | (CC)..... | i, 910* |
| Newbern, N. C.: | | | New London, Conn.: | | |
| (See notes, ii, 2797.) | | | (See notes, ii, 2789.) | | |
| Harbor lines..... | | ii, 2257 | Appro..... | | ii, 2287, 2289 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| New London, Conn.—Con. | | | Newport News, Va. (chan- nel to) | L-173-f..... | i, 433 |
| Forts..... | | ii, 1874 | Newport, R. I., district | C-(with map)..... | i, 105 |
| Harbor lines..... | | ii, 2257 | (See notes, ii, 2786.) | | |
| New London, Conn., dis- trict | D (with map)..... | i, 139 | Appro..... | | ii, 2288 |
| (See notes, ii, 2788.) | | | Newport R. | M-257-f..... | i, 477 |
| Appro..... | | ii, 2289 | Newport R., N. C. | M-282..... | i, 456 |
| New London H., Conn. | D-7..... | i, 141, 145 | Appro..... | | ii, 2292 |
| | D-9..... | i, 146 | Bridges..... | | ii, 2205 |
| New Madrid | (HH)..... | i, 1077* | Newport R. to Core Sound, N. C. | M-226-b..... | i, 471 |
| (See notes, ii, 2828, 2832.) | | | Newport, Wash. | (WW-2)..... | i, 1617* |
| New Madrid Bend (HH): | | | New Richmond | (CC)..... | i, 910* |
| (See notes, ii, 2832.) | | | New R., Fla. | P-152..... | i, 570, 587 |
| Newman Cr., Ohio | DD-388..... | i, 962 | | Q-19..... | i, 611 |
| Newmarket Cr., Va. | L-97..... | i, 412 | Bridges..... | | ii, 2205 |
| New Marsh Chan., Va. | L-42..... | i, 411 | New R. Inlet, Fla. | P-151..... | i, 570 |
| New Meadows R., Me. | A-245..... | i, 29, 52 | New R., La. | S-116..... | i, 682 |
| Bridges..... | | ii, 2204 | New R., N. C. | M-290..... | i, 456, 483 |
| New Mexico: | | | (See notes, ii, 2797.) | | |
| Field service..... | | ii, 2039, 2049 | Appro..... | | ii, 2292 |
| New Mill Cr., Va. | L-183..... | i, 412 | New R. to Swansboro, N. C.: | | |
| Bridges..... | | ii, 2204 | (See notes, ii, 2797.) | | |
| New Orleans | (HH)..... | i, 1077* | Newark B., N. J.: | | |
| (See notes, ii, 2830, 2832.) | | | (See notes, ii, 2793.) | | |
| Appro..... | | ii, 2287 | New R. to Beaufort H., N. C. (waterway) | M-257-e..... | i, 476 |
| Forts..... | | ii, 1796, 1976 | New R. to Swansboro, N. C. (waterway) | M-286..... | i, 456, 482 |
| Monuments..... | | ii, 2040, 2094 | New R., Va. and W. Va. | EE-77..... | i, 983, 994 |
| Navigation rules..... | | ii, 2041, 2107 | (See notes, ii, 2811.) | | |
| Wrecks..... | | ii, 2272 | Appro..... | | ii, 2296 |
| New Orleans, La., district. | S (with map)..... | i, 679, 681, 777 | New Rochelle H., N. Y. | E-13..... | i, 177, 182 |
| (See notes, ii, 2804.) | | | | E-11-a..... | i, 182 |
| Appro..... | | ii, 2294 | Appro..... | | ii, 2289 |
| New Orleans, La., district (4th Mississippi R. Comm.) | V..... | i, 779 | New Smyrna (channel to), Mosquito Inlet, Fla. | P-95..... | i, 584 |
| New Orleans to Grand Pass (Barataria B., La.) | S-339..... | i, 698 | New Tea Kettle Cr., Ga. | O-209..... | i, 534 |
| New Pass, Fla. | P-283..... | i, 571 | NEWTON, BRIG. GEN. JOHN, Chief of En- gineers: | | |
| Newport | (HH)..... | i, 1077* | Defenses, U. S..... | | ii, 1823 |
| Newport B., Cal. | SS-13..... | i, 1543 | Newton Cr., N. J. | I-50..... | i, 299, 312 |
| Bridges..... | | ii, 2204 | Newtons Cr., Va. | L-191..... | i, 412 |
| Newport Cr., Md. | J-81-a..... | i, 345 | Newtown Cr., N. Y. | F-109..... | i, 216, 242 |
| | K-68..... | i, 373 | | J-662..... | i, 336 |
| Newport Cr., Va. | I-84..... | i, 299 | Appro..... | | ii, 2289 |
| Newport H., Cal. | SS-13..... | i, 1546 | Bridges..... | | ii, 2205 |
| (See notes, ii, 2839.) | | | Harbor lines..... | | ii, 2257 |
| Newport H., R. I. | C-67..... | i, 107, 121 | Wrecks..... | | ii, 2272 |
| (See notes, ii, 2786, 2787.) | | | New Whatcom H., Wash. | XX-103..... | i, 1675 |
| Appro..... | | ii, 2287, 2288 | Appro..... | | ii, 2301 |
| Bridges..... | | ii, 2205 | Harbor lines..... | | ii, 2257 |
| Forts..... | | ii, 1866 | New Whitehall Cr., Md. | J-261..... | i, 333 |
| Harbor lines..... | | ii, 2257 | New York B., N. Y. and N. J. | G-2..... | i, 247 |
| Wrecks..... | | ii, 2272 | Harbor lines..... | | ii, 2257 |
| Newport H., R. I. (Split) | C-65..... | i, 107 | New York City to Great Lakes | RR-19-c..... | i, 1512 |
| Newport H., R. I. (Split at south end of Island) | C-65..... | i, 121 | Appro..... | | ii, 2299 |
| Newport, Ky. | (CC)..... | i, 910* | New York Hs., Lake On- tario | RR-40-b..... | i, 1520 |
| Newport News Cr., Va. | L-104..... | i, 412 | Appro..... | | ii, 2299 |
| | L-104-a..... | i, 419 | | | |
| Newport News H., Va. | L-104..... | i, 412 | | | |
| | L-104-b..... | i, 419 | | | |
| Harbor lines..... | | ii, 2257 | | | |
| Wrecks..... | | ii, 2272 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|----------------------------|-------------------|--------------------------------------|---------------------|-------------------|
| New York H., N. Y. and | | | Niagara R., N. Y., Port | | |
| N. J. (see East R., Hud- | | | Day | RR-15-d..... | i, 1511 |
| son R.) | E-17..... | i, 177 | Niagara R., N. Y., Tona- | | |
| | E-28..... | i, 177 | wanda to Gill Cr. | RR-15-c..... | i, 1511 |
| | F-105..... | i, 216 | Niagara R., N. Y., Tona- | | |
| | F-105..... | i, 233 | wanda to Port Day | RR-15-b..... | i, 1510 |
| | G-2..... | i, 247 | Niagara R., Youngstown | | |
| Appro. | ii, 2287, 2289 | | to Lake Ontario | RR-15-e..... | i, 1511 |
| Dumpage, regulation; | | | Niangua R., Mo. | GG-1508..... | i, 1036 |
| appro. | ii, 2286 | | (See notes, ii, 2824.) | | |
| Depot, Engineer | ii, 2039, 2045 | | Niantic R., Conn. | D-20..... | i, 141, 148 |
| Forts | ii, 1796, 1806, 1823, 1881 | | (See notes, ii, 2789.) | | |
| Governors Isld. enlarge- | | | Bridges | ii, 2205 | |
| ment | ii, 2041, 2134 | | Niearagua Canal Reports: | | |
| Harbor lines | ii, 2255, | | | ii, 2357 | |
| | 2257-2258, 2260, 2261 | | Nichols Cr., Tex.: | | |
| Harbor supervision | ii, 2041, 2111 | | (See notes, ii, 2806.) | | |
| Navigation rules | ii, 2041, 2107 | | Nickajack Cr., Tenn. and | | |
| Wrecks | ii, 2272 | | Ga. | AA-60..... | i, 848 |
| New York, N. Y., district | | | Nickel Cr., Cal. | TT-203..... | i, 1556 |
| No. 1. | E (with map)..... | i, 175 | Nicollet Cr., Minn. | KK-144..... | i, 1248 |
| (See notes, ii, 2792.) | | | Nicollet Isld. | (HH)..... | i, 1077* |
| Appro. | ii, 2289 | | Nigger Bar Chan., N. Y. | F-87..... | i, 216 |
| New York, N. Y., district | | | Nigger Bend | (GG-2)..... | i, 1039* |
| No. 2. | F (with map)..... | i, 213 | Nigger Tom Isld. | (WW-2)..... | i, 1617* |
| (See notes, ii, 2792.) | | | Niihau Isld., Hawaii. | YY-37..... | i, 1685 |
| Appro. | ii, 2289 | | (See notes, ii, 2846.) | | |
| New York, N. Y., district | | | Niles Chan., Fla. | P-194..... | i, 570 |
| No. 3. | G (with map)..... | i, 245 | Nile (The) | (HH)..... | i, 1077* |
| (See notes, ii, 2793.) | | | Nimishillen, Ohio | DD-381..... | i, 962 |
| Appro. | ii, 2290 | | Nimissila Cr., Ohio | DD-383..... | i, 962 |
| New York Slough, Cal. | TT-71..... | i, 1555 | Nina | (HH)..... | i, 1077* |
| | UU-5..... | i, 1577 | Ninemile Cr., Kans.: | | |
| New York (State of): | | | (See notes, ii, 2821.) | | |
| Forts | ii, 1796, 1816 | | Ninemile Cr., Minn. | KK-138..... | i, 1248 |
| Nezplique Bayou, La. | S-769..... | i, 687 | Ninemile Cr., Wyo.: | | |
| (See notes, ii, 2804.) | | | (See notes, ii, 2818.) | | |
| Bridges | ii, 2205 | | Ninemile Isld. | (HH)..... | i, 1077* |
| Negually Cr. | (WW-2)..... | i, 1617* | Nine Mile Bayou, La. | S-156..... | i, 682 |
| Nehalem B., Oreg. | VV-69..... | i, 1593 | Nine Mile Cr., Kans. | GG-1172..... | i, 1034 |
| Nehalem R., North Fork, | | | | GG-1198..... | i, 1034 |
| Oreg. | VV-71..... | i, 1593 | Nine Mile Cr., Mont. | GG-452..... | i, 1028 |
| Nehalem R., Oreg. | VV-70..... | i, 1593 | Nine Mile Cr., N. C. | L-349..... | i, 414 |
| Niagara Falls: | | | Nine Mile Cr., Tenn. | AA-106..... | i, 849 |
| Control of | ii, 2041, 2113 | | Nilemile Cr., W. Va. | EE-48..... | i, 983 |
| Niagara Falls, N. Y., be- | | | Nine Mile Cr., Wyo. | GG-728..... | i, 1030 |
| low | RR-24..... | i, 1493 | Nininger Slough (HH): | | |
| Niagara Falls, N. Y., canal | | | (See notes, ii, 2827.) | | |
| around | RR-15-f..... | i, 1511 | Nininger Slough (see | | |
| Niagara, Fort, N. Y. | ii, 1806 | | above) | (HH)..... | i, 1077* |
| Niagara R., below Ni- | | | Ninepin Bridges Cr., Md. | J-13..... | i, 331 |
| agara Falls, N. Y. | RR-24..... | i, 1493 | Niobrara | (GG-2)..... | i, 1039* |
| Niagara R., N. Y. | RR-15..... | i, 1493, 1509 | Niobrara Cr., Wyo. | GG-917..... | i, 1032 |
| | RR-15-a..... | i, 1509 | Niobrara, Nebr. | (GG-2)..... | i, 1037* |
| (See notes, ii, 2839.) | | | Bridges | ii, 2205 | |
| Appro. | ii, 2299 | | Niobrara R., Nebr. and | | |
| Bridges | ii, 2205 | | Wyo. | GG-906..... | i, 1032 |
| Discharge | ii, 2041, 2132 | | (See notes, ii, 2819.) | | |
| Forts | ii, 1994 | | Nota Chute | (HH)..... | i, 1077* |
| Great Lakes regulation | ii, 2041, 2124 | | Nishnabotna R., Mo. and | | |
| Harbor lines | ii, 2258 | | Iowa | GG-245..... | i, 1027, 1059 |
| Navigation rules | ii, 2041, 2107 | | (See notes, ii, 2814.) | | |
| Wrecks | ii, 2273 | | Nishnabotana R., Mo. | | |
| | | | and Iowa | GG-245..... | i, 1059 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------|---------------------|-------------------|-----------------------------|---------------------|-------------------|
| Nisqually R., Wash. | XX-645 | i, 165 | Norfolk H., Va., to Beau- | | |
| Bridges | | ii, 2205 | fort Inlet, N. C. | L-173-k | i, 435 |
| Nissequogue R., N. Y. | F-19 | i, 215 | Norfolk H., Va., to sounds | | |
| Nitchells Cr., N. C. | M-195 | i, 455 | of North Carolina | L-173-m | i, 437 |
| Nizina R., Alaska | XX-133 | i, 1656 | Norfolk to Cape Fear R., | | |
| Noal Cr., Ga. | O-33 | i, 533 | N. C. | L-173-h | i, 434 |
| Nobodys Bayou, La. | S-663 | i, 686 | Appro. | | ii, 2291 |
| Nodaway R., Iowa and | | | Norfolk, Va., district | L (with map) | i, 409, |
| Mo. | GG-236 | i, 1027 | | | 411 |
| (See notes, ii, 2814.) | | | (See notes, ii, 2795.) | | |
| Nohart Cr., S. Dak. | GG-820 | i, 1031 | Appro. | | ii, 2291 |
| Noharts Cr., Nebr. and | | | Norfolk, Va. (harbor at, | | |
| Kans. | GG-1152 | i, 1034 | and approaches there- | | |
| (See notes, ii, 2821.) | | | to) | L-173-c | i, 432 |
| No Heart Cr., S. Dak.: | | | Norfolk, Va., to Atlantic | | |
| (See notes, ii, 2818.) | | | Ocean south of Hat- | | |
| Nokasippi R., Minn. | KK-74 | i, 1247 | teras | L-173-j | i, 435 |
| Nokomo Cr., Kans. | GG-1384 | i, 1035 | Norfolk, Va., to Neuse | | |
| Nolichucky R., Tenn. and | | | R., N. C., to Cape Fear | | |
| N. C. | AA-122 | i, 849 | R., N. C. (survey for | | |
| Nolichucky R., Tenn. | AA-122 | i, 875 | water communication | | |
| Nolin R., Ky. | BB-10 | i, 891 | from Norfolk, Va., to the | | |
| | BB-7 | i, 892 | Atlantic Ocean south of | | |
| Nomini B., Va. | K-116 | i, 374 | Hatteras) | L-173-i | i, 434 |
| Nomini Cr., Va. | K-118 | i, 374, 395 | Norman Cove, Md. | J-203 | i, 332 |
| (See notes, ii, 2795.) | | | Norman Cr., Md. | J-1062 | i, 339 |
| Appro. | | ii, 2291 | Normandie, N. J.: | | |
| Wrecks | | ii, 2272 | Harbor lines | | ii, 2258 |
| No Mouth Cr., Wyo. | GG-700 | i, 1030 | Normans Kill, N. Y. | E-55 | i, 177 |
| (See notes, ii, 2817.) | | | Norris Branch, Md. | J-1125 | i, 339 |
| Noncommissioned offi- | | | Norris Cut, Fla. | P-156 | i, 570 |
| cers, Engineer Troops | | ii, 2039, 2060 | Norris Isld. | (GG-2) | i, 1039* |
| Nonconnah Rock | (HH) | i, 1077* | North American Lumber | | |
| Nonopapa Landing, H. I.: | | | & Timber Co. Canal, | | |
| (See notes, ii, 2846.) | | | La. | S-784 | i, 688 |
| Nooksack R., Wash. | XX-105 | i, 1656 | North and Northwestern | | |
| | XX-62-a | i, 1664 | Lakes (see Great Lakes): | | |
| | XX-105-a | i, 1675 | Forts | | ii, 1991 |
| Appro. | | ii, 2301 | North and South Dakota- | | |
| Bridges | | ii, 2205 | Minnesota line | KK-189 | i, 1248 |
| Noon Cr., Mont. | GG-437 | i, 1028 | North Anna R., Va. | K-312 | i, 375 |
| (See notes, ii, 2815.) | | | North B., N. C. | M-225 | i, 456 |
| Noonday Rock, San Fran- | | | North B. to Hoods Canal | | |
| cisco H., Cal. | TT-15-d | i, 1559 | Chan., Wash. | XX-62-d | i, 1668 |
| (See notes, ii, 2840.) | | | North B., Va. | L-234 | i, 413 |
| Noquette, Mich. | MM-5-b | i, 1299 | North Big Sandy Pond, | | |
| Norfolk and Portsmouth | | | N. Y. | RR-55 | i, 1493 |
| Hs., Va.: | | | North Branch, Canada | | |
| Harbor lines | | ii, 2258 | and Mont.: | | |
| Norfolk, Fort, Va.: | | | (See notes, ii, 2815.) | | |
| Harbor lines | | ii, 2255 | North Branch Dry Cr., | | |
| Norfolk H., Va. | L-173 | i, 412 | S. Dak. | GG-342 | i, 1027 |
| | L-173-b-f | i, 430 | North Branch, Md. | J-1119 | i, 339 |
| (See notes, ii, 2796.) | | | North Branch of Milk R., | | |
| Appro. | | ii, 2287, 2291 | Mont. | GG-444 | i, 1028 |
| Harbor lines | | ii, 2258 | North Branch, Mo. and | | |
| Navigation rules | | ii, 2041, 2107 | Iowa: | | |
| Wrecks | | ii, 2273 | (See notes, ii, 2814.) | | |
| Norfolk H., Va., and ap- | | | North Branch, Pa. | J-615 | i, 335 |
| proaches | L-173-b | i, 430 | | J-644 | i, 336 |
| Norfolk H., Va., to Alber- | | | | J-692 | i, 336 |
| marle Sound, N. C., | | | | J-850 | i, 337 |
| through Currituck | | | North Brother Isld., N. Y.: | | |
| Sound | L-173-l | i, 436 | Harbor lines | | ii, 2258 |
| (See notes, ii, 2796.) | | | | | |
| Navigation rules | | ii, 2041, 2107 | | | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|----------------------------|-------------------|--|---------------------|-------------------|
| North Canadian R., Okla. | Y-18 | i, 825 | North Fork, Nebr. | GG-955 | i, 1032 |
| North Carolina: | | | | GG-1127 | i, 1033 |
| Forts | ii, 1796, 1807, 1816, 1935 | | (See notes, ii, 2819, 2821.) | | |
| North Carolina, sounds of, to Norfolk H., Va. | L-173-m | i, 437 | North Fork, N. C. and Va. | EE-97 | i, 983 |
| North Carolina (sounds of), waterway connect- ing with Dismal Swamp Canal, Va. | L-173-o | i, 438 | North Fork, N. Dak. | GG-782 | i, 1031 |
| North Chan., Tampa B., Fla. | P-287 | i, 571 | (See notes, ii, 2818.) | | |
| North Chan., Va. | L-23 | i, 411 | North Fork of Hughes R., W. Va. | EE-182 | i, 984 |
| North Chickamauga Cr., Tenn. | AA-185 | i, 849 | North Fork of Snake R., S. Dak. | GG-326 | i, 1027 |
| North Cliff Battery, N. Y. | | ii, 1881 | North Fork, Ohio | DD-424 | i, 962 |
| North Cr., Fla. | P-280 | i, 571 | | DD-474 | i, 962 |
| North Cr., N. C. | M-67 | i, 454 | North Fork, Okla. | Y-19 | i, 818 |
| North Cr., Pa. | J-783 | i, 337 | North Fork, Pa. | J-600 | i, 335 |
| North Cr., Va. | L-170 | i, 412 | North Fork R., Mont.: | | |
| Northeast Branch, Md. | J-347 | i, 333 | (See notes, ii, —.) | | |
| | K-87 | i, 373 | North Fork R., Tenn. | AA-8 | i, 848 |
| Northeast Branch, N. C. | M-294 | i, 456 | | AA-13 | i, 848 |
| Northeast Cape Fear R., N. C. | M-306 | i, 491 | North Fork, Salt Cr., Ohio | DD-452 | i, 962 |
| (See notes, ii, 2797.) | | | North Fork, Saluda R., S. C. | N-179 | i, 500 |
| Appro. | | ii, 2292 | North Fork, Smoky Hill R., Kans. and Colo.: | | |
| Northeast Cove, Md. | J-200 | i, 332 | (See notes, ii, 2822.) | | |
| Northeast Cr., Md. | J-551 | i, 335 | North Fork, S. C. | O-15 | i, 533 |
| | J-1070 | i, 339 | North Fork, S. Dak. | GG-796 | i, 1031 |
| Bridges | | ii, 2205 | | GG-811 | i, 1031 |
| Northeast Division, Engi- neer Department | | ii, 2039, 2046 | | GG-864 | i, 1031 |
| North East H., Me. | A-53 | i, 27, 35 | (See notes, ii, 2815, 2818, 2819.) | | |
| Northeast Pass | (HH) | i, 1077* | North Fork, S. Dak. and Wyo. | GG-828 | i, 1031 |
| (See notes, ii, 2827.) | | | North Fork, W. Va. | DD-315 | i, 961 |
| Northeast Pass, La. | S-216 | i, 682 | North Fork, Wyo. | GG-729 | i, 1030 |
| Northeast R., Md. | J-547 | i, 335, 361 | (See notes, ii, 2817, 2818.) | | |
| Appro. | | ii, 2291 | North Hackberry Cr., Kans.: | | |
| North East R., N. C. | M-306 | i, 456 | (See notes, ii, 2822.) | | |
| Bridges | | ii, 2205 | North Haven H., Me. | A-128 | i, 28, 41 |
| Wrecks | | ii, 2273 | North Hero Isld., N. Y.: | | |
| North End Branch, Va. | K-278 | i, 375 | Appro. | | ii, 2289 |
| Northern B., Me. | A-99 | i, 27 | North Hero Islds., Vt. | E-79 | i, 203 |
| North Fork | DD-4-a | i, 963 | | E-80 | i, 203 |
| North Fork, Alaska | XX-179 | i, 1656 | North Inlet, Va. | L-21 | i, 411 |
| | XX-227 | i, 1657 | North Jupiter Narrows, Fla. | P-133 | i, 570 |
| North Fork, Ark. and Mo. | Y-36 | i, 818 | North Lake, Minn. | KK-209 | i, 1249 |
| North Fork, Colo. | GG-1092 | i, 1033 | North Lake, Minn. and Canada | KK-244 | i, 1249 |
| (See notes, ii, 2820.) | | | North Landing R. | L-173-l | i, 436 |
| North Fork, Del. and Md. | J-23 | i, 331 | North Landing R., N. C. and Va. | L-240 | i, 440, 413 |
| North Fork, Fla. | P-140 | i, 570 | Appro. | | ii, 2291 |
| North Fork, Ga. | O-32 | i, 533 | North Laramie R., Wyo.: | | |
| North Fork, Holston R., Tenn. and Va. | AA-136 | i, 849 | (See notes, ii, 2820.) | | |
| North Fork, Kans.: | | | North Loup R., Nebr. | GG-973 | i, 1032 |
| (See notes, ii, 2821, 2822.) | | | (See notes, ii, 2820.) | | |
| North Fork, Kentucky R. | DD-104 | i, 960 | North Menominee Canal, Wis.: | | |
| North Fork, Mont. | GG-439 | i, 1028 | Bridges | | ii, 2206 |
| | GG-480 | i, 1028 | North Moreau Cr., Mo.: | | |
| | GG-496 | i, 1029 | (See notes, ii, 2823.) | | |
| | GG-514 | i, 1029 | North Mouse Cr., Tenn. | AA-76 | i, 848 |
| | GG-587 | i, 1029 | | | |

(See notes, ii, 2815, 2816.)

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------|---------------------|-------------------|---------------------------|---------------------|-------------------|
| North Newport R., Ga. | O-184 | i, 534 | North Tonawanda, N. Y. | RR-19-b | i, 1512 |
| North Pacific Division, | | | Harbor lines | | ii, 2258 |
| Engineer Department | ii, 2039, 2047 | | Northumberland, Pa. | J-556-c | i, 364 |
| North Palous R., Wash. | VV-98 | i, 1612 | North Union Canal, Cal. | UU-22 | i, 1577 |
| North Pass. | (HH) | i, 1077* | North West B., N. Y. | E-95 | i, 178 |
| (See notes, ii, 2827.) | | | Northwest Branch, Fla. | P-127 | i, 570 |
| North Pass, La. | R-106 | i, 647 | Northwest Branch, Md. | J-348 | i, 333 |
| | S-46 | i, 681 | | K-88 | i, 373 |
| | S-212 | i, 682 | Northwest Branch, Va. | K-293 | i, 375 |
| North Platte R., Nebr., | | | | L-94 | i, 412 |
| Wyo., and Colo. | GG-983 | i, 1032 | Northwest Cr., N. C. | M-168 | i, 455 |
| (See notes, ii, 2820.) | | | Northwest Division, Engi- | | |
| North Pt. Cr., Md. | J-1081 | i, 339 | neer Department | ii, 2039, 2046 | |
| Bridges | ii, 2179, 2206 | | Northwest Fork, Fla. | P-141 | i, 570 |
| North Pt. Thorofare, N. J.: | | | North West H., Me. | A-94 | i, 27 |
| Bridges | ii, 2206 | | Northwest R., Va. and N. | | |
| North Pt. to Millers Isld., | | | C. | L-246 | i, 413, 441 |
| Md. | J-1081-a | i, 365 | Norton Cr., N. Y. | F-85 | i, 216 |
| North Pond, N. Y. | RR-53 | i, 1493 | Nortons Cr., N. Y.: | | |
| Northport | (WW-2) | i, 1617* | Bridges | ii, 2206 | |
| Northport B., N. Y. | F-17 | i, 215 | Nortons Shoal, Mass.: | | |
| Northport H., N. Y. | F-17 | i, 215, 220 | Wrecks | ii, 2273 | |
| North Portland H. | (WW-2) | i, 1617* | Norwalk H., Conn. | D-80 | i, 141, 169 |
| North R. | (HH) | i, 1077* | (See notes, ii, 2791.) | | |
| North R. Bar, N. C.: | | | Appro. | ii, 2289 | |
| Wrecks | ii, 2273 | | Bridges | ii, 2206, 2231 | |
| North R. B. | L-733-l | i, 436 | Harbor lines | ii, 2258 | |
| North R., Fla. | P-85 | i, 569 | Norwalk R., Conn. | D-81 | i, 141 |
| North R., Ga. | O-220 | i, 534 | Bridges | ii, 2206 | |
| | O-513 | i, 537 | Norwich Cr., Md. | J-301 | i, 333 |
| North R., Iowa. | JJ-70 | i, 1234 | Norwoods Cr., La. | S-93 | i, 682 |
| North R., Md. | J-1252 | i, 340 | Notes, River and Harbor | | |
| North R., Mass. | B-98 | i, 69 | Improvements | ii, 2779 | |
| | B-152 | i, 70 | Nottoway Cr., Va. | L-314 | i, 413, 444 |
| | B-98 | i, 81 | Appro. | ii, 2291 | |
| North R., Mich. | PP | i, 1419 | Bridges | ii, 2206 | |
| North R., Mo. | JJ-76 | i, 1234 | Nottoway R., Va. | L-314 | i, 444 |
| North R. N. Y. (See New | | | Novato Cr., Cal. | TT-124 | i, 1556 |
| York, N. Y.): | | | Bridges | ii, 2206 | |
| Harbor lines | ii, 2258 | | No Water Cr., Wyo. | GG-694 | i, 1030 |
| North R., N. C. | L-257 | i, 413 | (See notes, ii, 2817.) | | |
| | M-250 | i, 456 | Nowi R., Alaska | XX-192 | i, 1656 |
| Bridges | ii, 2206 | | No Wood Cr., Wyo. | GG-695 | i, 1030 |
| North R. to Beaufort H., | | | (See notes, ii, 2817.) | | |
| N. C. (water route) | M-257-d | i, 476 | Norubee R., Ala. and | | |
| North R. to Beaufort, N. | | | Miss. | R-39 | i, 646, 663 |
| C. (waterway) | M-256 | i, 456 | Appro. | ii, 2294 | |
| Harbor lines | ii, 2258 | | Bridges | ii, 2206 | |
| North R., Va. | K-273 | i, 375 | Noyaek B., N. Y. | F-40 | i, 215 |
| North R., Wash. | XX-12 | i, 1655, 1658 | Noyce Slough, Cal. | TT-81 | i, 1555 |
| Dams, private | ii, 2250 | | Noyes Rips | (HH) | i, 1077* |
| North Bun, Md. | J-1097 | i, 339 | Noyo R., Cal. | TT-150 | i, 1556 |
| North Sauty Cr., Ala. | AA-197 | i, 849 | Nueces R., Tex. | U-69 | i, 735 |
| North Slough, Ore. | VV-29 | i, 1593 | Bridges | ii, 2206 | |
| North Solo Slough, Wash. | WW-54 | i, 1615 | Nushagat R., Alaska | XX-163 | i, 1656 |
| North Table Cr., Nebr. | | | Nyaek H., N. Y. | E-70-a | i, 201 |
| and Kans. | GG-1147 | i, 1034 | Ny Bun, Va. | K-310 | i, 375 |
| (See notes, ii, 2821.) | | | | | |

O.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Oahu Isld., Hawaii | YY-39..... | i, 1685 | Ochlockonee R., Fla. | Q-12..... | i, 611 |
| (See notes, ii, 2846.) | | | Ochlockonee R., Fla.: | | |
| Oak B., Wash., to Port | | | Bridges..... | | ii, 2207 |
| Townsend B. | XX-46-a..... | i, 1664 | Ochlockonee R., Ga. and | | |
| Oak Cr., Kans. | GG-1318..... | i, 1035 | Fla. | Q-13..... | i, 611, 612 |
| | GG-1326..... | i, 1035 | Ocklawaha R., Fla. | P-33..... | i, 582 |
| (See notes, ii, 2822.) | | | Appro..... | | ii, 2293 |
| Oak Cr., Md. | J-370..... | i, 333 | Ocklockonee R., Fla.: | | |
| Bridges..... | | ii, 2207 | Bridges..... | | ii, 2207 |
| Oak Cr., S. Dak. | GG-794..... | i, 1031 | Logs, floating..... | | ii, 2041, 2109 |
| | GG-896..... | i, 1032 | Ocklockonee R., Ga. and | | |
| (See notes, ii, 2819.) | | | Fla.: | | |
| Oakdale H., Ohio: | | | (See notes, ii, 2800.) | | |
| Harbor lines..... | | ii, 2258 | Appro..... | | ii, 2293 |
| Oakland Beach, R. I.: | | | Ocklockonee R., Ga.: | | |
| Wrecks..... | | ii, 2274 | Bridges..... | | ii, 2207 |
| Oakland H., San Fran- | | | Ockmulhee R., Ga. | O-326..... | i, 555 |
| cisco B., Cal. | TT-57..... | i, 1555, 1562 | Ockwalkee Cr., Ga. | O-320..... | i, 535 |
| Appro..... | | ii, 2300 | Ocmulgee H., Ga.: | | |
| Bridges..... | | ii, 2207 | (See notes, ii, 2798.) | | |
| Harbor lines..... | | ii, 2258 | Ocmulgee R., Ga. | O-326..... | i, 535, 555 |
| Wrecks..... | | ii, 2273 | | O-2-i..... | i, 547 |
| Oakley Cr., Ky. | DD-202..... | i, 960 | Appro..... | | ii, 2293, 2296 |
| Oak Orchard Cr., N. Y. | RR-32..... | i, 1493 | Bridges..... | | ii, 2207 |
| Oak Orchard H., N. Y. | RR-31..... | i, 1493, 1516 | Wrecks..... | | ii, 2273 |
| Appro..... | | ii, 2299 | Ocmulgee R. ("Transpor- | | |
| Oak Pt., N. Y.: | | | tation Routes to Sea- | | |
| Harbor lines..... | | ii, 2258 | board") | AA-18-k..... | i, 869 |
| Obey R., Tenn. | AA-269..... | i, 850, 887 | Ocoee R., Tenn.: | | |
| | AA-239..... | i, 878 | Bridges..... | | ii, 2207 |
| Appro..... | | ii, 2296 | Ocoll R., Tenn. and Ga. | AA-72..... | i, 848 |
| Obeys R., Tenn. | AA-269..... | i, 887 | Oconalufy R., N. C. | AA-103..... | i, 849 |
| Obion Cr., Ky. | AA-15..... | i, 848 | (See notes, ii, 2809.) | | |
| Obion R., Tenn. | AA-5..... | i, 848, 852 | Oconee R., Ga. | O-258..... | i, 535, 553 |
| Appro..... | | ii, 2296 | Appro..... | | ii, 2293 |
| Bridges..... | | ii, 2207 | Bridges..... | | ii, 2207 |
| O'Brien Coulee, Mont. ... | GG-477..... | i, 1028 | O'Connells Slough. | (HH)..... | i, 1077* |
| (See notes, ii, 2816.) | | | Oconto H., Wis. | MM-12..... | i, 1302 |
| Obstructing Navigation, | | | Appro..... | | ii, 2298 |
| Bridges..... | | ii, 2041, 2105 | Bridges..... | | ii, 2207 |
| Obstructions | | i, 21 | Harbor lines..... | | ii, 2258 |
| Ocohannock Cr., Va. | L-73..... | i, 411, 415 | Oconto R., Wis. | MM-12..... | i, 1297 |
| Ocohannock R., Va. | L-73..... | i, 415 | Ocosta, Wash.: | | |
| Occoquan B., Va. | K-98..... | i, 373 | Harbor lines..... | | ii, 2258 |
| Occoquan Cr., Va. | K-100..... | i, 373, 390 | Ocqueoc R., Mich. | PP-41..... | i, 1419 |
| Appro..... | | ii, 2291 | Ocracoke Inlet, N. C. | M-66..... | i, 454 |
| Wrecks..... | | ii, 2273 | | M-260..... | i, 456, 480 |
| Occupacia Cr., Va. | K-216..... | i, 374 | Appro..... | | ii, 2292 |
| Ocean City, N. J.: | | | Octave Pass. | (HH)..... | i, 1077* |
| Wrecks..... | | ii, 2273 | (See notes, ii, 2827.) | | |
| Oceanport, N. J.: | | | Octave Pass, La. | S-207..... | i, 682 |
| Bridges..... | | ii, 2207 | Octorora Cr., Md. | J-559..... | i, 335 |
| Oceola Bar (HH): | | | Ode, The. | (HH)..... | i, 1077* |
| (See notes, ii, 2830.) | | | (See notes, ii, 2827.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|----------------------------------|-------------------|------------------------------------|---------------------|-------------------|
| Odell Cr., Mont. | GG-715..... | i, 1030 | Ohio R. to Lake Erie Can- | | |
| (See notes, ii, 2818.) | | | nal through Ohio. | QQ-5-b..... | i, 1465 |
| Oder, The (HH): | | | Ohopee R., Ga. | O-247..... | i, 535 |
| (See notes, ii, 2827.) | | | Ohoopee R., Ga. | O-247..... | i, 553 |
| Odingshell R., Ga. | O-103..... | i, 533 | Oil City, Pa. | FF-20..... | i, 1015 |
| O'Donnells Crossing | (HH)..... | i, 1077* | Oil Cr., Pa. | FF-35..... | i, 1003 |
| (See notes, ii, 2832.) | | | | FF-20..... | i, 1015 |
| Ofallons Cr., Mont. | GG-740..... | i, 1030 | Oil Cr., W. Va. | EE-170..... | i, 984 |
| (See notes, ii, 2818.) | | | Okahumpka Run, Fla. ... | P-47..... | i, 569 |
| Officers, Corps of Engi- | | | Okanogan R. | (WW-2)..... | i, 1617* |
| neers: | | | Okanogan R., Wash. | XX-116..... | i, 1656, 1679 |
| Civilian assistants..... | ii, 2039, 2059, 2060 | | Appro..... | | ii, 2301 |
| Services in the field..... | ii, 2039, 2050 | | Bridges..... | | ii, 2212 |
| Officers, Noncommis- | | | Okaw R. | (HH)..... | i, 1077* |
| sioned: | | | Okaw R., Ill.: | | |
| Engineer Troops..... | ii, 2039, 2060 | | Bridges..... | | ii, 2212 |
| Office, Chief of Engineers: | | | Okaw Crossing | (HH)..... | i, 1077* |
| Assistants..... | ii, 2039, 2043 | | Oklawaha R., Fla. | P-33..... | i, 569, 582 |
| Offices, U. S. Engineer: | | | Appro..... | | ii, 2293 |
| (See notes, ii, 2782.) | | | Oklmulgee R., Ga. | O-326..... | i, 555 |
| Locations..... | ii, 2782 | | Okobojo Cr., S. Dak. | GG-377..... | i, 1028 |
| (See also the first page | | | (See notes, ii, 2815.) | | |
| of each district in | | | Okoe Landing, Hawaii | YY-79..... | i, 1686 |
| Vol. I.) | | | Olalla Slough, Oreg | VV-49..... | i, 1593 |
| Ogden Landing | (CC)..... | i, 910* | Olay Cr., S. Dak. | GG-300..... | i, 1027 |
| Ogdensburg H., N. Y. | RR-72..... | i, 1493, 1536 | Olcott H., N. Y. | RR-28..... | i, 1493, 1515 |
| Appro..... | ii, 2299 | | Appro..... | | ii, 2299 |
| Wrecks..... | ii, 2273 | | Harbor lines..... | | ii, 2258 |
| Ogdonia Cr., Pa. | J-730..... | i, 336 | Old Brunswick, N. C.: | | |
| Ogeechee R., Ga. | O-120..... | i, 534 | Forts..... | | ii, 1935 |
| | O-120-a..... | i, 549 | Old Castle Cr., Va. | L-65..... | i, 411 |
| Bridges..... | ii, 2208 | | Old Fish Lake, Ga. | O-333..... | i, 535 |
| Wrecks..... | ii, 2273 | | Old Fort Bayou, Miss. ... | R-77..... | i, 646, 670 |
| Oglethorpe, Fort, Ga. | ii, 1948 | | Old H., Mass. | B-131..... | i, 70 |
| Ogleton Lake, Md. | J-1239..... | i, 340 | Old H. Cr., Mass. | B-182..... | i, 70 |
| Ogunquit H., Me. | A-277-b..... | i, 29, 59 | Old-House Chan., N. C. ... | M-28-b..... | i, 459 |
| Ohio & Chesapeake Can- | | | Old House Cove, Md. | J-49..... | i, 331 |
| nal. | K-46-p..... | i, 386 | Old House Cr., Va. | K-287..... | i, 375 |
| Ohio Canal to Big Beaver | | | Old Johns Cr., Md. | J-35..... | i, 331 |
| R., Pa. (for canal). | FF-38-a..... | i, 1021 | Old Lake, Ga. | O-479..... | i, 536 |
| Ohio Cr., Va. | L-198..... | i, 412 | | O-490..... | i, 536 |
| Ohio Reef, R. I. | C-79..... | i, 107 | Old Main R., Wash. | XX-97..... | i, 1655 |
| Ohio Reef, east passage, | | | Old Man Cr., Md. | J-1193..... | i, 340 |
| Narragansett R., R. I. | C-79..... | i, 125 | Oldmans Cr., N. J. | I-45..... | i, 299, 309 |
| Ohio R. | ii, 2041, 2113* | | Appro..... | | ii, 2290 |
| | (CC)..... | i, 905* | Bridges..... | | ii, 2212 |
| | (GG-2)..... | i, 1039* | Wrecks..... | | ii, 2274 |
| | (HH)..... | i, 1077* | Old Mill Branch, Md. | J-12..... | i, 331 |
| (See notes, ii, 2810, 2827, 2832, 2833.) | | | Old Mill Cr., Va. | L-187..... | i, 412 |
| Appro..... | ii, 2279, 2287, 2296 | | Old Neck Cr., Va. | L-129..... | i, 412 |
| Bridges..... | ii, 2208, 2209, 2210, 2211, 2212 | | Old Place Cr., N. Y. | G-29..... | i, 247 |
| Harbor lines..... | ii, 2254, 2258 | | Old Plantation Cr., Va. ... | L-61..... | i, 411 |
| Navigation rules..... | ii, 2041, 2107 | | Old Pt. Comfort, Va.: | | |
| Wrecks..... | ii, 2273, 2274 | | Forts..... | | ii, 1927 |
| Ohio R., connecting with | | | Old R. | (HH)..... | i, 1077* |
| James R. survey | EE-62-e..... | i, 993 | Old R., Cal. | UU-12..... | i, 1577 |
| (See notes, ii, 2811.) | | | Bridges..... | | ii, 2212 |
| Ohio R., junction, at | | | Old R., Ga. | O-260..... | i, 535 |
| Pittsburgh, Pa., of Alle- | | | | O-267..... | i, 535 |
| gheny and Mononga- | | | | O-270..... | i, 535 |
| hela Rs. | FF-5..... | i, 1003 | | O-319..... | i, 535 |
| Ohio R., Lake Erie to, | | | | O-494..... | i, 536 |
| Canal. | QQ-5-c..... | i, 1465 | Old R., La. | R-97-bb..... | i, 647 |
| Appro..... | ii, 2209 | | | S-204..... | i, 683 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Old R., La. (continued) | S-296..... | i, 683 | One Hundred and Two | | |
| | S-565..... | i, 686 | R., Iowa and Mo. | GG-221..... | i, 1026 |
| | S-609..... | i, 686 | (See notes, ii, 2814.) | | |
| Bridges..... | | ii, 2212 | One Hundredth Meridi- | | |
| Wreck..... | | ii, 2285 | an, Explorations. | ii, 2040, 2089 | |
| Old R., Miss. | X-7..... | i, 785 | Onell Slough, Cal. | TT-22..... | i, 1555 |
| | S-283..... | i, 683 | One Leg Cr., Ohio. | DD-370..... | i, 962 |
| Old R., Tex. | U-13..... | i, 735, 739 | Onemile Cr., Ala. | R-47..... | i, 646 |
| | U-17..... | i, 735 | Bridges..... | | ii, 2212 |
| Old Road B., Md. | J-1080..... | i, 339 | One Mile Cr., Kans. | GG-1167..... | i, 1034 |
| Old Romerly Marsh, Ga. | O-101..... | i, 533 | | GG-1275..... | i, 1035 |
| Old Tampa B. and Tampa | | | (See notes, ii, 2821, 2822.) | | |
| B., Fla. (channel be- | | | Onion Bayou, La. | S-691..... | i, 687 |
| tween) | P-288-a..... | i, 599 | | S-717..... | i, 687 |
| Old Tampa B., Fla. | P-310..... | i, 571 | Onion Lake, La. | S-718..... | i, 687 |
| Old Tea Kettle, Ga. | O-204..... | i, 534 | Onkanikan Cove, Md. | J-201..... | i, 332 |
| Old Town, Ark. (HH): | | | Onset B., Mass. | C-39..... | i, 107 |
| (See notes, ii, 2832.) | | | Onset H., Mass. | C-40..... | i, 107, 116 |
| Old Town Bend. (HH)..... | | i, 1077* | Ontario, Fort, N. Y. | | ii, 1806, 1997 |
| Oldtown Branch, Del. | J-289..... | i, 333 | Ontonagon H., Mich. | LL-35..... | i, 1284 |
| Old Town Cr., Miss. | R-38..... | i, 646, 662 | Appro..... | | ii, 2298 |
| Appro..... | | ii, 2294 | Bridges..... | | ii, 2212 |
| Old Town Cr., Ohio. | DD-392..... | i, 962 | Wrecks..... | | ii, 2274 |
| Old Town Landing. (HH)..... | | i, 1077* | Ontonagon R., Mich. | LL-35..... | i, 1265 |
| Old Turtle Cr., N. J.: | | | Bridges..... | | ii, 2212 |
| Bridges..... | | ii, 2212 | Oolenoe Cr., S. C. | N-182..... | i, 500 |
| Old Warwick Cove, R. I.: | | | Ooltewah Cr., Tenn. | AA-65..... | i, 848 |
| Wrecks..... | | ii, 2274 | Oostenaula R., Ga. | Q-54..... | i, 611 |
| Old Washington to Rich- | | | | Q-54-a..... | i, 641 |
| mond (Brazos R., Tex.) | U-40-d..... | i, 764 | (See notes, ii, 2802.) | | |
| Old Washington to Velas- | | | Appro..... | | ii, 2294 |
| co (Brazos R., Tex.) | U-40-c..... | i, 763 | Bridges..... | | ii, 2212 |
| Old Washington to Waco | | | Ootanaula Cr., Tenn. | AA-75..... | i, 848 |
| (Brazos R., Tex.) | U-40-e..... | i, 764 | Opelousas B., La. | S-628..... | i, 686 |
| Olentangy R., Ohio. | DD-458..... | i, 962 | Bridges..... | | ii, 2212 |
| Olentangy R., Ohio, East | | | Operating and Care of Ca- | | |
| Branch. | DD-459..... | i, 962 | nals, etc. (see Canals). | | |
| Olive Cr., La. | S-71..... | i, 681 | Operations, River and | | |
| Olive Branch, La. | S-96..... | i, 682 | Harbor Works. | | i, 22 |
| Olive Green Cr., Ohio. | DD-345..... | i, 961 | Forts..... | | ii, 1797 |
| Oliverian Canal, N. H. | B-26..... | i, 69 | Opossum Cr. (CC)..... | | i, 910* |
| | B-26..... | i, 75 | Opossum Cr., La. | S-92..... | i, 682 |
| Olson Cr., S. Dak. | GG-386..... | i, 1028 | Opossum Cr., Tenn. | AA-182..... | i, 849 |
| (See notes, ii, 2815.) | | | Opossum Fork. (HH)..... | | i, 1077* |
| Olustee Cr., Fla. | P-357..... | i, 572 | (See notes, ii, 2827.) | | |
| Olympia H., Wash. | XX-63..... | i, 1655, 1668 | Oquawka. (HH)..... | | i, 1077* |
| Appro..... | | ii, 2301 | (See notes, ii, 2827.) | | |
| Harbor lines..... | | ii, 2258 | Orangeburg to Charles- | | |
| Omaha. (GG-2)..... | | i, 1039* | ton, S. C. (waterways) | N-204-b..... | i, 523 |
| Harbor lines..... | | ii, 2259 | Orange Cr., Fla. | P-35..... | i, 569 |
| Omaha Cr., Nebr. | GG-941..... | i, 1032 | Orange Lake, Fla. | P-36..... | i, 569 |
| (See notes, ii, 2819.) | | | Orange Mills Flats (St. | | |
| Harbor lines..... | | ii, 2259 | Johns R., Fla.) | P-10-c..... | i, 579 |
| Omaha Division (GG): | | | Orange R., Fla. | P-233..... | i, 571, 592 |
| (See notes, ii, 2826.) | | | Appro..... | | ii, 2293 |
| Omaha, Nebr. (GG-2-a)..... | | i, 1037* | Bridges..... | | ii, 2212 |
| Omaha Reach. (GG-2)..... | | i, 1039* | Orange, Tex.: | | |
| Onancock Cr., Va. | L-83..... | i, 411 | (See notes, ii, 2806.) | | |
| Onancock H., Va. | L-83..... | i, 416 | Orange to Sabine R. | T-3-b..... | i, 719 |
| Appro..... | | ii, 2291 | Orchard Cr., N. C. | M-154..... | i, 455 |
| Onancock R., Va. | L-83..... | i, 416 | Orcutt Cr., Pa. | J-682..... | i, 836 |
| Appro..... | | ii, 2291 | Orcutts H., Me. | A-81..... | i, 27 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Ordnance Department, | | | Otoe Cr., Nebr. | GG-948..... | i, 1032 |
| Fire Control: | | | (See notes, ii, 2819, 2820.) | | |
| Forts..... | | ii, 1812 | Ottawa R., Ohio | QQ-12..... | i, 1461 |
| Oregon: | | | Bridges..... | | ii, 2212 |
| Dredging plant..... | | ii, 2300 | Ottawa R., Ohio and | | |
| Forts..... | | ii, 1809 | Mich..... | QQ-2..... | i, 1461 |
| Field service in..... | | ii, 2039, 2047 | Otter Cr., Kans. | GG-1267..... | i, 1035 |
| Oregon and Washington, | | | | GG-1287..... | i, 1035 |
| dredging plant for..... | VV-1-a..... | i, 1594 | (See notes, ii, 2822.) | | |
| Oregon Branch, Md..... | J-1034..... | i, 338 | Otter Cr., Ky. | DD-17..... | i, 959 |
| Oregon City (above), | | | | DD-41..... | i, 959 |
| Williamette R., Oreg..... | WW-30-e..... | i, 1646 | Otter Cr., Md. | J-186..... | i, 332 |
| Oregon Inlet, N. C. | L-216..... | i, 413, 440 | Otter Cr., Minn. | KK-130..... | i, 1248 |
| Oregon Slough. | (WW-2)..... | i, 1617* | Otter Cr., Mont. | GG-550..... | i, 1029 |
| Bridges..... | | ii, 2157, 2212 | | GG-716..... | i, 1030 |
| Oregon Slough, Oreg. | VV-77..... | i, 1593 | (See notes, ii, 2816, 2818.) | | |
| Orient H., N. Y. | F-31..... | i, 215 | Otter Cr., Nebr. | GG-992..... | i, 1032 |
| Ormoc, P. I. | YY-118..... | i, 1686 | (See notes, ii, 2820.) | | |
| Oronoken Cr., N. J.: | | | Otter Cr., N. Y. | E-7..... | i, 177 |
| Bridges..... | | ii, 2212 | Otter Cr., N. C. | M-187..... | i, 455 |
| Orrs Isld., Me.: | | | Otter Cr., Oreg. | VV-35..... | i, 1593 |
| Bridges..... | | ii, 2212 | Otter Cr., Pa. | J-754..... | i, 336 |
| Orrtons Isld. | (HH)..... | i, 1077* | Otter Cr., S. Dak. | GG-383..... | i, 1028 |
| Orwood-Middle R. Canal, | | | (See notes, ii, 2815.) | | |
| Cal..... | UU-24..... | i, 1577 | Otter Cr., Vt. | E-110..... | i, 178, 207 |
| Osage. | (GG-2)..... | i, 1039* | Appro..... | | ii, 2289 |
| Osage Chute. | (GG-2)..... | i, 1039* | Otter Cr., W. Va. | EE-149..... | i, 984 |
| Osage Fork, Mo. | GG-1520..... | i, 1037 | Otter Fork, Ohio | DD-425..... | i, 962 |
| (See notes, ii, 2824.) | | | Otter Isld. | (HH)..... | i, 1077* |
| Osage Pt. | (GG-2)..... | i, 1039* | Otter Pt. Cr., Md. | J-962..... | i, 338 |
| Osage R. | (GG-2)..... | i, 1039* | Otter Pond, Md. | J-150..... | i, 332 |
| Osage R., Mo. | (GG-2)..... | i, 1037* | | J-1182..... | i, 340 |
| | GG-1457..... | i, 1063 | Otter R., Va. | L-373..... | i, 414 |
| Osage R., Mo. and Kans. | GG-1457..... | i, 1036 | Otter Tail Lake and R., | | |
| (See notes, ii, 2823, 2826.) | | | Minn. and S. Dak..... | KK-190..... | i, 1259 |
| Appro..... | | ii, 2297 | | KK-190-a..... | i, 1259 |
| Bridges..... | | ii, 2212 | | KK-190-b..... | i, 1260 |
| Osborne. | (HH)..... | i, 1077* | Appro..... | | ii, 2297 |
| Osborne Field (HH): | | | Ottertall Rs., Minn. | KK-170..... | i, 1248 |
| (See notes, ii, 2833.) | | | Ottertall R., Minn. | KK-190..... | i, 1248 |
| Osceola. | (HH)..... | i, 1077* | Ottertall R., Minn. and | | |
| Osceola Bar (HH): | | | S. Dak..... | KK-190..... | i, 1259 |
| (See notes, ii, 2830.) | | | Otter Track Lake, Minn. | | |
| Oscoda H., Mich. | PP-53..... | i, 1419 | and Canada..... | KK-238..... | i, 1249 |
| Oshkosh, Wis.: | | | Ouachita and Black Rs., | | |
| Harbor lines..... | | ii, 2259 | La. and Ark..... | X-29..... | i, 802 |
| Oslab, P. I. | YY-123..... | i, 1686 | | X-29-a..... | i, 802 |
| Ossabaw Sound, Ga. | O-102..... | i, 533 | Ouachita R. above Cam- | | |
| Oswayo Cr., N. Y. and | | | den to Arkadelphia, | | |
| Pa..... | FF-32..... | i, 1003 | Ark..... | X-29-b..... | i, 805 |
| Oswegatchie R., N. Y. | RR-71..... | i, 1493 | Ouachita R., Ark. and La.: | | |
| Oswego Canal, N. Y. | RR-49-b..... | i, 1530 | Appro..... | | ii, 2295 |
| Oswego H., N. Y. | RR-48..... | i, 1493 | Bridges..... | | ii, 2212, 2213 |
| Appro..... | | ii, 2299 | Ouachita R., La. | X-34..... | i, 785 |
| Harbor lines..... | | ii, 2259 | Ouske B., La. | S-539..... | i, 685 |
| Oswego, N. Y.: | | | Outland Cr., S. C. | N-198..... | i, 500 |
| Forts..... | | ii, 1997 | Outlet (The), Va. | L-30..... | i, 411 |
| Oswego R., N. Y. | RR-49..... | i, 1493 | Overpeck Cr., N. J. | G-12..... | i, 247 |
| Appro..... | | ii, 2299 | Bridges..... | | ii, 2213 |
| Bridges..... | | ii, 2212 | Oversea river and harbor | | |
| Oswells Cut, Ga. | O-246..... | i, 535 | works..... | | i, 1683 |
| Otapasse Cr., Miss. | R-98-u..... | i, 647 | (See notes, ii, 2845.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------|---------------------|-------------------|---|---------------------|-------------------|
| Overshot Run, Md..... | J-1002..... | i, 338 | Oyster B., Ala..... | R-7..... | i, 646 |
| Owasoke Cr., N. C..... | L-286..... | i, 413 | Oyster B. H., N. Y..... | F-12..... | i, 219 |
| Owen Branch, Mo..... | GG-216..... | i, 1026* | Oyster B., N. Y..... | F-12..... | i, 215 |
| Owendaw Cr., S. C..... | N-202..... | i, 500 | Oyster Bayou, La..... | S-861..... | i, 688 |
| Owendaw R., S. C..... | N-202-a..... | i, 518 | | S-477..... | i, 685 |
| Owensboro, Ky..... | (CC)..... | i, 910* | Oyster Cove, Md..... | J-442..... | i, 334 |
| Owens Br., Ky..... | DD-122..... | i, 960 | | J-459..... | i, 334 |
| Owens Cr., Mo.: | | | Oyster Cr., Conn.: | | |
| (See notes, ii, 2824.) | | | Bridges..... | | ii, 2213 |
| Owl Bayou, La..... | S-49..... | i, 681 | Oyster Cr., Ga..... | O-84..... | i, 533 |
| Owl Branch, Md..... | J-1014..... | i, 338 | | O-88..... | i, 533 |
| Owl Cr., Colo..... | GG-1041..... | i, 1033 | Oyster Cr., Mass..... | B-221..... | i, 70 |
| (See notes, ii, 2820.) | | | | C-4..... | i, 107 |
| Owl Cr., Mo..... | GG-218..... | i, 1026 | Oyster Cr., Md..... | J-198..... | i, 332 |
| | GG-226..... | i, 1026 | | J-227..... | i, 332 |
| | GG-1423..... | i, 1036 | | J-1241..... | i, 340 |
| (See notes, ii, 2823, 2824.) | | | Oyster Cr., N. C..... | M-24..... | i, 454 |
| Owl Cr., Nebr..... | GG-1131..... | i, 1034 | | M-36..... | i, 454 |
| Owl Cr., S. Dak. and Wyo.: | | | | M-120..... | i, 455 |
| (See notes, ii, 2817, 2818.) | | | | M-227..... | i, 456 |
| Owl Cr., Va..... | L-215..... | i, 412 | | M-269..... | i, 456 |
| Owl Cr., Wyo..... | GG-686..... | i, 1030 | | M-240..... | i, 456 |
| Owl Feather Cr., S. Dak.. | GG-826..... | i, 1031 | Oyster Cr., N. J.: | | |
| (See notes, ii, 2818.) | | | Bridges..... | | ii, 2213 |
| Owl or Moreau R., S. Dak. | GG-802..... | i, 1031 | Oyster Cr., Tex..... | U-39..... | i, 735, 760 |
| (See notes, ii, 2824.) | | | | U-5-a..... | i, 736 |
| Owl R..... | (GG-2)..... | i, 1039* | Appro..... | | ii, 2295 |
| Owl R., S. Dak..... | GG-2..... | i, 1037 | Oyster Cr., Va..... | K-170..... | i, 374 |
| (See notes, ii, 2818.) | | | Oyster H., N. Y..... | F-12..... | i, 215 |
| Owl's Head B., Me..... | A-146..... | i, 28 | Oyster H., Va..... | L-62-b..... | i, 415 |
| Owl'shead H., Me..... | A-146-a..... | i, 45 | Oyster Isld..... | (HH)..... | i, 1077* |
| Appro..... | | ii, 2287 | Oyster R., Conn..... | D-40..... | i, 141 |
| Owyhee R., Oreg..... | VV-89..... | i, 1593 | Bridges..... | | ii, 2233 |
| Oxen Cr., Md..... | K-84..... | i, 373 | Oyster R., N. H..... | A-287..... | i, 29, 63 |
| Oxide Cr., Kans..... | GG-1353..... | i, 1035 | Ozark, Ark..... | Y-2-c..... | i, 820 |
| (See notes, ii, 2823.) | | | Ozaukee (see Port Wash- ington, Wis.): | | |
| Ox Portage..... | (HH)..... | i, 1077 | Appro..... | | ii, 2298 |
| Ox Swamp, S. C..... | N-94..... | i, 499 | Ozette R., Wash..... | XX-37..... | i, 1655 |

P

| | | | | | |
|----------------------------|-------------|----------------|----------------------------|--------------|-------------------|
| Pablo Cr., Fla..... | P-82..... | i, 569 | Padra Bayou, La..... | S-153..... | i, 682 |
| Bridges..... | | ii, 2214 | Paducah..... | (CC)..... | i, 910* |
| Pace Cr., Ky..... | DD-46..... | i, 959 | Paducah, Ky..... | AA-18..... | i, 855 |
| Pacet Chan., Fla..... | P-191..... | i, 570 | Paducah, Ky., Tennessee | | |
| Pacheco Slough, Cal.: | | | R..... | BB-4..... | i, 891 |
| Bridges..... | | ii, 2214 | Pagan Cr., Va..... | L-160..... | i, 412, 427 |
| Pacific Coast Harbors of | | | Pagan R., Va..... | L-160..... | i, 427 |
| Refuge..... | TT-1-a..... | i, 1556 | Appro..... | | ii, 2291 |
| Appro..... | | ii, 2300 | Navigation rules..... | | ii, 2041, 2107 |
| Pacific Division, Engineer | | | Wrecks..... | | ii, 2274 |
| Department..... | | ii, 2039, 2047 | Page Cr., Kans..... | GG-1333..... | i, 1035 |
| Pacific Division, Field | | | Pagle Lake, La..... | S-480..... | i, 685 |
| Service..... | | ii, 2039, 2049 | Paging, Annual Reports, | | |
| Pacolat R., S. C..... | N-166..... | i, 500 | Chief of Engineers, U. | | |
| Paddy Piddles Cove, Md.. | J-537..... | i, 335 | S. Army..... | | i, 16; ii, (viii) |
| Paddy Run..... | (CC)..... | i, 910* | Paidletons Cr., Ga..... | O-253..... | i, 535 |
| Paddy Run, Pa..... | J-768..... | i, 336 | Paloalo Chan., Hawaii..... | YY-53..... | i, 1685 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|---|
| Paint Cr., Ky..... | DD-231..... | i, 960 | Pamunkey R., Va..... | K-311..... | i, 375, 406 |
| Paint Cr., Ohio..... | DD-403..... | i, 962 | Appro..... | | ii, 2291 |
| | DD-473..... | i, 962 | Bridges..... | | ii, 2214 |
| | DD-474..... | i, 962 | Wrecks..... | | ii, 2274 |
| | DD-475..... | i, 962 | Panama Canal..... | | i, 10, 13; ii, 2357 |
| Paint Cr., W. Va..... | EE-74..... | i, 983 | (All the matter belong- ing to this subject is arranged in a-b-c or- der, beginning with ii, 2357.) | | |
| Painted Woods Cr., N. Dak..... | GG-396..... | i, 1028 | Forts..... | | ii, 1796, 1823, 2032, 2476, 2090 |
| (See notes, ii, 2815.) | | | Panasoffkee Outlet, Fla... | P-344..... | i, 571 |
| Painters Cr., Mo.: (See notes, ii, 2824.) | | | Forts..... | | ii, 1796, 1823, 2032, 2040, 2090, 2476 |
| Paint Lick, Ky..... | DD-12..... | i, 959 | Panasoffkee Run, Fla..... | P-344..... | i, 571 |
| Paint Rock Cr., Tenn..... | AA-86..... | i, 849 | Panay Isld., P. I..... | YY-135..... | i, 1686 |
| Paint Rock R., Ala. and Tenn..... | AA-202..... | i, 849 | Pantego Cr., N. C..... | M-58..... | i, 454 |
| Pajaro R., Cal..... | T-T-9..... | i, 1555 | Bridges..... | | ii, 2214, 2220 |
| Palacios, Tex., to Mata- gorda B. (channel)..... | U-53-a..... | i, 766 | Panther Branch, Md..... | J-1027..... | i, 338 |
| Palapag, P. I..... | YY-111..... | i, 1686 | Panther Cr., Mo..... | GG-1503..... | i, 1036 |
| Palatka to Jacksonville, St. Johns R., Fla..... | P-10-c..... | i, 579 | Panther Cr., Ohio..... | DD-462..... | i, 962 |
| Palatka to Lake Harney, St. Johns R., Fla..... | P-10-d..... | i, 580 | Panther Cr., Tenn..... | AA-125..... | i, 849 |
| Palawan Isld., P. I..... | YY-140..... | i, 1686 | | AA-235..... | i, 850 |
| Paling Cr., N. C..... | L-279..... | i, 413 | Panther Cr., W. Va..... | DD-303..... | i, 961 |
| Palix R., Wash..... | XX-7..... | i, 1655 | Panther Forest..... | (HH)..... | i, 1077* |
| Bridges..... | | ii, 2214 | Papillon R., Nebr..... | GG-949..... | i, 1032 |
| Palmas Altas H., P. R..... | YY-26-b..... | i, 1688 | (See notes, ii, 2819.) | | |
| Palmasola B., Fla..... | P-294..... | i, 571 | Papoose Lake..... | (HH)..... | i, 1077* |
| Palm Beach, Fla..... | P-146..... | i, 587 | Papscanee Cr., N. Y..... | E-50..... | i, 177 |
| Palm Beach H., Fla..... | P-146..... | i, 570 | Papys Bayou, Fla..... | P-312..... | i, 571 |
| Palmer Cr., Mo..... | GG-131..... | i, 1026 | Paquet Bayou, La..... | S-12..... | i, 681 |
| (See notes, ii, 2813.) | | | Paradise Cr., Kans.: (See notes, ii, 2822.) | | |
| Palmers Cove, Mass..... | B-103..... | i, 70 | Paradise Cr., Va..... | L-179..... | i, 412 |
| Palmetto Cr., La..... | S-830..... | i, 688 | Paradise Cut, Cal..... | UU-19..... | i, 1577 |
| Palmyra..... | (HH)..... | i, 1077* | Paradise or Little Snow Cr., Mont..... | GG-605..... | i, 1029 |
| Palouse Rapids..... | (WW-2)..... | i, 1617* | (See notes, ii, 2817.) | | |
| Palouse R., Wash. and Idaho..... | VV-97..... | i, 1594 | Paradise Cr., Va.: Bridges..... | | ii, 2214 |
| Pamet R., Mass..... | B-207..... | i, 70 | Harbor lines..... | | ii, 2259 |
| Pamlico R., N. C..... | M-66..... | i, 454, 460 | Parallel, Fortieth: Explorations..... | | ii, 2040, 2086 |
| | M-66-a..... | i, 460 | Parcerdue Bayou, La..... | S-711..... | i, 687 |
| | M-66-c..... | i, 461 | Parish Cr., Md..... | J-1276..... | i, 340, 369 |
| Appro..... | | ii, 2292 | Parker Branch, Md..... | K-989..... | i, 338 |
| Bridges..... | | ii, 2214 | Parker Branch, Mo..... | GG-145..... | i, 1026 |
| Harbor lines..... | | ii, 2259 | | GG-151..... | i, 1026 |
| Wrecks..... | | ii, 2274 | Parker Cr., Md..... | J-1278..... | i, 340 |
| Pamlico R. to Bay R., N. C. (waterway)..... | M-123-a..... | i, 465 | | K-5..... | i, 373 |
| Pamlico Sound, N. C..... | L-173-b..... | i, 438 | Parker Cr., N. C..... | M-82..... | i, 454 |
| | M-28..... | i, 454 | Parker Cr., Va..... | L-3..... | i, 411 |
| | M-28-a..... | i, 459 | Parker R., Mass..... | B-53..... | i, 69 |
| | M-28-b..... | i, 459 | Parkersburg..... | (CC)..... | i, 910* |
| Appro..... | | ii, 2292 | Parkers Cr., N. J..... | G-55..... | i, 247 |
| Wrecks..... | | ii, 2274 | Parkers Cove, Me..... | A-109..... | i, 28 |
| Pamlico Sound, N. C. (thoroughfare from Ce- dar Isld. B.)..... | M-231-a..... | i, 472 | Parkers Head H. and Chan., Me..... | A-238..... | i, 29 |
| Pamlico Sound to Beau- fort Inlet, N. C. (inland waterway)..... | M-205..... | i, 455, 471 | | A-238-a..... | i, 52 |
| | M-268..... | i, 456 | Parkers R., Mass..... | C-8..... | i, 107 |
| Navigation rules..... | | ii, 2041, 2107 | Wrecks..... | | ii, 2274 |
| Pamunkey Cr., Md..... | K-81..... | i, 373 | Park Lake..... | (HH)..... | i, 1077* |
| | | | Park R., Conn..... | D-36..... | i, 141 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|------------------------------|-------------------|---|------------------------|-------------------|
| Park R., Middle Branch, N. Dak. | KK-176..... | i, 1248 | Passaic R., N. J.—Con. | | |
| Park R., North Branch, N. Dak. | KK-175..... | i, 1248 | Appro..... | ..ii, 2290 | |
| Park R., N. Dak. | KK-173..... | i, 1248 | Bridges..... | ..ii, 2173, 2214, 2215 | |
| Park R., South Branch, N. Dak. | KK-177..... | i, 1248 | Harbor lines..... | ..ii, 2259 | |
| Parks Cr., Mo. | GG-1522..... | i, 1037 | Wrecks..... | ..ii, 2274 | |
| Parks, District of Colum- bia | ..ii, 2040, 2070, 2071, 2085 | | Passaic R., N. J. (above Newark) | G-16-a.....i, 248 | |
| Parks, National | ..ii, 2040 | | G-16-b..... | i, 249 | |
| Crater Lake..... | ..ii, 2040, 2096 | | Passaic R., N. J. (below Newark) | G-16-c.....i, 250 | |
| Mt. Rainier..... | ..ii, 2041, 2118 | | Pass a Loutre | (HH).....i, 1077* | |
| Parks Run, Md. | J-1037..... | i, 338 | Pass a Loutre Crevasse, La. | S-277.....i, 683 | |
| Parkville | (GG-2)..... | i, 1039* | Pass a Loutre, La. | S-213.....i, 628 | |
| Parrotts Cr., Va. | K-221..... | i, 374 | Pass au Herons, Ala. | R-53.....i, 664 | |
| Parsonage Cr., N. Y. | F-68..... | i, 215, 229 | Pass aux Herons, Ala. | R-53.....i, 646 | |
| Bridges..... | ..ii, 2214 | | Pass Cavallo H. | U-2-b.....i, 735 | |
| Parson Cr., Md. | K-44..... | i, 373 | U-58-a..... | i, 767 | |
| Parsons Bar | (HH)..... | i, 1077* | Pass Cavallo Inlet | U-58-a.....i, 767 | |
| Parsons Cr., Ga. | O-442..... | i, 536 | Pass Cavallo, Tex. | U-58.....i, 735 | |
| Parsons Cr., Md. | J-234..... | i, 332 | Appro..... | ..ii, 2295 | |
| Parsons Cr., Mo.: | | | Pass Cavallo to Aransas Pass, Tex. | U-38-f.....i, 759 | |
| (See notes, ii, 2813.) | | | Pass Cavallo to Port La- vacca, Tex. (channel) | U-56-b.....i, 767 | |
| Parsons Cr., Va. | L-130..... | i, 412 | Pass Cavallo to Port O'Connor, Tex. (chan- nel) | U-58-b.....i, 768 | |
| Partridge Cr., Va. | L-88..... | i, 412 | Pass Cr., S. Dak. | GG-870.....i, 1031 | |
| Partridge Isld., Mich. | LL-51..... | i, 1265 | GG-891..... | i, 1032 | |
| Partridge R., Minn. | KK-114..... | i, 1248 | (See notes, ii, 2819.) | | |
| Pascagoula H., Miss. | R-63..... | i, 664 | Pass Cr., Wyo. | GG-1050.....i, 1033 | |
| R-63-a..... | i, 665 | | (See notes, ii, 2820.) | | |
| Wrecks..... | ..ii, 2274 | | Passerdyke Cr., Md. | J-91.....i, 331 | |
| Pascagoula R., Ala. | R-63..... | i, 646, 664 | Passes, Mississippi R. | V.....i, 779 | |
| R-63-a..... | i, 665 | | (HH)..... | i, 1077* | |
| R-63-c..... | i, 666 | | (See notes, ii, 2827, 2828, 2831.) | | |
| Pascagoula R. and H., Miss.: | | | Pass Fourchon, La. | S-417.....i, 684 | |
| Appro..... | ..ii, 2294 | | Pass Manchac, La. | S-45.....i, 681 | |
| Pascagoula R., Miss.: | | | Appro..... | ..ii, 2294 | |
| (See notes, ii, 2803.) | | | Pass Manchac (vicinity of) | S-8.....i, 688 | |
| Bridges..... | ..ii, 2214 | | Pass Marianne, Miss.: | | |
| Navigation rules..... | ..ii, 2041, 2107 | | Wrecks..... | ..ii, 2274 | |
| Pascagoula R., Miss. (above mouth of Dog R.) | R-63-d..... | i, 667 | Pataganset R., Conn. | D-21.....i, 141 | |
| Pascagoula Ship Chan., Ala. | R-62..... | i, 646 | Patapco R., Md. | J-1079.....i, 339 | |
| Pascal Cr., S. Dak. | GG-819..... | i, 1031 | Bridges..... | ..ii, 2215 | |
| (See notes, ii, 2818.) | | | Harbor lines..... | ..ii, 2259 | |
| Passig R., P. I. | YY-100-a..... | i, 1691 | Wrecks..... | ..ii, 2274 | |
| Passquotank R., N. C. | L-264..... | i, 413, 441 | Patapco R., Md. (west branch from Light Street Br. to head of tidewater) | J-1079-a.....i, 365 | |
| L-173-n..... | i, 438 | | Patchogue R., Conn. | D-42.....i, 141 | |
| Appro..... | ..ii, 2291 | | Bridges..... | ..ii, 2215, 2233 | |
| Bridges..... | ..ii, 2214 | | Harbor lines..... | ..ii, 2259 | |
| Harbor lines..... | ..ii, 2259 | | Patchogue R., N. Y. | F-57.....i, 215 | |
| Wrecks..... | ..ii, 2274 | | Patcong Cr., N. J.: | | |
| Passagasawakeag R., Me. | A-139..... | i, 28 | Bridges..... | ..ii, 2215 | |
| (See notes, ii, 2783.) | | | Pates Cr., Wyo. | GG-1061.....i, 1033 | |
| Bridges..... | ..ii, 2214 | | Pat Glennon Bayou, La.: | | |
| Passage Key Inlet, Fla. | P-285..... | i, 571 | (See notes, ii, 2805.) | | |
| Pass A Grille, Fla. | P-317..... | i, 571 | | | |
| Passaic R., N. J. | G-16..... | i, 247, 248 | | | |
| G-16-d..... | i, 250 | | | | |

(See notes, ii, 2793.)

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Patoka R., Ind. | BB-24..... | i, 891 | Pea R., Ala. | Q-34..... | i, 611, 628 |
| | BB-23..... | i, 898 | Pearl Branch, Md. | J-448..... | i, 334 |
| Patout Canal, La. | S-703..... | i, 687 | Pearl Cr., La. | T-2-y..... | i, 717 |
| Patron Cr., Tex.: (See notes, ii, 2806.) | | | (See notes, ii, 2805.) | | |
| Patsaliga R., Ala. | Q-44..... | i, 611, 632 | Pearl Cr., S. Dak. | GG-308..... | i, 1027 |
| (See notes, ii, 2801.) | | | (See notes, ii, 2815.) | | |
| Pattaguomscott R., R. I. | C-96..... | i, 108 | Pearl H., Hawaii. | YY-46-a..... | i, 1689 |
| Pattens B., Me. | A-64..... | i, 27 | (See notes, ii, 2846.) | | |
| Patterson Slough, Cal. | TT-49..... | i, 1555 | Appro..... | ii, 2282, 2301 | |
| Patton, Ark. | (HH)..... | i, 1077* | Forts..... | ii, 1823 | |
| Patton Run. | (CC)..... | i, 910* | Harbor lines..... | ii, 2259 | |
| Pattys Branch, Md. | J-11..... | i, 331 | Pearl Lake, La. | S-575..... | i, 686 |
| Patuxent R., Md. | K-7..... | i, 373, 375 | Pearl R., Hawaii. | YY-46..... | i, 1685 |
| Appro..... | ii, 2291 | | Pearl R., La. (east mouth) | R-105..... | i, 647 |
| Bridges..... | ii, 2215 | | Pearl R., La. (west mouth) | R-104..... | i, 647 |
| Paul Bayou, La. | S-110..... | i, 682 | Pearl R., Miss. and La. | R-98..... | i, 647, 674 |
| Pauls Cr., Ky. | DD-91..... | i, 959 | (See notes, ii, 2803.) | | |
| Pauls Cr., Va. | L-186..... | i, 412 | Appro..... | ii, 2294 | |
| Pawcatuck R., R. I. and Conn. | D-1..... | i, 141, 142 | Bridges..... | ii, 2215 | |
| (See notes, ii, 2788.) | | | Pease Cr., Fla. | P-260..... | i, 595 |
| Appro..... | ii, 2289 | | Appro..... | ii, 2293 | |
| Pawnee Cr., Colo. | GG-1082..... | i, 1033 | Pease Cr., Mont. | GG-648..... | i, 1030 |
| (See notes, ii, 2820.) | | | (See notes, ii, 2817.) | | |
| Pawnee Cr., Nebr. | GG-980..... | i, 1032 | Pease R., Fla. | P-260..... | i, 595 |
| Pawpaw Cove, Md. | J-356..... | i, 333 | Peat Cr., Kans. | GG-1279..... | i, 1035 |
| Paw Paw Cr., Kans. | GG-1380..... | i, 1035 | (See notes, ii, 2822.) | | |
| Paw Paw Cr., Ky. | DD-56..... | i, 959 | Peavine Branch, Mo. | GG-153..... | i, 1026 |
| Paw Paw Cr., S. C. | N-108..... | i, 500 | Pebble Cr., N. Dak. | GG-751..... | i, 1031 |
| Paw Paw R., Mich. | OO-12..... | i, 1377 | (See notes, ii, 2818.) | | |
| Bridges..... | ii, 2215 | | Pecan Pt. | (HH)..... | i, 1077* |
| Pawtucket R., R. I. | C-83..... | i, 107, 128 | Pecan Pt. Crossing (HH): (See notes, ii, 2832.) | | |
| (See notes, ii, 2787.) | | | Pecatonica R., Ill. | JJ-21..... | i, 1234 |
| Appro..... | ii, 2288 | | Pecatonica R., Wis. and Ill. | JJ-21..... | i, 1241 |
| Bridges..... | ii, 2215 | | Peckenpaugh. | (CC)..... | i, 910* |
| Harbor lines..... | ii, 2259 | | Peck Lake, Fla. | P-134..... | i, 570 |
| Wrecks..... | ii, 2274 | | Peck Lake, Fla.-Great Pocket (canal between). | P-132..... | i, 570 |
| Pawtuxet Cove, R. I. | C-84..... | i, 107, 130 | Peconic B., Jamaica B., and Great South B., N. Y. (waterway con- necting). | F-48-b..... | i, 227 |
| (See notes, ii, 2787.) | | | Peconic Canal, N. Y.: Bridges..... | ii, 2231 | |
| Pawtuxet H., R. I. | C-85..... | i, 107, 130 | Peconic R., N. Y. | F-38..... | i, 215, 224 |
| (See notes, ii, 2787.) | | | Appro..... | ii, 2289 | |
| Pawtuxet R., R. I. | C-86..... | i, 107, 130 | Pecos R., Tex. and N. Mex. | U-76..... | i, 735 |
| Parton Cr., Pa. | J-594..... | i, 335 | Peddler Run, Md. | J-923..... | i, 338 |
| Pay Bayou, La. | S-548..... | i, 686 | Pedee Cr., Mo. | GG-165..... | i, 1026 |
| Paynes Cr., Va. | K-184..... | i, 374 | | GG-229..... | i, 1026 |
| Peace Cr., Fla. | P-260..... | i, 571, 595 | (See notes, ii, 2814.) | | |
| | P-258-a..... | i, 594 | Pedernales R., Tex. | U-52..... | i, 735 |
| Appro..... | ii, 2293 | | Peekskill B., N. Y.: Bridges..... | ii, 2216 | |
| Peace R., Fla. | P-260..... | i, 571, 595 | Peekskill Cr., N. Y. | E-36..... | i, 177 |
| | P-258-a..... | i, 594 | Peekskill H., N. Y. | E-35..... | i, 177, 197 |
| Bridges..... | ii, 2215, 2246 | | Appro..... | ii, 2289 | |
| Peachblossom Cr., Md. | J-327..... | i, 333 | Peggys Run, Md. | J-1023..... | i, 338 |
| Peach Bottom Cr., Va. | EE-94..... | i, 983 | Pelham B., N. Y. | E-14..... | i, 177 |
| Peach Orchard Cr., Md. | J-1087..... | i, 339 | Pelican Bend. | (GG-2)..... | i, 1039* |
| Peacock Spft. | (WW-2)..... | i, 1617* | Pelican Cr. | (HH)..... | i, 1077* |
| Peak Cr., Va. | EE-90..... | i, 983 | | | |
| Peaks Isld. and Great Diamond Isld., Me. (passage between)..... | A-262-a..... | i, 55 | | | |
| Pearce Cr., Md. | J-515..... | i, 335 | | | |
| | J-525..... | i, 335 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------|---------------------------------------|---------------------|-------------------|
| Pelican Cr., Mont. | GG-661..... | i, 1030 | Pentwater H., Mich. | OO-41..... | i, 1377, 1400 |
| Pelican Lake, La. | S-464..... | i, 685 | Appro..... | | ii, 2298 |
| Pelican R. | (HH)..... | i, 1077* | Navigation rules..... | | ii, 2041, 2107 |
| Pelican R., Minn. | KK-191..... | i, 1248 | Pentwater R., Mich. | OO-42..... | i, 1377 |
| Pelletiers Cr., N. C. | M-278..... | i, 456 | Peoples Cr., Mont. | GG-453..... | i, 1028 |
| Pellicers Cr., Fla. | P-92..... | i, 569 | (See notes, ii, 2816.) | | |
| Pemaquid H., Me. | A-179..... | i, 28 | Peoria, Ill.: | | |
| Pemaquid R., Me. | A-180..... | i, 28 | Harbor lines..... | | ii, 2259 |
| Pembina R., N. Dak. | KK-171..... | i, 1248 | Peoria Lake, Ill.: | | |
| Pembroke Cr., N. C. | L-297..... | i, 413 | Harbor lines..... | | ii, 2259 |
| Pembroke H., Me. | A-6..... | i, 27 | Pepin. | (HH)..... | i, 1077* |
| | A-6-a..... | i, 31 | Pepper Cr., Nebr. | GG-915..... | i, 1032 |
| Pemigewasset R., N. H. | B-27..... | i, 69 | (See notes, ii, 2819.) | | |
| Penasoffkee Outlet: | | | Pepper Cr., Va. | K-264..... | i, 375 |
| Bridges..... | | ii, 2216 | Pepperells Cove, Me. | A-281..... | i, 29, 61 |
| Penchant Bayou, La. | S-497..... | i, 685 | Appro..... | | ii, 2288 |
| Penconning R., Mich. | PP-62..... | i, 1419 | Pequaming, Mich. | LL-47..... | i, 1265 |
| Pend Orelle | (WW-2)..... | i, 1617* | Pequea Cr., Pa. | J-566..... | i, 335 |
| Pend Orelle R., Idaho and | | | Pequonnock R., Conn.: | | |
| Wash..... | XX-110..... | i, 1656 | Bridges..... | | ii, 2216 |
| | XX-110-a..... | i, 1676 | Perch Cr., Md. | J-538..... | i, 335 |
| Appro..... | | ii, 2301 | Percys. | (WW-2)..... | i, 1617* |
| Bridges..... | | ii, 2216 | Percys Cr., Miss. | S-279..... | i, 683 |
| Pend O'Reille R., Mont. | XX-110-b..... | i, 1677 | Percys Isld. | (WW-2)..... | i, 1617* |
| Penhorn Cr., N. J. | G-7..... | i, 247 | Percys Slough. | (WW-2)..... | i, 1617* |
| Penitentiary Pt. | (HH)..... | i, 1077* | Perdido B., Fla. and Ala. | Q-47..... | i, 611 |
| Pennamaquam R. (Pembroke H.), Me. | A-6..... | i, 27 | Perdido R., Ala. and Fla. | Q-48..... | i, 611 |
| Penn Cr., Pa. | J-844..... | i, 337 | Bridges..... | | ii, 2216 |
| Pennichuck Brook, N. H. | B-39..... | i, 69 | Pere Marquette R., Mich. | OO-43..... | i, 1402 |
| Pennsylvania. | (CC)..... | i, 910* | Appro..... | | ii, 2298 |
| Forts..... | | ii, 1807, 1816 | Pere Marquette R., Mich. | OO-44..... | i, 1377 |
| Pennsylvania line. | (CC)..... | i, 910* | Perico Bayou, Fla. | P-295..... | i, 571 |
| Pennypack Cr., Pa. | H-17..... | i, 271 | Permanent International | | |
| Bridges..... | | ii, 2216 | Association of Navigation | | |
| Penobscot B., Me.: | | | Congresses: | | |
| Wrecks..... | | ii, 2274 | Appro..... | | ii, 2283 |
| Penobscot R., Me. | A-101..... | i, 28, 38 | Perot Bayou, La. | S-364..... | i, 684 |
| (See notes, ii, 2783.) | | | Perquimans R., N. C. | L-285..... | i, 413, 442 |
| Appro..... | | ii, 2287 | Appro..... | | ii, 2291 |
| Forts..... | | ii, 1841 | Perriwig Bar, N. J. and | | |
| Harbor lines..... | | ii, 2259 | Pa..... | H-3-n..... | i, 286 |
| Pensacola B. | Q-39..... | i, 611 | Perry Cr., Iowa | GG-273..... | i, 1027 |
| | Q-42..... | i, 611 | (See notes, ii, 2814.) | | |
| | Q-45..... | i, 611 | Perry Cr., La. | R-98-m..... | i, 647 |
| | Q-38..... | i, 611 | Perry Towhead. | (HH)..... | i, 1077* |
| Pensacola B., Fla. | | | Persimmon Cr., Md. | K-30..... | i, 373 |
| Pensacola B., Fla., to Bon | | | Perth Amboy, N. J.: | | |
| Secour B., Ala. (canal).... | Q-46..... | i, 632 | Harbor lines..... | | ii, 2259 |
| Pensacola B. to Bon Se- | | | Perugue Isld. | (HH)..... | i, 1077* |
| cour B., Ala. (canal)..... | Q-46..... | i, 611 | Peruque (HH): | | |
| Pensacola H., Fla. | Q-38..... | i, 611, 628 | (See notes, ii, 2827.) | | |
| (See notes, ii, 2801.) | | | Peruque Isld. (HH): | | |
| Appro..... | | ii, 2293 | (See notes, ii, 2827.) | | |
| Forts..... | | ii, 1796, 1823, 1965 | Pescadero Cr., Cal. | TT-12..... | i, 1555 |
| Harbor lines..... | | ii, 2259 | Pescara Cr., Va. | I-194..... | i, 412 |
| Wrecks..... | | ii, 2274 | Peshaw Cr., Mo. | GG-1493..... | i, 1036 |
| Pensaukee H. and R., | | | (See notes, ii, 2824.) | | |
| Wis..... | MM-13-a..... | i, 1304 | Peshtigo R., Wis. | MM-11..... | i, 1297 |
| Appro..... | | ii, 2298 | Petaluma Cr., Cal. | TT-121..... | i, 1556, 1567 |
| Pensaukee R., Wis. | MM-13..... | i, 1297 | Appro..... | | ii, 2300 |
| Pensauken Cr., N. J. | I-52..... | i, 299, 312 | Bridges..... | | ii, 2216 |
| Bridges..... | | ii, 2216, 2230 | Wrecks..... | | ii, 2274 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|------------------------------------|---------------------|----------------------------|
| Peter Cr., Kans. | GG-1226..... | i, 1034 | Philadelphia, Pa. (estab- | | |
| Peter Cr., Ky. | DD-300..... | i, 961 | ishment and regula- | | |
| Peter Mashews Cr., N. C. | M-19..... | i, 454 | tion of port wardens' | | |
| Petersburg, Va., Appo- | | | line). | H-3-l..... | i, 285 |
| mattox R. | L-150..... | i, 424 | Philadelphia, Pa., to Tren- | | |
| Peters Cr., Kans. | GG-1159..... | i, 1034 | ton, N. J., Delaware R. | H-3-d..... | i, 281 |
| (See notes, ii, 2821.) | | | Philadelphia, Pa., to | | |
| Peters Cr., La. | R-98-f..... | i, 647 | mouth of Delaware R. | H-3-c..... | i, 278 |
| Peters Cr., Md. | J-114..... | i, 332 | Philadelphia Pt. | (HH)..... | i, 1077* |
| Peters Cr., S. C. | N-75..... | i, 499 | Philip Cr., Md. | J-468..... | i, 334 |
| Peters Cr., Va. | K-195..... | i, 374 | Philippines (The). | YY-86..... | i, 1683 |
| Peters Cr., W. Va. | EE-122..... | i, 984 | | YY..... | i, 1686 |
| Peters Crossing | (HH)..... | i, 1077* | Appro. | | ii, 2301 |
| (See notes, ii, 2832.) | | | Estimates, contingencies | | ii, 2039, 2042 |
| Peters Neck B., N. Y. | F-32..... | i, 223 | Field service | | ii, 2039, 2049 |
| Peters Neck (Long Beach) | | | Forts | | ii, 1796, 1809, 1810, 2034 |
| B., N. Y. | F-32..... | i, 215 | Military structures | | ii, 2041, 2134 |
| Peterson Run, Md. | J-1040..... | i, 338 | Searchlights | | ii, 1811 |
| Petersons Cr., S. Dak. | GG-365..... | i, 1028 | Sites | | ii, 1813 |
| (See notes, ii, 2815.) | | | Torpedo structures, etc. | | ii, 1812 |
| Peter Toreys Cr., Ga. | O-121..... | i, 534 | Phillippe Cr., Fla. | P-281..... | i, 571 |
| Petit Ance Bayou, La. | S-707..... | i, 711 | Phillips Cr., Md. | J-243..... | i, 332 |
| Petit Anse Bayou, La. | S-707..... | i, 687, 711 | Phillis Cr., S. C. | N-45..... | i, 499 |
| Petit Anse Canal, La. | S-710..... | i, 687 | Phillis Isld. | (CC)..... | i, 910* |
| Petit Bayou, La. | S-379..... | i, 684 | Phinholoway Cr., Ga. | O-410..... | i, 536 |
| Petite Saline Cr., Mo. | GG-1440..... | i, 1036 | Phoenix Cr., Pa. | J-759..... | i, 336 |
| (See notes, ii, 2823.) | | | Phoenix, Fort | | ii, 1866 |
| Petit Saline Cr. | (GG-2)..... | i, 1039 | Physical Characteristics, | | |
| Petit Jean R., Ark. | Y-21..... | i, 818, 825 | Rivers and Harbors. | | i, 22 |
| (See notes, ii, 2808.) | | | Plankatank R., Va. | K-235..... | i, 375, 402 |
| Appro. | | ii, 2295 | Wrecks | | ii, 2274 |
| Bridges | | ii, 2216 | Piasa Dam | (HH)..... | i, 1077* |
| Petit Passe Bayou, La. | S-645..... | i, 686 | Piasa Isld. | (HH)..... | i, 1077* |
| Petit Prairie Bayou, La. | S-583..... | i, 686 | Picayune Bayou | (HH)..... | i, 1077* |
| Petoskey H., Mich. | OO-62..... | i, 1377, 1414 | Piccowaxton Cr., Md. | K-73..... | i, 373 |
| (See notes, ii, 2838.) | | | Pickers, Fort | | ii, 1802, 1965 |
| Appro. | | ii, 2298 | Pickering Cr., Md. | J-384..... | i, 334 |
| Navigation rules | | ii, 2041, 2107 | Pico Cr., Ga. | O-231..... | i, 534 |
| Petoskey, Mich. (harbor | | | (See notes, ii, 2798.) | | |
| of refuge near). | OO-61..... | i, 1413 | Picowaxton Cr., Md.: | | |
| Petoskey, Mich. (inland | | | (See notes, ii, 2795.) | | |
| route to Cheboygan, | | | Piedras R., P. R. | YY-3..... | i, 1685 |
| Mich.) | OO-62-b..... | i, 1414 | Pierce Branch, Md. | J-998..... | i, 338 |
| Petoskey to Cheboygan, | | | Pierces Cr., N. C. | M-155..... | i, 455 |
| Mich. | PP..... | i, 1419 | Pierre | (GG-2)..... | i, 1039* |
| Petoskey to Cheboygan, | | | Pierre Bayou, La. | S-567..... | i, 686 |
| Mich. (inland water- | | | | X-49..... | i, 785, 813 |
| way). | PP-32-a..... | i, 1432 | Appro. | | ii, 2295 |
| Peuokahi H., H. I.: | | | Pierre Bayou, Miss. | X-2..... | i, 785 |
| (See notes, ii, 2846.) | | | Appro. | | ii, 2295 |
| Peytonia Slough, Cal. | TT-96..... | i, 1555 | Pierre Cr., S. Dak. | GG-304..... | i, 0127 |
| Phelps Slough, Cal. | TT-24..... | i, 1555 | Pierre Lake Bayou, La. | S-568..... | i, 686 |
| Philadelphia, Pa.: | | | Pierre, S. Dak. | (GG-2)..... | i, 1037* |
| Appro. | | ii, 2287 | Pigeon B., Minn. | LL-2..... | i, 1265 |
| Forts | | ii, 1903 | | LL-60..... | i, 1265 |
| Harbor lines | | ii, 2259 | Pigeon Bayou, La. | S-603..... | i, 686 |
| Wrecks | | ii, 2274 | | S-606..... | i, 686 |
| Philadelphia, Pa., and | | | | S-298-a..... | i, 695 |
| Camden, N. J., (harbor | | | Pigeon Broad R., N. C. | | |
| between). | H-3-l..... | i, 285 | and Tenn.: | | |
| Philadelphia, Pa., district | H (with map)..... | i, 269 | Appro. | | ii, 2296 |
| (See notes, ii, 2794.) | | 270, 271 | Pigeon Cove, Mass. | B-78..... | i, 69 |
| Appro. | | ii, 2290 | Wrecks | | ii, 2274 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Pigeon Cr. | (GG-2)..... | i, 1039* | Pine Isld. Cr., Ga. | O-467..... | i, 536 |
| Pigeon Cr., Fla. | O-519..... | i, 537 | Pine Isld. Sound, Fla. | P-254..... | i, 571, 593 |
| Pigeon Cr., Ind. | BB-21..... | i, 891 | Pine Knoll | (HH)..... | i, 1077* |
| Pigeon Cr., Iowa | GG-257..... | i, 1027 | Pine Lake | (HH)..... | i, 1077* |
| (See notes, ii, 2814.) | | | Pine Lake, Mich. | OO-60..... | i, 1377 |
| Pigeon Cr., Md. | J-84..... | i, 331 | | OO-58..... | i, 1412 |
| Pigeon Cr., Ohio | DD-384..... | i, 962 | (See notes, ii, 2838.) | | |
| | DD-451..... | i, 962 | Appro. | | ii, 2298 |
| Pigeon Cr., Pa. | J-731..... | i, 336 | Bridges | | ii, 2216 |
| Pigeon Cr., S. C. | N-106..... | i, 500 | Pine Lake, Minn. and | | |
| Pigeon Cr., W. Va. | DD-323..... | i, 961 | Canada | KK-241..... | i, 1249 |
| Pigeon Hill B., Me. | A-31..... | i, 27 | Pine Rapids | (HH)..... | i, 1077* |
| Pigeon R., Mich. | OO-23-a..... | i, 1390 | Pine R. | (HH)..... | i, 1077* |
| | PP-38..... | i, 1419 | Pine R., Mich. | OO-59..... | i, 1377 |
| | PP-77..... | i, 1419 | | PP-26..... | i, 1419 |
| | PP-77-b..... | i, 1439 | | PP-60..... | i, 1419 |
| Pigeon R., Minn. | LL-3..... | i, 1265 | | PP-91..... | i, 1419 |
| Pigeon Roost Cr., N. C. | L-360..... | i, 414 | Appro. | | ii, 2299 |
| Pig Eye | (HH)..... | i, 1077* | Bridges | | ii, 2216 |
| Pig R. (mouth of) to | | | Pine R., Mich., Saginaw | | |
| Brook Neal | L-367-a..... | i, 447 | B. | PP-60..... | i, 1435 |
| Pigs Eye | (HH)..... | i, 1077* | Pine R., Mich., St. Clair | | |
| Pike Cr., Minn. | KK-117..... | i, 1248 | City | PP-91..... | i, 1446 |
| Pike Cr., Pa. | J-698..... | i, 336 | Pine R., Minn. | KK-102..... | i, 1248 |
| Pike Cr., Wis. | MM-37..... | i, 1297 | Pine R., Wis. | KK-10..... | i, 1247 |
| Bridges | | ii, 2216 | | KK-21..... | i, 1247 |
| Pike, Fort. | | ii, 1796, 1803 | Pines R., Mass. | B-111..... | i, 70 |
| Pike Isld. | (HH)..... | i, 1077* | Pinetree Cr., S. C. | N-116..... | i, 500 |
| Pilchers Pt. | (HH)..... | i, 1077* | Pine Tree Rapid | (WW-2)..... | i, 1617* |
| Pilchuck R., Wash. | XX-83..... | i, 1655 | Piney Branch, Md. | J-294..... | i, 333 |
| Pile Drivers, list | | ii, 2343 | Piney Cove, Md. | J-429..... | i, 334 |
| Piles Cr., N. J. | G-32..... | i, 247 | Piney Cr. Cove, Md. | J-544..... | i, 335 |
| Pilkingtton Bayou, Tex. | U-54..... | i, 735, 766 | Piney Cr., Md. | J-415..... | i, 334 |
| Pillager Cr., Minn. | KK-105..... | i, 1248 | | J-545..... | i, 335 |
| Pilottown Bayou, La. | S-234..... | i, 683 | | J-1028..... | i, 338 |
| Pilot, U. S. Coast; check- | | | Piney Cr., Mo. | GG-1527..... | i, 1087 |
| ing this Index | | i, 13 | (See notes, ii, 2824.) | | |
| Pineckney, Castle, S. C.: | | | Piney Cr., Pa. | J-872..... | i, 337 |
| Ports | | ii, 1808, 1940 | Piney Cr., Tenn. | AA-234..... | i, 850 |
| Pine Bend | (HH)..... | i, 1077* | Piney Cr., W. Va. | EE-80..... | i, 983 |
| Pine Bluff, Ark. | Y-2-c..... | i, 820 | Piney Isld. B., N. C. | L-250..... | i, 413 |
| (See notes, ii, 2808.) | | | Piney Isld. Cove, Md. | J-175..... | i, 332 |
| Pine Bluff, Arkansas R. | Y-2-h..... | i, 823 | Piney R., Tenn. | AA-177..... | i, 849 |
| Pine Chan., Fla. | P-193..... | i, 570 | Piney Run, Md. | J-1144..... | i, 339 |
| Pine Cr. | (HH)..... | i, 1077* | | J-1150..... | i, 339 |
| Pine Cr., Ala. | AA-199..... | i, 849 | Pinkham B., Me. | A-33..... | i, 27 |
| Pine Cr., Colo. | GG-1102..... | i, 1033 | Pinkham Cr., Colo. | GG-1043..... | i, 1033 |
| Pine Cr., Minn. | JJ-54..... | i, 1234 | Pinnacle Cr., W. Va. | EE-26..... | i, 983 |
| Pine Cr., Miss. | S-281..... | i, 683 | Pinnebog R., Mich. | PP-78..... | i, 1419 |
| Pine Cr., Mont. | GG-557..... | i, 1029 | | PP-78-a..... | i, 1440 |
| (See notes, ii, 2816.) | | | Pinoak Cr., Mo.: | | |
| Pine Cr., Nebr. | GG-921..... | i, 1032 | (See notes, ii, 2824.) | | |
| (See notes, ii, 2819.) | | | Pinole Cr., Cal. | TT-63..... | i, 1555 |
| Pine Cr., Pa. | J-607..... | i, 335 | Pinto Isld., Ala.: | | |
| | J-705..... | i, 336 | Harbor-lines | | ii, 2259 |
| | J-748..... | i, 336 | Pipe Cr., Kans.: | | |
| | J-845..... | i, 337 | (See notes, ii, 2822.) | | |
| Pine Cr., S. Dak.: | | | Pipe Cr., N. Y. | J-659..... | i, 336 |
| (See notes, ii, 2819.) | | | Piper Slough, Cal. | UU-10..... | i, 1577 |
| Pine Isld. | (HH)..... | i, 1077* | Pipstem Cr., N. Dak. | GG-317..... | i, 1027 |
| Pine Isld. Bayou, Tex.: | | | (See notes, ii, 2815.) | | |
| (See notes, ii, 2806.) | | | Piquant Bayou, La. | S-373..... | i, 864 |
| Bridges | | ii, 2216 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Piscataqua R., Me. and | | | Plaquemine Brule Bayou, | | |
| N. H. | A-280..... | i, 60 | La. (continued) | S-760..... | i, 712 |
| Appro..... | ..... | ii, 2288 | Appro..... | ..... | ii, 2294 |
| Bridges..... | ..... | ii, 2216 | Bridges..... | ..... | ii, 2216 |
| Piscataqua R. (Portsmouth H.), Me. and | | | Plaquemine (HH): | | |
| N. H. | A-280..... | i, 29 | (See notes, ii, 2831.) | | |
| Piscataquog R., N. H. | B-34..... | i, 69 | Plaquemine Lock, La. | | |
| Piscataway Cr., Md. | K-82..... | i, 373, 389 | (operating and care).... | S-298-c..... | i, 698 |
| Piscataway Cr., Va. | K-219..... | i, 374, 401 | Plat Bayou, La. | S-393..... | i, 684 |
| Bridges..... | ..... | ii, 2216 | Plates or views, engineering constructions..... | ..... | ii, 2625 |
| Piser Cr., Mont. | GG-489..... | i, 1029 | Platin (HH): | | |
| (See notes, ii, 2816.) | | | (See notes, ii, 2827.) | | |
| Pistol Cr., Ga. | O-38..... | i, 533 | Platin Rock (HH)..... | i, 1078* | |
| Pistol R., Oreg. | VV-6..... | i, 1593 | (See notes, ii, 2829.) | | |
| Pitcher Cr., Cal. | TT-189..... | i, 1556 | Platte Cr., S. Dak. | GG-360..... | i, 1028 |
| Pithlachascotee R., Fla. | P-329..... | i, 571 | (See notes, ii, 2815.) | | |
| (See notes, ii, 2799.) | | | Platte; Field service..... | ..... | ii, 2039, 2049 |
| Pithlochascotee R., Fla. | P-329..... | i, 603 | Platte R., Mo. and Iowa | (GG-2)..... | i, 1039* |
| Pitman Cr., Ky. | AA-282..... | i, 850 | (HH)..... | ..... | i, 1078* |
| Pitmans Cove, Va. | K-156..... | i, 374 | (See notes, ii, 2814.) | | |
| Pitmans Cr., N. C. | M-147..... | i, 455 | Platte R., Minn. | KK-72..... | i, 1247 |
| M-220..... | ..... | i, 455 | Platte R., Nebr. | GG-950..... | i, 1032 |
| Pittard Cr., N. C. | L-389..... | i, 414 | (GG-2)..... | ..... | i, 1037* |
| Pittsburgh | (CC)..... | i, 910* | (See notes, ii, 2819.) | | |
| Pittsburgh H., Pa. | FF-19..... | i, 1013 | Plattsburg | (GG-2)..... | i, 1039* |
| Pittsburgh, Pa. | FF-19..... | i, 1003 | Plattsburg H., N. Y. | E-86..... | i, 177, 204 |
| FF-20..... | ..... | i, 1015 | Appro..... | ..... | ii, 2289 |
| (See notes, ii, 2812.) | | | Plattsmouth | (GG-2)..... | i, 1039* |
| Appro..... | ..... | ii, 2297 | Pleasant B., Mass. | B-212..... | i, 70 |
| Harbor lines..... | ..... | ii, 2259, 2260 | Pleasant B., Me. | A-25..... | i, 27 |
| Pittsburgh, Pa., district | FF(with map) | i, 1001, 1003 | Pleasant Cove, Me. | A-193..... | i, 28 |
| (See notes, ii, 2812.) | | | A-223..... | ..... | i, 28 |
| Appro..... | ..... | ii, 2297 | Pleasant R., Me. | A-26..... | i, 27 |
| Pittsburgh, Pa. | FF-6-a..... | i, 1003 | Appro..... | ..... | ii, 2287 |
| Pittsburgh, Pa. (Junction at, of Allegheny and Monongahela Rs. with Ohio R.) | FF-5..... | i, 1003 | Wrecks..... | ..... | ii, 2274 |
| Pittsburgh Landing | (WW-2)..... | i, 1617* | Pleasant R., Me. (Columbia Falls to mouth) | A-26..... | i, 33 |
| Plaindealing Cr., Md. | J-330..... | i, 333 | Pleasant Run | (CC)..... | i, 910* |
| Planner Cove, Va. | J-42..... | i, 331 | Pleasant Stream, Pa. | J-742..... | i, 336 |
| Plans, Rivers and Harbor Improvements..... | ..... | i, 22 | Pleasant Valley Cr., Minn. | JJ-50..... | i, 1234 |
| Plantation Cr., Ga. | O-441..... | i, 536 | Pleasant Valley Landing: | | |
| O-439-a..... | ..... | i, 558 | Harbor lines..... | ..... | ii, 2259 |
| Appro..... | ..... | ii, 2293 | Pleasure B., Me. | B-130..... | i, 70 |
| Plant, Concrete Mixing; | | | Pleasure B., N. J. | G-56..... | i, 247 |
| list..... | ..... | ii, 2356 | Pleasure House Cr., Va. | L-209..... | i, 412 |
| Plant, Floating..... | ..... | ii, 2041, 2115 | Plover R., Wis. | KK-8..... | i, 1247 |
| Platin (HH)..... | ..... | i, 1078* | Plum Beach Chan., N. Y. | F-101..... | i, 216 |
| (See notes, ii, 2827.) | | | Plum Branch, Mo. | GG-159..... | i, 1026 |
| Plaquemine (HH)..... | ..... | i, 1078* | Plum Cr., Colo. | GG-1104..... | i, 1033 |
| Plaquemine Bayou, La. ... | S-298..... | i, 683, 695 | (See notes, ii, 2820.) | | |
| S-522..... | ..... | i, 685 | Plum Cr., Kans. | GG-1165..... | i, 1034 |
| S-298-a..... | ..... | i, 695 | GG-1336..... | ..... | i, 1035 |
| S-298-b..... | ..... | i, 697 | (See notes, ii, 2821, 2822.) | | |
| (See notes, ii, 2805.) | | | Plum Cr., Md. | J-543..... | i, 335 |
| Appro..... | ..... | ii, 2294 | J-1223..... | ..... | i, 340 |
| Bridges..... | ..... | ii, 2216 | Plum Cr., Minn. | KK-127..... | i, 1248 |
| Navigation rules..... | ..... | ii, 2041, 2107 | Plum Cr., Nebr. | GG-927..... | i, 1032 |
| Plaquemine Brule Bayou, La. | S-760..... | i, 687 | GG-953..... | ..... | i, 1032 |
| | | | (See notes, ii, 2819.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------|---------------------|-------------------|------------------------------|---------------------|-------------------|
| Plum Cr., Pa..... | J-614..... | i, 335 | Pointer Cr., N. Dak. | GG-786..... | i, 1031 |
| Plum Cr., S. Dak..... | GG-352..... | i, 1027 | (See notes, ii, 2818.) | | |
| | GG-860..... | i, 1031 | Point, Fort..... | | ii, 1801, 2005 |
| (See notes, ii, 2815, 2819.) | | | Point H. Chan., N. C..... | L-221-a..... | i, 440 |
| Plum Gut, N. Y..... | F-28..... | i, 215 | Point Jose, Cal.; forts..... | | ii, 2005 |
| Wrecks..... | | ii, 2274 | Point Judith Pond, R. I. . | C-101..... | i, 108 |
| Plum Isld. R., Mass..... | B-52..... | i, 69 | Appro..... | | ii, 2288 |
| Plum Pt. Reach..... | (HH)..... | i, 1078* | Bridges..... | | ii, 2216 |
| Plum R..... | (HH)..... | i, 1078* | Point Judith Pond, R. I. | | |
| Plum R., Ill..... | JJ-22..... | i, 1234 | (entrance to)..... | C-101..... | i, 132 |
| Plummer Cr., Cal..... | TT-42..... | i, 1555 | Point Judith, R. I.: .. | | |
| Plummer Slough, Cal..... | TT-50..... | i, 1555 | (See notes, ii, 2787.) | | |
| Plum Tree Run, Md..... | J-965..... | i, 338 | Appro..... | | ii, 2288 |
| Plunkett Cr., Pa..... | J-738..... | i, 336 | Wrecks..... | | ii, 2274 |
| Plunkett Cr., Tenn..... | AA-260..... | i, 850 | Point Judith, R. I. (har- | | |
| Plymouth Beach and H., | | | bor of refuge)..... | C-102..... | i, 108, 133 |
| Mass..... | B-168..... | i, 98 | Point Lobos, Cal.: .. | | |
| (See notes, ii, 2785.) | | | Forts..... | | ii, 2005 |
| Appro..... | | ii, 2288 | Point Lookout Cr., Md. . | K-48..... | i, 373 |
| Forts..... | | ii, 1855 | Point Lookout, Mich..... | PP-57..... | i, 1419 |
| Wrecks..... | | ii, 2274 | Point Peter Cr., Ga..... | O-512..... | i, 537 |
| Plymouth Beach, Mass. . | B-168..... | i, 70 | Point Pleasant..... | (HH)..... | i, 1078* |
| Pocantico R., N. Y..... | E-31..... | i, 177 | Monuments..... | | ii, 2040, 2094 |
| Pocasin Cr., La..... | S-31..... | i, 681 | Point Pleasant, Me.: .. | | |
| Pocason Cr., Fla..... | P-363..... | i, 572 | Bridges..... | | ii, 2216 |
| Pocasset R., Mass..... | C-35..... | i, 107 | Point Pleasant Crossing | | |
| Pocatalico R., W. Va. . | EE-152..... | i, 984 | (HH): .. | | |
| Pocket, Fla..... | P-130..... | i, 570 | (See notes, ii, 2832.) | | |
| Pocomoke R., Md. and | | | Point Pleasant, W. Va. | | |
| Va..... | J-3..... | i, 331, 340 | (ice harbor)..... | EE-62-c..... | i, 991 |
| Appro..... | | ii, 2291 | Point Sal, Cal. (harbor of | | |
| Bridges..... | | ii, 2216 | refuge)..... | SS-25-c..... | i, 1551 |
| Harbor lines..... | | ii, 2259 | Point San Pablo: | | |
| Pocomoke Sound, Md. | | | Harbor lines..... | | ii, 2259 |
| and Va..... | J-2..... | i, 331 | Poison Cr., Wyo.: .. | | |
| Pocoson Cr., La..... | T-2-u..... | i, 717 | (See notes, ii, 2817.) | | |
| (See notes, ii, 2805.) | | | Poison Spider Cr., Wyo. . | GG-1003..... | i, 1033 |
| Pocotaligo R., S. C..... | N-90..... | i, 499 | (See notes, ii, 2820.) | | |
| | N-262..... | i, 501 | Pokai H., H. I.: .. | | |
| Poe Cr., Pa..... | J-847..... | i, 337 | (See notes, ii, 2846.) | | |
| Poeno Cr., S. Dak..... | GG-865..... | i, 1031 | Pokegama..... | (HH)..... | i, 1078* |
| Poesten Kill, N. Y..... | E-52..... | i, 177 | Pokegama Br., Minn..... | KK-98..... | i, 1248 |
| Pohlek B., Va..... | K-97..... | i, 373 | Pole Cr., Kans..... | GG-1351..... | i, 1035 |
| Polindexter Cr., N. C..... | L-275..... | i, 413 | Pole Cr., Mont..... | GG-583..... | i, 1029 |
| Point Adams..... | (WW-2)..... | i, 1617* | (See notes, ii, 2816.) | | |
| Point A la Hache..... | (HH)..... | i, 1078* | Pole Cr., S. Dak..... | GG-380..... | i, 1028 |
| Point Allerton..... | (HH)..... | i, 1078* | (See notes, ii, 2815.) | | |
| Point Aux Barques H., | | | Polk Cr., S. C..... | N-223..... | i, 500 |
| Mich..... | PP-80..... | i, 1419 | Polk Cr., Va..... | L-17..... | i, 411 |
| Point Breeze..... | (HH)..... | i, 1078* | Polks Crossing..... | (HH)..... | i, 1078* |
| Wrecks..... | | ii, 2274 | (See notes, ii, 2832.) | | |
| Point Celeste, La.: .. | | | Pollock Rip Chan..... | C-3..... | i, 107, 108 |
| Wrecks..... | | ii, 2274 | Pollock Rip, Mass.: .. | | |
| Point Cr., Va..... | L-28..... | i, 411 | Wrecks..... | | ii, 2274 |
| Point Douglas..... | (HH)..... | i, 1078* | Pollock Rip Shoal, Mass.: .. | | |
| Pointe au Chien Bayou, | | | Wrecks..... | | ii, 2274 |
| La..... | S-438..... | i, 685 | Pollock Rip Slue, Mass.: .. | | |
| Pointe au Loups Bayou, | | | Wrecks..... | | ii, 2274 |
| La..... | S-764..... | i, 687 | Polly..... | (HH)..... | i, 1078* |
| Pointe Aux Barques, | | | Pologaino Bayou, Tex.: .. | | |
| Mich..... | PP-80..... | i, 1440 | (See notes, ii, 2806.) | | |
| Pointe Coupee Bayou, | | | Polson B., Mont..... | XX-110-c..... | i, 1678 |
| La..... | S-813..... | i, 688 | Appro..... | | ii, 2301 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|---------------------|-------------------|
| Pomeroy | (CC)..... | i, 910* | Poplar Run, Md. | J-1019..... | i, 338 |
| | (GG-2)..... | i, 1039* | Poplar Run, Pa. | J-871..... | i, 337 |
| Pomme de Terre R., Minn. | KK-150..... | i, 1248 | Popo Agie R., Wyo.: (See notes, ii, 2817.) | | |
| Pomme de Terre R., Mo. | GG-1495..... | i, 1036 | Popolopen Cr., N. Y. | E-67..... | i, 177 |
| (See notes, ii, 2824.) | | | Poponesset B., Mass. | C-11..... | i, 107 |
| Pomme de Terre Slough. (HH)..... | | i, 1078* | Poquessing Cr., Pa. | H-16..... | i, 271 |
| Pompeys Pillar Cr., Mont. | GG-651..... | i, 1030 | Poquetannuck Cove, Conn. | D-13..... | i, 141 |
| (See notes, ii, 2817.) | | | Poquonock R., Conn. | D-6..... | i, 141 |
| Ponca Cr., Nebr. | GG-945..... | i, 1032 | | D-71..... | i, 141 |
| (See notes, ii, 2819.) | | | (See notes, ii, 2788.) | | |
| Ponca Cr., Nebr. and S. Dak. | GG-905..... | i, 1032 | Bridges | | ii, 2216 |
| (See notes, ii, 2819.) | | | Poquoson R., Va. | L-86..... | i, 411 |
| Ponce de Leon B., Fla. | P-201..... | i, 570 | Porcupine Cr., Mont. | GG-424..... | i, 1028 |
| Ponce H., P. R. | YY-13..... | i, 1685, 1687 | (See notes, ii, 2815.) | | |
| Wrecks..... | | ii, 2275 | Porcupine Cr., S. Dak. | GG-885..... | i, 1032 |
| Ponchatoula R., La. | S-53..... | i, 681, 692 | (See notes, ii, 2819.) | | |
| (See notes, ii, 2805.) | | | Porcupine Isld. to Mount Desert, Me. | A-52..... | i, 35 |
| Pond Cove, Me. | A-18..... | i, 27 | Porcupine R., Alaska | XX-210..... | i, 1656 |
| Pond Cr., Ga. | O-289..... | i, 535 | Pork Cr., Md. | J-1188..... | i, 340 |
| Pond Cr., Kans. | GG-1338..... | i, 1035 | Poropotank B., Va. | K-304..... | i, 375 |
| (See notes, ii, 2822.) | | | Poropotank Cr., Va. | K-304..... | i, 375 |
| Pond Cr., Ky. | DD-298..... | i, 961 | Porpoise Chan., Stony Brook H., N. Y. | F-20..... | i, 215, 221 |
| Pond Cr., Md. | J-524..... | i, 335 | Porpoise Cr., Md. | J-312..... | i, 333 |
| Pond Cr., Pa. | J-624..... | i, 335 | Porson Cr., Wyo. | GG-692..... | i, 1030 |
| Pond Cr., Tenn. | AA-88..... | i, 849 | Portage. (HH)..... | | i, 1078* |
| Pond R., Ky. | BB-8..... | i, 891, 896 | Portage Bayou, La. | S-446..... | i, 685 |
| | BB-7..... | i, 892 | | S-534..... | i, 685 |
| Pon Pon R., S. C. | N-219..... | i, 500 | | S-630..... | i, 686 |
| Pontchartrain. (HH)..... | | i, 1078* | | S-639..... | i, 686 |
| (See notes, ii, 2827.) | | | | S-687..... | i, 687 |
| Pontchartrain Cr., La. | S-21..... | i, 681 | | S-715..... | i, 687 |
| Pontchartrain Lake, La.: Wrecks..... | | ii, 2275 | Portage Canal, Wis. | MM-20..... | i, 1297 |
| Pontoosac. (HH)..... | | i, 1078* | Bridges | | ii, 2216 |
| (See notes, ii, 2827.) | | | Portage Cr., Pa. | J-781..... | i, 337 |
| Pony Cr., Colo. | GG-1038..... | i, 1033 | Portage Lake, Manistee Co., Mich. (harbor of refuge). | OO-51..... | i, 1407 |
| Pony Cr., S. Dak. | GG-340..... | i, 1027 | Portage Lake, Mich. | LL-42..... | i, 1265 |
| Pony Cr., Va. | K-314..... | i, 375 | | OO-51..... | i, 1377 |
| Pony Slough, Oreg. | VV-18..... | i, 1593 | Appro. | | ii, 2298 |
| Pool Slough, Oreg. | VV-47..... | i, 1593 | Bridges | | ii, 2216 |
| Poor Fork, Ky. | AA-278..... | i, 850 | Harbor lines | | ii, 2259 |
| Poor Robin Lake, Ga. | O-391..... | i, 536 | Navigation rules | | ii, 2041, 2107 |
| Poor Robin Spring, Ga. | O-313..... | i, 535 | Portage Lake Ship Ca- nals, Mich.: Navigation rules..... | | ii, 2041, 2107 |
| Pope. (GG-2)..... | | i, 1039* | Wrecks | | ii, 2275 |
| Pope Cr., Va. | K-115..... | i, 374 | Portage, Mich. | OO-9..... | i, 1377 |
| Pope R., Ill. | JJ-16..... | i, 1234 | Portage R., Mich. | OO-28..... | i, 1377 |
| Popes Cr., Md. | K-74..... | i, 373 | Portage R., Ohio. | QQ-14..... | i, 1461, 1466 |
| Popes Isld., Va.: Wrecks..... | | ii, 2275 | Bridges | | ii, 2217 |
| Popham, Fort, Me. | | ii, 1804, 1841 | Port Allen (HH): (See notes, ii, 2827, 2829.) | | |
| Poplar Branch B., N. C. | L-255..... | i, 413 | Port Allerton (HH): (See notes, ii, 2827, 2829.) | | |
| Poplar Cr., Ala. | AA-208..... | i, 850 | Port Angeles, Wash.: Harbor lines..... | | ii, 2259 |
| Poplar Cr., Mont. | GG-419..... | i, 1028 | Port Arthur Canal (chan- nel from) to mouths of Sabine and Neches Rs., Tex. | T-3-a..... | i, 717 |
| Poplar Cr., N. C. | L-361..... | i, 414 | | | |
| Poplar Cr., Tenn. | AA-172..... | i, 849 | | | |
| Poplar Fork, Ohio. | DD-432..... | i, 962 | | | |
| Poplar Hill Cr., S. C. | N-77..... | i, 499 | | | |
| Poplar Isld. H., Md. | J-360..... | i, 333 | | | |
| Poplar Neck Cr., Va. | K-164..... | i, 374 | | | |
| Poplar R., Mont. | GG-415..... | i, 1028 | | | |
| (See notes, ii, 2815.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|------------------------|-------------------|
| ort Arthur Canal, Tex. (operating and care)..... | T-8..... | i, 721 | Portland Bar..... | (CC)..... | i, 910* |
| ort Arthur Ship Canal, Tex..... | T-8..... | i, 717 | Portland Canal..... | (CC)..... | i, 910* |
| (See notes, ii, 2805, 2806.) | | | Portland Chan. (Canal), Alaska..... | XX-122-c..... | i, 1680 |
| Appro..... | | ii, 2294 | Appro..... | | ii, 2301 |
| Navigation rules..... | | ii, 2041, 2107 | Portland H., Me..... | A-262..... | i, 29, 53 |
| ort Arthur to East Gal- veston B., Tex. (inland waterway)..... | U-7..... | i, 735 | Portland H., N. Y..... | RR-6..... | i, 1493, 1498 |
| ort Austin, Mich..... | PP-79..... | i, 1419, 1440 | Appro..... | | ii, 2299 |
| ort B., N. Y..... | RR-45..... | i, 1493 | Portland Head Light, Me.: Wrecks..... | | ii, 2275 |
| ort Bolivar Chan., Tex..... | U-3..... | i, 735 | Portland Head, Me.: Forts..... | | ii, 1804, 1841 |
| ort Bolivar, Tex..... | U-4..... | i, 735, 736 | Portland Isld..... | (GG-2)..... | i, 1039* |
| Appro..... | | ii, 2295 | Portland, Me.: Appro..... | | ii, 2287, 2288 |
| ort Bolivar to Galveston, Tex. (channel)..... | U-3..... | i, 736 | Bridges..... | | ii, 2144, 2217 |
| ort Byron..... | (HH)..... | i, 1078* | Forts..... | | ii, 1823, 1841 |
| ort Canay, P. I..... | YY-154..... | i, 1686 | Harbor lines..... | | ii, 2259 |
| ort Chester H., N. Y..... | E-1..... | i, 177, 178 | Wrecks..... | | ii, 2275 |
| Appro..... | | ii, 2289 | Portland, Me., Back Cove. A-263..... | | i, 55 |
| Harbor lines..... | | ii, 2259 | Portland, Me., district..... | A (with map) i, 25, 27 | |
| Wrecks..... | | ii, 2275 | (See notes, ii, 2783.) | | |
| ort Clinton H., Ohio..... | QQ-15..... | i, 1466 | Appro..... | | ii, 2287 |
| Appro..... | | ii, 2299 | Portland (North) H., Oreg..... | VV-77..... | i, 1593 |
| Wrecks..... | | ii, 2275 | Portland, Oreg..... | (WW-2)..... | i, 1617* |
| ort Clinton, Ohio..... | QQ-15..... | i, 1461 | (See notes, ii, 2844.) | | |
| ort Clyde H., Me..... | A-154..... | i, 28 | Appro..... | | ii, 2287, 2300 |
| ort Costa: Harbor lines..... | | ii, 2259 | Harbor lines..... | | ii, 2259 |
| ort Crescent H., Mich..... | PP-78..... | i, 1419 | Portland, Oreg., 1st dis- trict..... | VV (with map) i, 1591, | 1593 |
| ort Crescent, Mich..... | PP-78-b..... | i, 1440 | (See notes, ii, 2841.) | | |
| ort Day, Niagara R., N. Y..... | RR-15-d..... | i, 1511 | Appro..... | | ii, 2300 |
| ort Day to Tonawanda, N. Y..... | RR-15-b..... | i, 1510 | Portland, Oreg., 2d dis- trict..... | WW (with map)..... | i, 1613, 1615 |
| ort Eads..... | (HH)..... | i, 1078* | (See notes, ii, 2841.) | | |
| orter Cr., Md..... | J-365..... | i, 333 | Port Lavaca, Tex.: Appro..... | | ii, 2295 |
| orter Cr., W. Va..... | EE-137..... | i, 984 | Harbor lines..... | | ii, 2259 |
| orter, Fort, N. Y..... | | ii, 1806, 1994 | Port Lavaca, Tex., to Pass Cavallo (channel)..... | U-56-b..... | i, 767 |
| orter B., Mass..... | B-95..... | i, 69 | Port Louisa..... | (HH)..... | i, 1078* |
| orters Bayou, La..... | R-98-gg..... | i, 647 | Port Marshall H., N. Y..... | E-101..... | i, 178, 206 |
| orters Cr., N. C..... | M-100..... | i, 455 | Port Morris, N. Y.: Harbor lines..... | | ii, 2259 |
| orters Lake..... | (HH)..... | i, 1078* | Port O'Connor, Tex., to Pass Cavallo (channel)..... | U-58-b..... | i, 768 |
| ort Haddock, Wash.: Harbor lines..... | | ii, 2259 | Port of Portland..... | (WW-2)..... | i, 1617* |
| ort Henry H., N. Y..... | E-97..... | i, 178, 205 | Portohonk Cr., N. C..... | L-266..... | i, 413 |
| Wrecks..... | | ii, 2275 | L-266..... | | i, 442 |
| ort Huron, at mouth of Black R., Mich..... | PP-89..... | i, 1444 | Port Ontario H., N. Y..... | RR-51..... | i, 1493, 1531 |
| ort Huron, Mich..... | PP-90..... | i, 1419 | Appro..... | | ii, 2299 |
| Appro..... | PP-89-c..... | i, 1446 | Port Orchard H., Wash.: Harbor lines..... | | ii, 2259 |
| Harbor lines..... | | ii, 2259 | Port Orford, Oreg..... | VV-10..... | i, 1593, 1595 |
| Wrecks..... | | ii, 2275 | Porto Rico..... | YY..... | i, 1685 |
| ort Jefferson H., N. Y..... | F-21..... | i, 215, 221 | Appro..... | | ii, 2301 |
| Appro..... | | ii, 2289 | Field service..... | | ii, 2039, 2050 |
| ort Jervis, N. J.: (See notes, ii, 2794.) | | | Forts..... | | ii, 1796, 2031 |
| ort Kent H., N. Y..... | E-90..... | i, 177, 205 | Structures, navigable wa- ters..... | | ii, 2041, 2115 |
| ortland (above), William- ette R..... | WW-30-a..... | i, 1642 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------------------|---|----------------------------------|-------------------|
| Porto Rico, Hawaii, and The Philippines. | YY | i, 1683 | Post Cr., Kans. | GG-1386 | i, 1036 |
| Port Penn, Del., Dela- ware R. | H-3-h | i, 282 | (See notes, ii, 2823.) | | |
| Port Ferry, Pa.: | | | Postells Cr., Ga. | O-436 | i, 536 |
| Harbor lines | | ii, 2259 | Postillion Bayou, La. | S-607 | i, 686 |
| Port Real, P. R. | YY-18 | i, 1685 | Postoak Cr., Mo.: | | |
| Port Royal Bar, S. C. | N-258 | i, 501, 528 | (See notes, ii, 2823.) | | |
| Port Royal R., S. C. | N-259 | i, 528 | Post Office Bar | (WW-2) | i, 1617* |
| Appro. | | ii, 2292 | Posts. | ii, 2039, 2052, 2053 | |
| Forts | | ii, 1940 | Jefferson Barracks | ii, 2039, 2056 | |
| Wrecks | | ii, 2275 | Military Equipment, Engineer | ii, 2041, 2133 | |
| Port Royal Sound, S. C.: | | | Subpost, Fort Foote | ii, 2039, 2052 | |
| Wrecks | | ii, 2275 | Washington Barracks | ii, 2039, 2057 | |
| Ports: | | | Potash Cr., Va. | L-109 | i, 412 |
| Forts | | ii, 1810 | Potato Cr., S. C. | N-107 | i, 500 |
| Port Sanilac H., Mich. | PP-85 | i, 1419 | Potato Slough, Cal. | UU-44 | i, 1577 |
| Port Sanilac, Mich. (har- bor of refuge). | PP-85 | i, 1443 | Pot Cove, N. Y.: | | |
| Portsmouth | (CC) | i, 910* | Harbor lines | | ii, 2259 |
| Portsmouth H., Me. and N. H. | A-280 | i, 29 | Poteau R., Okla. and Ark. | Y-20 | i, 818 |
| Appro. | A-280-a | i, 60 | Bridges | ii, 2216, 2217 | |
| Bridges | | ii, 2217 | Potecasi Cr., N. C. | L-328 | i, 413, 445 |
| Forts | | ii, 1805, 1823, 1851 | Po (The) | (HH) | i, 1078* |
| Harbor lines | | ii, 2259 | Potohunk R., N. C. | L-266 | i, 442 |
| Wrecks | | ii, 2275 | Potomac Cr., Va. | K-109 | i, 374, 394 |
| Portsmouth H., N. H., Pull-and-be-Damned Pt. | A-280-b | i, 61 | Potomac Park, D. C. | | ii, 2040, 2071 |
| Portsmouth, Little H., N. H. | A-290 | i, 64 | Potomac R., Md. | K-46 | i, 373 |
| Portsmouth (Seloto R., Ohio) | DD-446 | i, 962 | Potomac R. to Baltimore, Md. (canal) | K-46-m | i, 385 |
| Port Tobacco Cr., Md. | K-75-a | i, 388 | Potomac R. to the Juni- ata (canal) | K-46-n | i, 385 |
| Port Tobacco R., Md. | K-75 | i, 373 | Potomac R., Va., D. C., and Md. | K-46 | i, 377 |
| | K-75-a | i, 388 | Appro. | ii, 2291 | |
| Port Tobago B., Va. | K-213 | i, 374 | Bridges | ii, 2039, 2064, 2217, 2218, 2219 | |
| Port Townsend B., Puget Sound, to Oak B., Wash. | XX-46-a | i, 1664 | Forts | ii, 1823, 1921 | |
| Port Townsend B., Wash.: | | | Harbor lines | ii, 2259 | |
| Harbor lines | | ii, 2259 | Highway Bridge | ii, 2039, 2062, 2063 | |
| Port Townsend to Cape Flattery, Wash. | XX-39 | i, 1655 | Wrecks | ii, 2275 | |
| Portuguese R., P. R. | YY-14 | i, 1685 | Potonowut R., R. I. | C-92 | i, 131 |
| Port Washington H., Wis. | MM-32 | i, 1297, 1331 | (See notes, ii, 2787.) | | |
| Appro. | | ii, 2298 | Appro. | ii, 2288 | |
| Navigation rules | | ii, 2041, 2107 | Potopotank R., Va. | K-304 | i, 375 |
| Port Wing H., Wis. | LL-26 | i, 1265, 1281 | Potopotank Cr., Va. | K-304 | i, 375 |
| (See notes, ii, 2835, 2836.) | | | Potowannet R., R. I. | C-92 | i, 131 |
| Appro. | | ii, 2298 | Potowomut R., R. I. | C-92 | i, 107, 131 |
| Po Run, Va. | K-309 | i, 375 | (See notes, ii, 2787.) | | |
| Poses | (CC) | i, 910* | Potsbury Cr., Fla.: | | |
| Position Finders, forts | | ii, 1796, 1797, 1799, 1812, 1831 | Bridges | ii, 2219 | |
| Possum Bayou, La. | S-667 | i, 687 | Potter Cr., Md. | K-49 | i, 373 |
| Possum Cr., Ga. | O-328 | i, 535 | POTTER, DR. SAMUEL O. L.: | | |
| Possum Quarter Cr., N. C. | L-273 | i, 413 | Robert Index | | i, 9 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|-----------------------|-------------------|--------------------------------------|----------------------|-------------------|
| Powder R., Mont. and | | | Presidents Isld. Crossing | | |
| Wyo..... | GG-721..... | i, 1030 | (HH): | | |
| (See notes, ii, 2818.) | | | (See notes, ii, 2832.) | | |
| Powder R., Oreg. | VV-87..... | i, 1503 | Presley Cr., Va. | K-132..... | i, 374 |
| Powells Cr., Pa. | J-598..... | i, 335 | Presque Isle, Pa.: | | |
| Powells Cr., Va. | K-105..... | i, 374 | (See notes, ii, 2838.) | | |
| | L-153..... | i, 412 | Presque Isle B., Erie H., | | |
| Bridges..... | ii, 2204, 2219 | | Pa. | RR-4..... | i, 1493 |
| Powells R., Tenn. and | | | Presque Isle H., Mich. | PP-46..... | i, 1419 |
| Va..... | AA-169..... | i, 849, 876 | Wrecks..... | ii, 2275 | |
| Bridges..... | ii, 2219 | | Presque Isle, Mich. | LL-52..... | i, 1265 |
| Power (see Water Power). | | | Presque Isle Peninsula, | | |
| Power, forts. | ii, 1810 | | Pa. | RR-5-b..... | i, 1497 |
| Powers Isld. | (HH)..... | i, 1078* | Presque Isle, Pa. | RR-5-a..... | i, 1494 |
| Powhatan Cr., Va. | L-117..... | i, 412 | Presque Isle Pt., Mich. | | |
| Powow R., Mass. and N. | | | (harbor of refuge) | LL-54-b..... | i, 1293 |
| H..... | B-5..... | i, 69, 74 | (See notes, ii, 2836.) | | |
| (See notes, ii, 2784.) | | | Appro..... | ii, 2298 | |
| Appro..... | ii, 2288 | | Prettyboy Branch, Md. | J-1024..... | i, 338 |
| Bridges..... | ii, 2219 | | Pretty Cr., Kans. | GG-1381..... | i, 1035 |
| Powter Cr., S. C. | N-27..... | i, 499 | Pretty Cr., La. | S-91..... | i, 682 |
| Poydras Bayou, La. | S-526..... | i, 685 | Pretty Cr., N. Dak. | GG-769..... | i, 1031 |
| Prairie Bird Pt. | (HH)..... | i, 1078* | (See notes, ii, 2818.) | | |
| Prairie Chan. | (WW-2)..... | i, 1617* | Pretty Marsh H., Me. | A-59..... | i, 27 |
| Prairie Chan., Oreg. | WW-10..... | i, 1615 | Price Cr., Md. | K-58..... | i, 373 |
| Prairie Cr., Cal. | TT-192..... | i, 1556 | Price Cr., Tenn. | AA-77..... | i, 848 |
| Prairie Cr., Fla. | P-262..... | i, 571 | Prices Towhead. | (HII)..... | i, 1078* |
| Prairie Cr., La. | T-2-t..... | i, 717 | Pride Cr., N. Dak. | GG-402..... | i, 1028 |
| (See notes, ii, 2805.) | | | (See notes, ii, 2815.) | | |
| Prairie Cr., Minn. | JJ-31..... | i, 1234 | Prien Lake, La. | S-803..... | i, 688 |
| Prairie Cr., Mo. | GG-205..... | i, 1026 | Priest Rapids. | (WW-2)..... | i, 1617* |
| | GG-1420..... | i, 1036 | Priest B., Mont. | (WW-2)..... | i, 1617* |
| (See notes, ii, 2814, 2823.) | | | Prime Hook Cr., Del. | I-72..... | i, 299, 324 |
| Prairie Cr., Nebr. | GG-977..... | i, 1032 | Princess B., N. Y. (break- | | |
| (See notes, ii, 2820.) | | | water)..... | G-26..... | i, 253 |
| Prairie Dog Cr., Nebr. and | | | Princess B., Staten Isld., | | |
| Kans.: | | | N. Y. | G-26..... | i, 247 |
| (See notes, ii, 2822.) | | | Princeton. | (HH)..... | i, 1078* |
| Prairie du Chien. | (HH)..... | i, 1078* | Principio Cr., Md. | J-553..... | i, 335 |
| (See notes, ii, 2827.) | | | Private Parties, appropri- | | |
| Prairie du Point. | (HH)..... | i, 1078* | tions by, waterway im- | | |
| Prairie Fork, Mo. | GG-41..... | i, 1025 | provements..... | ii, 2041, 2109, 2116 | |
| | GG-104..... | i, 1026 | Private Parties: | | |
| (See notes, ii, 2813.) | | | Occupation of river and | | |
| Prairie Owl Cr., Nebr.: | | | harbor works..... | ii, 2041, 2116 | |
| (See notes, ii, 2821.) | | | Private work, waterway | | |
| Prairie R., Mich. | OO-8..... | i, 1377 | improvement..... | i, 22 | |
| Prairie R., Minn. | KK-86..... | i, 1248 | Proctors Landing, La.: | | |
| Prairie R., Wis. | KK-11..... | i, 1247 | Forts..... | ii, 1803 | |
| Prater Cr., Ky. | DD-245..... | i, 961 | Proctorville, Tower at; | | |
| Prater Cr., Va. | DD-275..... | i, 961 | forts..... | ii, 1976 | |
| Preamble, Fort, Me. | ii, 1804, 1841 | | Profs Cr., Mo. | GG-1507..... | i, 1036 |
| Premium R., N. Y. | E-12..... | i, 177 | (See notes, ii, 2824.) | | |
| Prentice Cr., Va. | K-149..... | i, 374 | Projects, river and harbor | | |
| Prentiss Bayou, La. | S-545..... | i, 686 | works..... | i, 22 | |
| Prentiss Slough. | (HH)..... | i, 1078* | Proofs, Index (this edition). | i, 13; ii, 2779 | |
| Prescott. | (HH)..... | i, 1078* | Prospect B., Md. | J-394..... | i, 334 |
| Preservation and Repair, | | | Prospect H., Me. | A-40..... | i, 27 |
| forts..... | ii, 1796, 1797, 1799, | | Prospect Slough, Cal. | UU-64..... | i, 1577 |
| | 1811, 1812, 1830 | | Prouty Branch, Pa. | J-778..... | i, 337 |
| Presidents Isld. | (HH)..... | i, 1078* | Providence H. and R., | | |
| Presidents Isld. Bar (HH): | | | R. I. | C-81..... | i, 107, 125 |
| (See notes, ii, 2832.) | | | | C-81-a..... | i, 128 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|----------------------|---------------------------------|---------------------|-------------------|
| Providence H. and R., | | | Pugsleys Cr., N. Y. | E-20 | i, 177 |
| R. I. (continued) | C-85 | i, 130 | (See notes, ii, 2792.) | | |
| (See notes, ii, 2787.) | | | Wrecks | | ii, 2275 |
| Appro. | | ii, 2288 | Pujada B., P. I. | YY-158 | i, 1686 |
| Bridges | | ii, 2219 | Pukoo Landing, H. I.: | | |
| Harbor lines | | ii, 2259 | (See notes, ii, 2846.) | | |
| Wrecks | | ii, 2275 | Pulaski, Fort | | ii, 1803, 1948 |
| Provincetown H., Mass. | B-208 | i, 70, 101 | Harbor lines | | ii, 2255 |
| (See notes, ii, 2785.) | | | Pull-and-be-Damned Pt., | | |
| Appro. | | ii, 2288 | Portsmouth H., N. H. | A-280-b | i, 61 |
| Forts | | ii, 1855 | Pull Tight. | (HH) | i, 1078* |
| Wrecks | | ii, 2275 | Pulpit H., Me. | A-131 | i, 28 |
| Prugh Branch, Md. | J-1140 | i, 339 | Pultneyville H., N. Y. | RR-42 | i, 1493, 1521 |
| Prunty Isld. | (GG-2) | i, 1039* | Appro. | | ii, 2299 |
| Pry Cove, Md. | J-199 | i, 332 | Wrecks | | ii, 2275 |
| Pryor Cr., Mont. | GG-675 | i, 1030 | Pumpkin Bayou, La. | S-789 | i, 688 |
| Pryors Cr., Mo. | GG-1490 | i, 1036 | Pumpkin Cr., Mont. | GG-718 | i, 1030 |
| (See notes, ii, 2824.) | | | (See notes, ii, 2818.) | | |
| Pryors Cr., Mont.: | | | Pumpkin Cr., S. Dak. | GG-887 | i, 1032 |
| (See notes, ii, 2817.) | | | (See notes, ii, 2819.) | | |
| Public Buildings and | | | Pumpkin Cr., Wyo. | GG-733 | i, 1030 |
| Grounds, D. C. | | ii, 2040, 2072 | (See notes, ii, 2818.) | | |
| Public Buildings: | | | Pumpkin Seed Cr., Nebr. | | |
| Laws | | ii, 2329 | (See notes, ii, 2820.) | | |
| Public Reservations, D. C. | | ii, 2040, 2070 | Punahuu H., Hawaii: | | |
| Puckert Isld. | (HH) | i, 1078* | (See notes, ii, 2846.) | | |
| (See notes, ii, 2827.) | | | Punahuu Landing, Ha- | | |
| Puckett (HH): | | | wall. | YY-77 | i, 1686 |
| (See notes, ii, 2827.) | | | Puncheoncamp Cr., Ky. | DD-99 | i, 959 |
| Pudding Cr., Va. | K-268 | i, 375 | Puncheop Camp Cr., Mo. | GG-1535 | i, 1037 |
| Pueblo, Cal.: | | | Punch Isld. Cr., Md. | J-223 | i, 332 |
| Surveys, latitude and | | | Pungers Cr., Md. | J-178 | i, 332 |
| longitude | | ii, 2041, 2122 | Pungo Cr., N. C. | M-60 | i, 454 |
| Pueokahi B., H. I.: | | | Bridges | | ii, 2220 |
| (See notes, ii, 2846.) | | | Pungo R., N. C. | M-43 | i, 454 |
| Puerto Princesa, P. I. | YY-144 | i, 1686 | Bridges | | ii, 2220 |
| Pues Cr., Ga. | O-274 | i, 535 | Pungo R. to Sladesville, | | |
| Puget Isld. | (WW-2) | i, 1617* | N. C. (waterway) | M-43-a | i, 460 |
| Puget Sound to Grays | | | Pungoteague Cr., Va. | L-80 | i, 411, 416 |
| H., Wash. | XX-13-c | i, 1661 | Wrecks | | ii, 2275 |
| Puget Sound, Wash. | XX-62 | i, 1655 | Puntarasa, Fla. (inside | | |
| Forts | | ii, 1796, 1823, 2025 | passage to Charlotte H., | | |
| Harbor lines | | ii, 2259 | Fla.) | P-258-c | i, 595 |
| Puget Sound, Wash., and | | | Puntarasa H., Fla. | P-231 | i, 590 |
| its tributaries. | XX-62-a | i, 1664 | Punta Rassa H., Fla. | P-231 | i, 571 |
| Appro. | | ii, 2301 | Puppy Cr. | (OC) | i, 910* |
| Puget Sound, Wash. (fish | | | Puppy Cr., Ind. | BB-19 | i, 891 |
| traps). | XX-62-e | i, 1668 | Purgatory Cr., Minn. | KK-139 | i, 1248 |
| Puget Sound, Wash., | | | Purtan B., Va. | K-303 | i, 375 |
| Hammersley Inlet. | XX-62-c | i, 1667 | Pusey Branch, Md. | J-34 | i, 331 |
| Puget Sound, Wash., | | | Pushepetappa Cr., La. | R-98-b | i, 647 |
| Hoods Canal to North | | | Put in B., Ohio: | | |
| B. | XX-62-d | i, 1668 | Wrecks | | ii, 2275 |
| Puget Sound, Wash. (wa- | | | Puyallup R., Wash. | XX-68 | i, 1655, 1671 |
| terway to connect Lakes | | | Bridges | | ii, 2220 |
| Union, Sammamish, | | | Wrecks | | ii, 2275 |
| and Washington). | XX-62-b | i, 1666 | Puzzle Cr., Iowa and Mo. | GG-128 | i, 1026 |
| Bridges | | ii, 2184, 2219 | (See notes, ii, 2813.) | | |
| | | | Pysht R., Wash. | XX-42 | i, 1655 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

Q.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|------------------------------------|---------------------|-------------------|
| Quaking Asp Cr., Mont. .. | GG-416..... | i, 1028 | Queue de Torture Bayou, | | |
| (See notes, ii, 2815.) | | | La.—Continued. | | |
| Quanticassee R., Mich. | PP-75..... | i, 1438 | Appro..... | ii, 2294 | |
| Quannicassee R., Mich. | PP-75..... | i, 1419 | Qulambog Cove, Conn. | D-4..... | i, 141 |
| Quansett H., Mass. | B-211..... | i, 70 | (See notes, ii, 2788.) | | |
| Quantico B., Va. | K-105..... | i, 374 | Quick Cr., Mo. | GG-47..... | i, 1025 |
| | K-105-b..... | i, 392 | (See notes, ii, 2813.) | | |
| Quantico Cr., Md. | J-113..... | i, 332 | Quicksand Cr., Ky. | DD-166..... | i, 960 |
| Quantico Cr., Va. | K-105..... | i, 374 | Quicksand Cr., Mo.: | | |
| | K-105-a..... | i, 392 | (See notes, ii, 2813.) | | |
| Bridges..... | ii, 2204, 2221 | | Quilcene R., Wash. | XX-48..... | i, 1655 |
| Quarantine B., La. | S-197..... | i, 682 | Quillayute H. and R., | | |
| Quarantine Isld. (recla- | | | Wash..... | XX-32..... | i, 1662 |
| mation of), Honolulu, | | | Quillayute R., Wash. | XX-32..... | i, 1655 |
| Hawaii | YY-45-b..... | i, 1689 | Quimby Cr., S. C.: | | |
| Quarrel Cr., Mont. | GG-602..... | i, 1029 | Wrecks..... | ii, 2275 | |
| (See notes, ii, 2817.) | | | Quincy | (HH)..... | i, 1078* |
| Quarterboats, list | | ii, 2353 | Quincy B. | (HH)..... | i, 1078* |
| Quarter Cove, Md. | J-383..... | i, 334 | Quincy B., Ill.: | | |
| | J-392..... | i, 334 | Bridges..... | ii, 2221 | |
| Quatre Bayou Pass, La. ... | S-334..... | i, 684 | Harbor lines..... | ii, 2259 | |
| Quassalc Cr., N. Y. | E-65..... | i, 177 | Quincy Dam | (HH)..... | i, 1078* |
| Queen Bess Cr., Ga. | O-158..... | i, 534 | Quindaro | (GG-2)..... | i, 1039* |
| Queen Run, Pa. | J-764..... | i, 336 | Quindaro Bend | (GG-2)..... | i, 1039* |
| Queens Bluff | (HH)..... | i, 1078* | Quinault R., Wash. | XX-28..... | i, 1655 |
| Queens Cr., N. C. | M-53..... | i, 454 | Quinnipiac R., Conn. | D-58..... | i, 141 |
| | M-287..... | i, 456 | (See notes, ii, 2790.) | | |
| Queens Cr., Va. | K-249..... | i, 375, 403 | Bridges..... | ii, 2221 | |
| Queens (see New York, | | | Quitmans Lake, La. | S-458..... | i, 685 |
| N. Y.): | | | Quittapahilla Cr., Pa. | J-584..... | i, 335 |
| Harbor lines..... | ii, 2253, 2259 | | Quiver R., Miss. | X-17..... | i, 785, 794 |
| Queenstown Cr., Md. | J-420..... | i, 334 | Quivett Cr., Mass. | B-195..... | i, 70 |
| Queenstown H., Md. | J-422..... | i, 334, 357 | Quogue Ditch, N. Y. | F-50..... | i, 215 |
| Appro..... | ii, 2291 | | Quohog B., Me. | A-249..... | i, 29 |
| Queets R., Wash. | XX-29..... | i, 1655 | Quonochontang, R. I.: | | |
| Queue de Torture Bayou, | | | Wrecks..... | ii, 2275 | |
| La. | S-756..... | i, 687, 712 | Quostinet R., Mass. | C-20..... | i, 107 |
| (See notes, ii, 2805.) | | | | | |

R.

| | | | | | |
|----------------------------------|-------------|---------|---------------------------------|----------------|-------------|
| Rabbit Cr., Minn. | KK-78..... | i, 1247 | Raccoon B., N. C. | L-230..... | i, 413 |
| Rabbit Cr., S. Dak. | GG-810..... | i, 1031 | Raccoon Cr., Ala. | AA-58..... | i, 848 |
| (See notes, ii, 2818.) | | | Raccoon Cr., Md. | J-165..... | i, 332 |
| Rabbit Cr., Tex.: | | | | J-309..... | i, 333 |
| (See notes, ii, 2805.) | | | Raccoon Cr., N. J. | I-46..... | i, 299, 310 |
| Rabbit R., Mich. | OO-20..... | i, 1377 | Appro..... | ii, 2290 | |
| Raccoon Bar | (CC)..... | i, 910* | Bridges..... | ii, 2222, 2230 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|-------------------------------------|-----------------------|-------------------|
| Raccoon Cr., N. C. | L-290..... | i, 413 | Randolph Bend: | | |
| | M-137..... | i, 455 | (See notes, ii, 2825.) | | |
| Raccoon Cr., Ohio | DD-428..... | i, 962 | Randolph Bluff | (GG-2)..... | i, 1039* |
| | DD-444..... | i, 962 | Randolph Slough, Oreg. | VV-15..... | i, 1593 |
| Raccoon Cr., Pa. | J-893..... | i, 337 | Randolph Station to | | |
| | FF-3..... | i, 1003 | Brook Neal | L-387-b..... | i, 447 |
| Raccoon R., Iowa | JJ-69..... | i, 1234 | Random Shot Break | (HH)..... | i, 1078* |
| Raccoon R., N. J. | I-46..... | i, 310 | Random Shot Crossing | | |
| Raccoon R., Ohio | DD-444..... | i, 979 | (HH): | | |
| Raccoon Straits, Cal. | TT-129..... | i, 1556 | (See notes, ii, 2832.) | | |
| Racine H., Wis. | MM-36-a..... | i, 1338 | Range Finders, Forts | ii, 1796, 1797, 1799, | |
| Appro..... | | ii, 2298 | | 1812, 1824, 1831 | |
| Navigation rules..... | | ii, 2041, 2107 | Ransoms B., Vt. | E-130..... | i, 178 |
| Reef..... | | ii, 2041, 2133 | Rantowles Cr., S. C.: | | |
| Wrecks..... | | ii, 2275 | Bridges..... | | ii, 2222 |
| Radcliff Cr., Md. | J-455..... | i, 334 | Raphaels Pass, La. | S-209..... | i, 682 |
| Raemar Cr., Kans.: | | | Rapid Cr., S. Dak. | GG-842..... | i, 1031 |
| (See notes, ii, 2822.) | | | (See notes, ii, 2819.) | | |
| Raft Bayou, Ark. | Y-48..... | i, 818 | Rapides Bayou, La. | S-562..... | i, 686 |
| Rafting Cr., S. C. | N-114..... | i, 500 | Rapid R., Minn. | KK-216..... | i, 1249 |
| Raft R., Ala. | R-15..... | i, 646 | Rapid Run, Pa. | J-842..... | i, 337 |
| Ragay Gulf, P. I. | YY-97..... | i, 1686 | Rapids City | (HH)..... | i, 1078* |
| Ragged Isld. Cr., Va. | L-163..... | i, 412 | Rappahannock R., Va. | K-171..... | i, 374, 398 |
| Rahway R., N. J. | G-33..... | i, 247, 257 | Appro..... | | ii, 2291 |
| Appro..... | | ii, 2290 | Wrecks..... | | ii, 2275 |
| Bridges..... | | ii, 2222 | Raquette B., La. | S-343..... | i, 684 |
| Harbor lines..... | | ii, 2259 | Raquette R., N. Y. | RR-76..... | i, 1493 |
| Ralburns Cr., S. C. | N-177..... | i, 500 | Raritan and Delaware | | |
| Rainbow Cr., Ohio | DD-438..... | i, 962 | Canal, N. J. | G-36-a..... | i, 260 |
| Raines Cr., Va. | K-270..... | i, 375 | Raritan B., N. Y. and N. | | |
| Rainey Cr., Mo. | GG-1499..... | i, 1036 | J | G-23..... | i, 247, 252 |
| (See notes, ii, 2824.) | | | (See notes, ii, 2793.) | | |
| Rainy Lake and R., Minn. | KK-213..... | i, 1262 | Appro..... | | ii, 2290 |
| Rainy Lake, Minn. and | | | Bridges..... | | ii, 2222 |
| Canada | KK-220..... | i, 1249 | Harbor lines..... | | ii, 2259 |
| Rainy Lake R., Minn.: | | | Wrecks..... | | ii, 2275 |
| Dams, private..... | | ii, 2250 | Raritan Branch, N. J.: | | |
| Rainy R. and Lake, Minn. | | | Harbor lines..... | | ii, 2259 |
| and Canada | KK-213..... | i, 1249 | Raritan R., N. J. | G-36..... | i, 247, 258 |
| Rainy R., Minn.: | | | (See notes, ii, 2793.) | | |
| Bridges..... | | ii, 2222 | Appro..... | | ii, 2290 |
| Logs, floating..... | | ii, 2041, 2109 | Bridges..... | | ii, 2222 |
| Rainy R. system | KK-209..... | i, 1249 | Wrecks..... | | ii, 2275 |
| Raisin R., Mich. | PP-124..... | i, 1420, 1457 | Raspberry Cr., Colo. | GG-1029..... | i, 1033 |
| Appro..... | | ii, 2299 | (See notes, ii, 2820.) | | |
| Wrecks..... | | ii, 2275 | Rat R., Alaska | XX-213..... | i, 1656 |
| Ralstons Cr., Ga. | O-344..... | i, 535 | Rat Root R., Minn. | KK-221..... | i, 1249 |
| Rambour Bayou, La. | S-421..... | i, 684 | Rattan B., N. C. | M-222..... | i, 455 |
| Rampart or Oak Cr., S. | | | Rattlesnake Cr., Kans.: | | |
| Dak. | GG-794..... | i, 1031 | (See notes, ii, 2822.) | | |
| (See notes, ii, 2818.) | | | Rattlesnake Cr., Mont. | GG-518..... | i, 1029 |
| Ramsays Gut, Md. | J-1261..... | i, 340 | | GG-601..... | i, 1029 |
| Rams Horn Cr., S. C.: | | | (See notes, ii, 2816, 2817.) | | |
| Wrecks..... | | ii, 2275 | Rattlesnake Cr., N. Y. | RR-20..... | i, 1493 |
| Rancocas Cr., N. J.: | | | Rattlesnake Cr., Ohio | DD-477..... | i, 962 |
| Bridges..... | | ii, 2222 | Rattling Cr., Pa. | J-603..... | i, 335 |
| Rancocas R., N. J. | I-53..... | i, 299, 313 | Raunt (The), N. Y. | F-82..... | i, 216 |
| Appro..... | | ii, 2290 | Raven Cr., Pa. | J-707..... | i, 336 |
| Bridges..... | | ii, 2222, 2230 | Raven Run, Ky. | DD-184..... | i, 960 |
| Wrecks..... | | ii, 2275 | Ravenswood: | | |
| Randalls Isld., N. Y.: | | | Harbor lines..... | | ii, 2259 |
| Harbor lines..... | | ii, 2259 | Ravenswood Slough, Cal. | TT-30..... | i, 1555 |
| Randolph | (GG-2)..... | i, 1039* | Rawhide Cr., Nebr. | GG-965..... | i, 1032 |
| | | | (See notes, ii, 2819.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Rawhide Cr., Wyo. | GG-996..... | i, 1032 | Red Lake and Red Lake | | |
| (See notes, ii, 2820.) | | | R., Minn. and S. Dak. ... | KK-190..... | i, 1259 |
| Rayamon R., P. R. | YY-28..... | i, 1685 | | KK-198-b..... | i, 1261 |
| Raymond Cr., Va. | K-276..... | i, 375 | Red Lake, Minn. and S. | | |
| Raymond Ditch, Md. | J-158..... | i, 332 | Dak. | KK-190-b..... | i, 1260 |
| Raymond Explorations, | | | Bridges | | ii, 2222, 2297 |
| Yukon R., Alaska | | ii, 2040, 2090 | Red Lake R., Minn. and | | |
| RAYMOND, GEN. C. W., | | | S. Dak. | KK-198..... | i, 1248 |
| Corps of Engineers, U. | | | | KK-198-a..... | i, 1260 |
| S. Army: | | | | KK-190-b..... | i, 1260 |
| Index, Reports, Chief of | | | Appro. | | ii, 2297 |
| Engineers | | i, 9 | Bridges | | ii, 2222 |
| Raymonds Cr., N. C. | L-265..... | i, 413 | Logs, floating | | ii, 2041, 2109 |
| Raymond, Wash.: | | | Red Lion Branch, Md. | J-449..... | i, 334 |
| Harbor lines | | ii, 2259 | Red Lion Cr., Md. | K-8..... | i, 873 |
| Ray R., Alaska | XX-220..... | i, 1657 | Red Lodge Cr., Mont. | GG-673..... | i, 1030 |
| Raystown Branch, Pa. | J-875..... | i, 337 | (See notes, ii, 2817.) | | |
| Razor Cr., Mont. | GG-652..... | i, 1030 | Redmon Cove, Md. | J-953..... | i, 338 |
| (See notes, ii, 2817.) | | | Redmond Cr., N. C. | M-323..... | i, 456 |
| Reads Landing | (HH)..... | i, 1078* | Redoak Cr., Ohio | DD-487..... | i, 963 |
| (See notes, ii, 2827.) | | | Redondo Beach H., Cal. ... | SS-21..... | i, 1550 |
| Beams Cr., Kans. and | | | (See notes, ii, 2839.) | | |
| Nebr. | GG-1311..... | i, 1035 | Redondo, Cal. | SS-21..... | i, 1543 |
| (See notes, ii, 2822.) | | | Red Pass, La. | S-309..... | i, 683 |
| Reardon Inlet, Md. | J-961..... | i, 338 | Red R. | (HH)..... | i, 1078* |
| Reason Cr., Va. | K-139..... | i, 374 | (See notes, ii, 2827, 2830.) | | |
| Reas Run | (CC)..... | i, 910* | Red R., Ark., La., Okla., | | |
| Rebecca Cr., Kans. and | | | and Tex. | X-28-a..... | i, 796 |
| Nebr. | GG-1308..... | i, 1035 | | S-795..... | i, 683 |
| (See notes, ii, 2822.) | | | | S-558..... | i, 686 |
| Reclamation | | ii, 2040, 2087 | | T-11..... | i, 717, 726 |
| Reconnoissances | | ii, 2040, 2086 | (See notes, ii, 2807, 2808.) | | |
| Recovery, Fort, Ohio: | | | Appro. | | ii, 2296 |
| Monument | | ii, 2040, 2091 | Bridges | | ii, 2222, 2223 |
| Red Bank Cr., Mont. and | | | Red R., below Fulton, | | |
| N. Dak.: | | | Ark. and La. | X-28..... | i, 786 |
| (See notes, ii, 2815.) | | | Red R., La. | S-295..... | i, 683 |
| Red Bank Cr., N. Dak. | GG-410..... | i, 1028 | | S-558..... | i, 686 |
| Red Bank Cr., Pa. | FF-28..... | i, 1003, 1020 | Red R. of the North and | | |
| | FF-20..... | i, 1015 | tributaries, Minn. and | | |
| Bridges | | ii, 2222 | S. Dak. | KK-170..... | i, 1256 |
| Red Bank, N. J.: | | | Red R. of the North, Dak. | | |
| Forts | | ii, 1903 | and Minn.: | | |
| Red Bird Cr., Ga. | O-156..... | i, 534 | (See notes, ii, 2835.) | | |
| Red Bird Cr., Ky. | DD-49..... | i, 959 | Appro. | | ii, 2297 |
| Red Bluff Cr., Ga. | O-265..... | i, 535 | Bridges | | ii, 2222 |
| Red Cedar R., Iowa | JJ-66..... | i, 1243 | Red R. of the North sys- | | |
| Red Cedar R., Mich. | OO-29..... | i, 1377 | tem | KK-170..... | i, 1246 |
| Red Cedar R., Wis. | KK-42..... | i, 1247 | Red R., Tenn.: | | |
| Red Cr., Miss. | R-69..... | i, 646 | Appro. | | ii, 2299 |
| Red Earth Cr., S. Dak. | GG-806..... | i, 1031 | Red R., Tenn. and Ky. ... | AA-239..... | i, 871 |
| (See notes, ii, 2818.) | | | | AA-313..... | i, 850, 881 |
| Red Fish B., La. | S-219..... | i, 683 | | DD-179..... | i, 964 |
| Red Fork | (HH)..... | i, 1078* | Red Rock | (HH)..... | i, 1078 |
| Red Fork, Ark. | Y-2-c..... | i, 820 | Red Rock Cr., Mont. | GG-441..... | i, 1026 |
| Red Hook, N. Y.: | | | | GG-521..... | i, 1026 |
| Harbor lines | | ii, 2259 | (See notes, ii, 2815, 2816.) | | |
| Red Hook Pt., N. Y.: | | | Red Root Cr., N. J. | G-37..... | i, 24 |
| Harbor lines | | ii, 2259 | Red Route Cr., Mont. ... | GG-634..... | i, 1031 |
| Red House Cr., Md. | J-1073..... | i, 339 | (See notes, ii, 2817.) | | |
| Redhouse Cr., Md. | J-1181..... | i, 340 | Red Run, Md. | J-1103..... | i, 33 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|----------------------|-------------------|--|----------------------------|-------------------|
| Reds Landing (HH): (See notes, ii, 2827.) | | | Reports, paging of; annual reports, Chief of Engineers, U. S. Army. | | i, 16 |
| Redstone Cr., S. Dak. | GG-306. | i, 1027 | Republican and Smoky Hill Rs., Kans. | GG-1276-a. | i, 1062 |
| (See notes, ii, 2815.) | | | Republican R., Colo., Nebr., and Kans. | GG-1276. | i, 1035 |
| Red Tick Cr., Wyo. | GG-1065. | i, 1033 | (See notes, ii, 2822.) | | |
| Red Vermillion Cr., Kans. | GG-1244. | i, 1034 | Appro. | ii, 2297 | |
| (See notes, ii, 2821.) | | | Reservations, Governors Isld., N. Y. | ii, 2041, 2134 | |
| Red Water Cr., Mont. | GG-622. | i, 1030 | Reservations, Public, D. C. | ii, 2040, 2070, 2075 | |
| (See notes, ii, 2817.) | | | Reserved Chan., Mass. | B-129. | i, 70 |
| Red Water Cr., S. Dak. and Wyo. | GG-804. | i, 1031 | Reservoirs. | (HH) | i, 1078* |
| (See notes, ii, 2818.) | | | Reservoirs, D. C. | ii, 2040, 2084, 2085 | |
| Red Wing. | (HH) | i, 1078* | Rest Lake. | (HH) | i, 1078* |
| (See notes, ii, 2834.) | | | Retreat Cr., Ga. | O-172. | i, 534 |
| Redwood Cr. and H., Cal. | TT-191. | i, 1572 | Revel Cr., Va. | L-18. | i, 411 |
| Redwood Cr., Cal. | TT-26. | i, 1555 | Bewastica Cr., Md. | J-116. | i, 332 |
| | TT-191. | i, 1556 | Reynolds Cr., Cal. | TT-165. | i, 1556 |
| Appro. | ii, 2300 | | Reynolds Cr., S. Dak. | GG-373. | i, 1028 |
| Bridges. | ii, 2223 | | (See notes, ii, 2815.) | | |
| Redwood Cr., La. | S-97. | i, 682 | Rhine. | (HH) | i, 1078* |
| Redwood H., Cal.: Appro. | ii, 2300 | | Rhinelanders Landing. | (GG-2). | i, 1039* |
| Redwood R., Minn. | KK-158. | i, 1248 | Rhineland Landing, Missouri R.: (See notes, ii, 2824.) | | |
| Ree Cr., S. Dak. | GG-329. | i, 1027 | Rhine R. (Germany). | (CC) | i, 910* |
| Reed Cr., Md. | J-430. | i, 334 | Rhine (The), S. Dak. | GG-347. | i, 1027 |
| Reed Cr., Va. | EE-91. | i, 983 | Rhode Isld.: Forts. | ii, 1796, 1807, 1816, 1866 | |
| Reedy Cr., Ga. | O-64. | i, 533 | Rhodes Cr., Ga. | O-105. | i, 533 |
| Reedy Cr., N. C. | L-327. | i, 413 | Rhodes R., Md. | J-1264. | i, 340 |
| Reedy Cr., W. Va. | EE-161. | i, 984 | Rhone (The). | (HH) | i, 1078* |
| Reedy Isld., Delaware R. | H-3-h. | i, 282 | (See notes, ii, 2827.) | | |
| (See notes, ii, 2794.) | | | Ricaby Bayou, La. | S-623. | i, 686 |
| Reedy Isld. H. (Port Penn, Del. | H-3-h. | i, 282 | Rice Cr., Fla. | P-32. | i, 569 |
| Reedy Lake, Fla. | P-251. | i, 571 | Bridges. | ii, 2223 | |
| Reedy R., S. C. | N-170. | i, 500 | Rice Cr., Mich. | OO-17. | i, 1377 |
| Reelfoot. | (HH) | i, 1078* | Rice Cr., Minn. | KK-69. | i, 1247 |
| Reelfoot Crossing (HH): (See notes, ii, 2827, 2832.) | | | Rice Cr., S. C. | N-139. | i, 500 |
| Reelfoot Lake, Tenn. | AA-14. | i, 848 | Rice R., Minn. | KK-81. | i, 1247 |
| Reelfoot Levee (HH): (See notes, ii, 2827.) | | | Rices Cr., N. C. | M-93. | i, 455 |
| Reelfoot R., Tenn. | AA-14. | i, 848 | Rices Landing, Pa.: Harbor lines. | ii, 2259 | |
| Reeds. | (HH) | i, 1078* | Rices Pt., Minn.: Bridges. | ii, 2223 | |
| Reeds Cr., Md. | J-314. | i, 333 | Rice Trunk, Ga. | O-414. | i, 536 |
| Reeds Run, Ohio. | DD-380. | i, 962 | Richardson B., Cal. | TT-130. | i, 1556 |
| Reeves Pt. to La Grange. | M-305-d. | i, 490 | Richardson Brook, Mass. .. | B-12. | i, 69 |
| References, in this Index, Vols. I and II. | | i, 15 | Richardson Cr., Ga. | O-80. | i, 533 |
| (See notes, ii, 2782.) | | | (See notes, ii, 2798.) | | |
| Regulations, Rules and: Canals, etc. | ii, 2041, 2107 | | Richardson Cr., La. | R-98-h. | i, 647 |
| Rehoboth B., Del. | I-76. | i, 299 | Rich Cr., W. Va. | EE-22. | i, 983 |
| Rehoboth B. to Delaware B., Del. (inland waterway). | I-76-a. | i, 325 | | EE-106. | i, 984 |
| Appro. | ii, 2290 | | | EE-115. | i, 984 |
| Beld Bedford. | (HH) | i, 1078* | Richland Cove, Md. | J-220. | i, 332 |
| Remer Cr., Nebr. | GG-1261. | i, 1035 | Richland Cr., Ga. | O-282. | i, 535 |
| Renonco Cr., Md. | J-117. | i, 332 | Richland Cr., Mo. | GG-63. | i, 1025 |
| Reo Pass. | (HH) | i, 1078* | | GG-115. | i, 1026 |
| Repairs (see Preservation and Repairs): Forts. | ii, 1797, 1799, 1811 | | | GG-1480. | i, 1036 |

(See notes, ii, 2813, 2823.)

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|------------------------|
| Richland Cr., Tenn. | AA-146.....i, | 849, 875 | Rio Grande to Boston, In- | | |
| | AA-180.....i, | 849 | tracoastal waterways. | ii, | 2041, 2116 |
| | AA-229.....i, | 850 | Rio Grande R. to West | | |
| Richland R., Tenn. | AA-146.....i, | 875 | Galveston B. (inland | | |
| Richmond. | (HH).....i, | 1078* | waterway, coast of Tex- | | |
| Richmond Bar. | (CC).....i, | 910* | as) | U-38.....i, | 756 |
| Richmond Battery, N. Y.: | | | Rio Grande R. to West | | |
| Forts..... | ii, | 1881 | Galveston B., Tex. (in- | | |
| Richmond, Fort, N. Y. | ii, | 1807 | land waterway) | U-38.....i, | 735 |
| Richmond H., Kennebec | | | Rio Grande, Tex., to | | |
| R., Me..... | A-219-a.....i, | 50 | Donaldsonville, La. (in- | | |
| Appro..... | ii, | 2288 | land waterway), via Ver- | | |
| Richmond H., Va.: | | | million B., La., etc. | S-696-a.....i, | 709 |
| Wrecks..... | ii, | 2275 | | S-696-b.....i, | 709 |
| Richmond Isld., Me. | | | | U-38-g.....i, | 759 |
| (breakwater)..... | A-265-a.....i, | 56 | Rio Hondo, Cal. | SS-17.....i, | 1543 |
| Appro..... | ii, | 2288 | Rioll Cove, Md. | J-247.....i, | 333 |
| Richmonds Isld. H., Me. | A-265.....i, | 29 | Rio San Juan R., Utah, | | |
| Richmond to City Pt., | | | Colo., and N. Mex. | SS-5.....i, | 1543 |
| Va.: | | | Riparia. | (WW-2).....i, | 1617* |
| Harbor lines..... | ii, | 2259 | Riparia (WW): | | |
| Richmond to Old Wash- | | | (See notes, ii, 2841.) | | |
| ington (Brazos R., Tex.). | U-40-d.....i, | 764 | Ripley | (CC).....i, | 910* |
| Rickey Rapids. | (WW-2).....i, | 1617* | Rising Cr., Mo. | GG-1456.....i, | 1036 |
| Ridge Cr., La. | T-2-m.....i, | 717 | (See notes, ii, 2823.) | | |
| Ridge Cr., Pa. | I-56.....i, | 314 | Rising Sun. | (CC).....i, | 910* |
| Ridley Cr., Pa. | I-57-a.....i, | 314 | Rising Water or Pride Cr., | | |
| Appro..... | ii, | 2290 | N. Dak. | GG-402.....i, | 1028 |
| Bridges..... | ii, | 2223, 2230 | (See notes, ii, 2815.) | | |
| Ridley Cr., Tenn. | AA-84.....i, | 848 | Rivax Cr., Mo. | GG-73.....i, | 1025 |
| Ridley R., Pa. | I-56.....i, | 299, 314 | (See notes, ii, 2813.) | | |
| Ridout Cr., Md. | J-1207.....i, | 340 | River and Harbor Works. | i, 1-1791; ii, | 2041, |
| Rifle Cut, Ga. | O-318.....i, | 535 | | | 2104, 2113 |
| Rifle R., Mich. | PP-59.....i, | 1419 | (See notes, ii, 2779, 2845.) | | |
| Right Fork, Ky. | DD-159.....i, | 960 | Appro..... | ii, | 2041, 2103, 2116, 2279 |
| Right Fork, W. Va. | EE-147.....i, | 984 | Board of Engineers..... | ii, | 2041, 2104 |
| | EE-165.....i, | 984 | Contractors..... | ii, | 2307 |
| Right Hand Cr., La. | S-835.....i, | 688 | Data, arrangement..... | i, | 13 |
| Rigolets, La. | R-110.....i, | 647 | Deterioration..... | ii, | 2041, 2116 |
| | S-5.....i, | 681 | Discontinuance..... | ii, | 2041, 2116 |
| Bridges..... | ii, | 2223 | District appros..... | ii, | 2302 |
| Rigolets Pass, La.: | | | Engineers, list of..... | ii, | 2303 |
| Forts..... | ii, | 1803, 1976 | Estimates..... | ii, | 2039, 2042 |
| Rigolets(The), Lake Pont- | | | Non-United States work..... | ii, | 2041, 2109 |
| chartrain, and St. John | | | Occupation..... | ii, | 2041, 2116 |
| Bayou (connecting ship | | | Oversea works..... | i, | 1635; ii, 2845 |
| canal). | R-110.....i, | 678 | River au Chenes, La. | S-190.....i, | 682 |
| Rigolettes Bayou, La. | S-355.....i, | 684 | River des Peres | (HH).....i, | 1078* |
| Rikers Isld., N. Y.: | | | River Junction | (HH).....i, | 1078* |
| Harbor lines..... | ii, | 2259 | River Styx, Fla. | P-38.....i, | 569 |
| Riley Cr., Pa. | J-639.....i, | 335 | Riverton | (HH).....i, | 1078* |
| Rincon B., P. R. | YY-10.....i, | 1685 | Riverton, Ala. | AA-18.....i, | 855 |
| Rincon Rock, San Fran- | | | Riverton (below), Tennes- | | |
| cisco H., Cal. | TT-15-c.....i, | 1559 | see R. | AA-18-c.....i, | 861 |
| Rinearson Slough | (WW-2).....i, | 1617* | Riverton to Chattanooga, | | |
| Rinearson Slough, Oreg. | WW-22.....i, | 1615 | Tennessee R. | AA-18-d.....i, | 862 |
| Ringold Cove, Md. | J-1217.....i, | 340 | (See notes, ii, 2809.) | | |
| Rio Grande H., Tex.: | | | Roads | ii, | 2041, 2117, 2118, 2119 |
| Appro..... | ii, | 2295 | District of Columbia..... | ii, | 2040, 2075, 2076 |
| Rio Grande R., Tex., Mex, | | | Roads H., Md.: | | |
| and N. Mex. | U-74.....i, | 735, 775 | Wrecks..... | ii, | 2275 |
| Appro..... | ii, | 2294, 2295 | Roads, Military | ii, | 2041, 2119 |
| Bridges..... | ii, | 2223 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------|------------------------|-------------------|-----------------------------------|----------------------------|-------------------|
| Roanoke R., N. C. and | | | Rock Cr., Kans. | GG-1160.....i, 1034 | |
| Va. | L-352.....i, 414, 445 | | | GG-1189.....i, 1034 | |
| (See notes, ii, 2796.) | | | | GG-1209.....i, 1034 | |
| Appro. |ii, 2291 | | | GG-1228.....i, 1034 | |
| Bridges. |ii, 2223 | | | GG-1245.....i, 1034 | |
| Wrecks. |ii, 2275 | | | GG-1398.....i, 1036 | |
| Roanoke Sound, N. C. | L-217.....i, 413 | | (See notes, ii, 2821, 2823.) | | |
| | M-20.....i, 454 | | Rock Cr., La. | S-76.....i, 681 | |
| Roaring Cr., Pa. | J-616.....i, 335 | | Rock Cr., Md. | J-82.....i, 331 | |
| Roaring Fork, Colo. | GG-1028.....i, 1033 | | | J-192.....i, 332 | |
| (See notes, ii, 2820.) | | | | J-1172.....i, 339 | |
| Roaring R., Cal. | TT-75.....i, 1555 | | | K-24.....i, 373 | |
| Roaring R., Tenn. | AA-268.....i, 850 | | Wrecks. |ii, 2276 | |
| | AA-239.....i, 878 | | Rock Cr., Mass. | B-198.....i, 70 | |
| | J-1136.....i, 339 | | Rock Cr., Minn. | KK-146.....i, 1248 | |
| Roaring Run, Md. | J-1136.....i, 339 | | Rock Cr., Mo. | GG-187.....i, 1026 | |
| Robert Bayou, La. | S-589.....i, 686 | | | GG-198.....i, 1026 | |
| Robert Index. |i, 9 | | | GG-244.....i, 1027 | |
| Roberts B., Fla. | P-274.....i, 571 | | | GG-1414.....i, 1036 | |
| Roberts Bayou, La. | S-755.....i, 687 | | | GG-1436.....i, 1036 | |
| Roberts Branch, Mo. | GG-215.....i, 1026 | | | GG-1451.....i, 1036 | |
| (See notes, ii, 2814.) | | | (See notes, ii, 2814, 2823.) | | |
| Roberts Cr., Kans. | GG-1376.....i, 1035 | | Rock Cr., Mont. | GG-507.....i, 1029 | |
| Roberts Cr., Va. | L-90.....i, 412 | | (See notes, ii, 2816.) | | |
| Roberts H., Me. | A-115.....i, 28 | | Rock Cr., Nebr. | GG-963.....i, 1032 | |
| Robertsons Bayou, La. | S-553.....i, 686 | | Rock Cr., S. Dak. | GG-305.....i, 1027 | |
| Robin Cove, Md. | J-432.....i, 334 | | | GG-909.....i, 1032 | |
| Robin Hood Cove, Me. | A-213.....i, 28 | | (See notes, ii, 2815.) | | |
| (See notes, ii, 2783.) | | | Rock Cr., Washington, | | |
| Robins Cr., Md. | J-278.....i, 333 | | D. C.: | | |
| Robinson Canal, La. | S-459.....i, 685 | | Bridges. |ii, 2223 | |
| Robinson Cove, Md. | J-1198.....i, 340 | | Rock Cr., Wyo. | GG-1007.....i, 1033 | |
| Robinson Cr., Ky. | DD-250.....i, 961 | | (See notes, ii, 2820.) | | |
| Robinsons Cove, Me. | A-184.....i, 28 | | Rockdale Cr., Va. | L-148.....i, 412 | |
| Robinsons Cr., Va. | K-225.....i, 374 | | Rock De Dundy R., Ga. | O-235.....i, 534 | |
| Rochee Perchee Cr., Mo. | GG-83.....i, 1025 | | Rockfish Cr., N. C. | M-319.....i, 456 | |
| (See notes, ii, 2813.) | | | Rock Fork, Ky. | DD-240.....i, 961 | |
| Rochepoint | (GG-2).....i, 1039* | | Rock Gap Cr., Mont. | GG-502.....i, 1029 | |
| Rochepoint Reach | (GG-2).....i, 1039* | | Rockhall Cr., Md. | J-498.....i, 334 | |
| Rochester, Pa. | (CC).....i, 910* | | Rockhall Cr., N. C. | L-218.....i, 413 | |
| Harbor lines |ii, 2259 | | Rockhall H., Md. | J-499.....i, 334, 358 | |
| Rockaway Inlet, N. Y. | F-78.....i, 215 | | Appro. |ii, 2291 | |
| | F-78-a.....i, 230 | | Rockhall, Md. (inner har- | | |
| Bridges. |ii, 2167 | | bor). | J-499.....i, 358 | |
| Harbor lines |ii, 2259 | | Rock H., Mass. | B-197.....i, 70 | |
| Wrecks. |ii, 2275 | | Rock H., Mich. | LL-61.....i, 1265 | |
| Rockaway Inlet to Ja- | | | Rockhaven | (GG-2).....i, 1039* | |
| malca B., N. Y. (chan- | | | Rock Hole Cr., Md.: | | |
| nel). | F-78-b.....i, 230 | | Bridges. |ii, 2224, 2238 | |
| Rockaway-Jamaica | | | Rock Hole, Md. | J-50.....i, 331 | |
| Chan., N. Y. | F-88.....i, 216 | | Rockhouse Cr., Ky. | DD-74.....i, 959 | |
| Rockaway, N. Y.: | | | | DD-140.....i, 960 | |
| Wrecks. |ii, 2276 | | | DD-206.....i, 960 | |
| Rockcastle Cr., Ky. | DD-293.....i, 961 | | Rockhouse Fork, Ky. | DD-294.....i, 961 | |
| Rock Castle Cr., W. Va. | EE-36.....i, 983 | | Rockhouse Fork, W. Va. | DD-324.....i, 961 | |
| Rockcastle R., Ky. | AA-280.....i, 850, 888 | | Rock Isld. | (HH).....i, 1078* | |
| Rock Cr. Bridge, D. C. |ii, 2039, 2064 | | Rock Isld., Ill.: | | |
| Rock Cr., Cal. | TT-79.....i, 1555 | | Appro. |ii, 2297 | |
| Rock Cr., D. C. | K-89.....i, 373 | | Rock Isld., Ill., district | JJ (with map).....i, 1231, | |
| Rock Cr., Ga. | O-22.....i, 533 | | | 1234 | |
| | O-353.....i, 535 | | (See notes, ii, 2829, 2834.) | | |
| | O-402.....i, 536 | | Rock Isld. Rapids | (HH).....i, 1078* | |
| Rock Cr., Iowa and | | | | (WW-2).....i, 1617* | |
| Minn.: | | | (See notes, ii, 2833, 2843.) | | |
| (See notes, ii, 2814.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|------------------------------------|---------------------|-------------------|
| Rockland H., Me. | A-145..... | i, 28, 44 | Rocky Fork, Ohio (con.) ... | DD-478..... | i, 962 |
| Appro. |ii, | 2287 | DD-483..... | i, 963 | |
| Harbor lines..... |ii, | 2259 | Rockyhock Cr., N. C. | L-299..... | i, 413 |
| Wrecks..... |ii, | 2276 | Bridges..... |ii, | 2224 |
| Rock Lick Cr., Ky. | DD-110..... | i, 960 | Rocky Mount to Tar- | | |
| Rock Pt., Md.: | | | boro, N. C..... | M-66-e..... | i, 463 |
| Forts..... |ii, | 1914 | Rocky Nemah R., Wash. | XX-4..... | i, 1655 |
| Rockport | (CC)..... | i, 910* | Rocky Pt. | (HH)..... | i, 1078* |
| Rockport (below), Pearl | | | Rocky R. | (GG-2)..... | i, 1039* |
| R., Miss..... | R-98-b..... | i, 674 | Rocky R. H., Ohio. | QQ-24..... | i, 1477 |
| Rockport H., Me. | A-143..... | i, 28, 43 | Appro..... |ii, | 2299 |
| (See notes, ii, 2783.) | | | Rocky R., Ohio. | QQ-24..... | i, 1461 |
| Appro..... |ii, | 2287 | Bridges..... |ii, | 2224 |
| Wrecks..... |ii, | 2276 | Rocky R., S. C. | O-11..... | i, 533 |
| Rockport H., Mass. | B-79..... | i, 69, 78 | Rocky Spring Cr., S. C. ... | N-240..... | i, 501 |
| (See notes, ii, 2784.) | | | Rocky Swamp, S. C. | N-236..... | i, 501 |
| Appro..... |ii, | 2288 | Rodeo Cr., Cal. | TT-64..... | i, 1555 |
| Rockport H., Mich. | PP-48..... | i, 1419 | Rodgers R., Fla. | P-204..... | i, 570 |
| Rockport, Tex., to Aran- | | | Rodman Cr., N. C. | M-90..... | i, 454 |
| sas Pass, H..... | U-67-c..... | i, 772 | Roebuck Lake, Miss. | X-6..... | i, 788 |
| Rock R. | (HH)..... | i, 1078* | Roeliff Jansen Kill, N. Y. | E-47..... | i, 177 |
| (See notes, ii, 2827.) | | | Rogers Bayou, La. | S-775..... | i, 687 |
| Rock R. Canal, Milwau- | | | Rogers City H., Mich. ... | PP-42..... | i, 1419, 1432 |
| kee and..... | MM-33-e..... | i, 1337 | Appro..... |ii, | 2299 |
| Appro..... |ii, | 2298 | Rogers Shoal, Mass.: | | |
| Rock R., Ill. and Wis. | JJ-18..... | i, 1234, 1235 | Wrecks..... |ii, | 2276 |
| Appro..... |ii, | 2297 | Rogue R., Mich. | OO-33..... | i, 1377 |
| Bridges..... |ii, | 2224 | Rogue R., Ore. | VV-8..... | i, 1593, 1595 |
| Dams, private..... |ii, | 2250 | Rogues H., Md. | J-546..... | i, 335 |
| Navigation rules..... |ii, | 2041, 2107 | Roland Run, Md. | J-1094..... | i, 339 |
| Rock R., Iowa and Minn.: | | | Rolling Fork Bayou, | | |
| (See notes, ii, 2814.) | | | Miss..... | X-22..... | i, 785 |
| Rock R., Mich. and Ind. ... | OO-10..... | i, 1377 | Rolling Stone | (HH)..... | i, 1078* |
| Rock R., Minn. and Iowa. | GG-280..... | i, 1027 | Rollingstone Cr., Minn. | JJ-49..... | i, 1234 |
| Rock R. Pool, Ill. (Illinois | | | Rollover Bayou, La. | S-742..... | i, 687 |
| and Mississippi Canal). | JJ-20-d..... | i, 1239 | Rome, Ga.: | | |
| Rock R., Vt. | E-128..... | i, 178 | (See notes, ii, 2802.) | | |
| Rock Run, Md. | J-558..... | i, 335 | Rome, Ga., to East | | |
| J-937..... | i, 338 | | Tennessee, Virginia & | | |
| Rock Run, Pa. | J-743..... | i, 336 | Georgia Railroad Br. | | |
| Rock Slough, Cal. | UU-15..... | i, 1577 | (Coosa R.)..... | Q-52-c..... | i, 638 |
| Rocktwist Cr., N. C. | L-346..... | i, 414 | Romerly Marsh Cr., Ga. ... | O-100..... | i, 533 |
| Rockwalking Cr., Md. | J-106..... | i, 331 | Appro..... |ii, | 2293 |
| Rockwood | (HH)..... | i, 1078* | Romerly Marsh, Ga. (wa- | | |
| Rocky Beach | (WW-2)..... | i, 1617* | ter route through)..... | O-101..... | i, 548 |
| Rocky Branch, Md. | J-985..... | i, 338 | Rome to Macon, Ga. | | |
| Rocky Branch, Mo. | GG-55..... | i, 1025 | (Georgia Canal)..... | O-326-b..... | i, 557 |
| Rocky Comfort Cr., Ga. ... | O-132..... | i, 534 | Romney Cr., Md. | J-945..... | i, 338 |
| Rocky Cr., Ga. | O-58..... | i, 533 | Rondout Cr., N. Y. | E-64..... | i, 177, 200 |
| O-69..... | i, 533 | | Bridges..... |ii, | 2224 |
| O-137..... | i, 534 | | Rondout H., N. Y. | E-64..... | i, 200 |
| O-256..... | i, 535 | | Appro..... |ii, | 2289 |
| O-375..... | i, 535 | | Wrecks..... |ii, | 2276 |
| Rocky Cr., Mo. | GG-89..... | i, 1025 | Rones B., Va. | K-159..... | i, 374 |
| Rocky Cr., Mont. | GG-426..... | i, 1028 | Roosevelt Board: | | |
| Rocky Cr., Mont. and | | | Forts..... |ii, | 1817 |
| Canada: | | | Root R. | (HH)..... | i, 1078* |
| (See notes, ii, 2815.) | | | Root R., Minn. | JJ-55..... | i, 1234 |
| Rocky Cr., S. C. | N-65..... | i, 499 | Root R., Wis. | MM-36..... | i, 1297 |
| N-135..... | i, 500 | | Bridges..... |ii, | 2224 |
| Rocky Fork, Mo.: | | | Wrecks..... |ii, | 2276 |
| (See notes, ii, 2814.) | | | Rooty Cr., Ga. | O-301..... | i, 535 |
| Rocky Fork, Ohio | DD-412..... | i, 962 | Rope Cr., Nebr. | GG-1300..... | i, 1035 |
| DD-423..... | i, 962 | | (See notes, ii, 2822.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Roque Isld. H., Me. | A-19..... | i, 27 | Rouville Bayou, La. | S-15..... | i, 681 |
| Rose B., Fla. | P-101..... | i, 569 | Rowanty Cr., Va. | L-315..... | i, 413 |
| Rose B., N. C. | M-38..... | i, 454 | Rowes Hole Chan., Va. | L-32..... | i, 411 |
| Roseberry Cr., Ala. | AA-196..... | i, 849 | Rowes Ranch. | (GG-2)..... | i, 1039* |
| Roseberry Cr., Tenn. | AA-148..... | i, 849 | Rowlands Race. | (CC)..... | i, 910* |
| Rosebud Cr., S. Dak. | GG-895..... | i, 1032 | Rowley R., Mass. | B-57..... | i, 69 |
| (See notes, ii, 2819.) | | | Royal R., Me. | A-260..... | i, 29 |
| Rosebud R., Mont. | GG-709..... | i, 1030 | | A-260-a..... | i, 53 |
| (See notes, ii, 2817.) | | | Appro..... | | ii, 2288 |
| Rose Cr., Kans. | GG-1340..... | i, 1035 | Boys Cr., Nebr. and Kans. | GG-1153..... | i, 1034 |
| (See notes, ii, 2822.) | | | (See notes, ii, 2821.) | | |
| Rosedale. | (HH)..... | i, 1078* | Ruby R., Mont. | GG-523..... | i, 1029 |
| Rosier Cr., Va. | K-112..... | i, 374 | (See notes, ii, 2816.) | | |
| Roslin Cr., Md. | K-36..... | i, 373 | Rude Waterway, Alaska: | | |
| Roslyn H., N. Y. | F-10..... | i, 215, 218 | Harbor lines..... | | ii, 2259 |
| Ross Cove, Md. | J-1191..... | i, 340 | Rudy Inlet, Va. | L-214..... | i, 412 |
| Ross Cr., Ky. | DD-23..... | i, 959 | Ruggles Cr., Mass. | B-141..... | i, 70 |
| Ross Isld. | (WW-2)..... | i, 1617* | Rulo. | (GG-2)..... | i, 1039* |
| | WW-30-c..... | i, 1645 | Rulo Beach. | (GG-2)..... | i, 1039* |
| (See notes, ii, 2841.) | | | (See notes, ii, 2824.) | | |
| Ross Isld. Chan. (WW): | | | Rum Cr., Ga. | O-371..... | i, 535 |
| (See notes, ii, 2841.) | | | Rum Cr., W. Va. | EE-44..... | i, 983 |
| Rossville, Staten Isld., N. Y.: | | | Rummerfeld Cr., Pa. | J-645..... | i, 336 |
| Harbor lines..... | | ii, 2259 | Rum R. | (HH)..... | i, 1078* |
| Rotten Grass Cr., Mont. | GG-702..... | i, 1030 | (See notes, ii, 2828.) | | |
| (See notes, ii, 2817.) | | | Rum R., Minn. | KK-64..... | i, 1247 |
| Roubidoux Cr., Mo. | GG-1526..... | i, 1037 | Rumsey and Calhoun, Ky. | BB-7..... | i, 892 |
| (See notes, ii, 2824.) | | | Rumsey, Ky., Green R., Lock No. 2. | BB-7-c..... | i, 894 |
| Rogue Bayou, La. | S-560..... | i, 686 | Running Chan., Va. | L-43..... | i, 411 |
| | S-579..... | i, 686, 704 | Running Cr., Tenn. and Ga. | AA-61..... | i, 848 |
| Rogue R., Mich. | PP-110..... | i, 1420, 1455 | Runyon Cr., N. C. | M-75..... | i, 454 |
| (See notes, ii, 2838.) | | | Bridges..... | | ii, 2224 |
| Appro..... | | ii, 2299 | Rush Brook, Md. | J-1044..... | i, 338 |
| Bridges..... | | ii, 2224 | Rush Chute. | (HH)..... | i, 1078* |
| Harbor lines..... | | ii, 2259 | Rush Cr., Kans. | GG-1246..... | i, 1034 |
| Wrecks..... | | ii, 2276 | Rush Cr., Ky. | DD-70..... | i, 959 |
| Rough R., Ky. | BB-11..... | i, 891, 896 | Rush Cr., Mo. | GG-190..... | i, 1026 |
| | BB-7..... | i, 892 | | GG-201..... | i, 1026 |
| | BB-11-a..... | i, 896 | (See notes, ii, 2814.) | | |
| | BB-11-b..... | i, 897 | Rush Cr., Nebr.: | | |
| Appro..... | | ii, 2296 | (See notes, ii, 2819.) | | |
| Navigation rules..... | | ii, 2041, 2107 | Rush Cr., Ohio. | DD-463..... | i, 962 |
| Roundaway Bayou, La. | X-30-c..... | i, 807 | Rush Isld. | (HH)..... | i, 1078* |
| Appro..... | | ii, 2295 | Rush Isld. Cr., Minn. | KK-143..... | i, 1248 |
| Round B., La. | S-347..... | i, 684 | Rush R., Wis. | KK-43..... | i, 1247 |
| | S-406..... | i, 684 | Rush Tower. | (HH)..... | i, 1078* |
| Round B., Md. | J-1226..... | i, 340 | Rush Towhead. | (HH)..... | i, 1078* |
| Round Bayou, La. | S-492..... | i, 685 | Russell Cr., Ky. | DD-165..... | i, 960 |
| Round Grove Cr., Mo. | GG-1407..... | i, 1036 | Russell Cr., Nebr. | GG-1135..... | i, 1034 |
| (See notes, ii, 2823.) | | | Russell Fork, Ky. and Va. | DD-255..... | i, 961 |
| Round Lake. | (HH)..... | i, 1078* | Russell Isld. Chan., Mich. | PP-96..... | i, 1420 |
| Round Lake, La. | S-403..... | i, 684 | Russell Prater Cr., Va. | DD-271..... | i, 961 |
| | S-634..... | i, 686 | Russells Cr., N. C. | M-264..... | i, 456 |
| Round Lake, Mich.: | | | Russian R., Cal. | TT-136..... | i, 1556 |
| (See notes, ii, 2838.) | | | Rutherford Fork, Tenn. | AA-11..... | i, 848 |
| Round Lick Cr., Tenn. | AA-259..... | i, 850 | Rutmans Cr., N. C. | M-52..... | i, 454 |
| Round Pt. | RR-38..... | i, 1493 | Ryder Cove, Mass. | B-216..... | i, 70 |
| Round Pond H., Me. | A-175..... | i, 28 | Rye H., N. H. | A-292..... | i, 29, 66 |
| Round Pond, Md. | J-161..... | i, 332 | | | |
| Rouse Pt., N. Y. (breakwaters) | E-77..... | i, 202 | | | |
| Rouses Pt., N. Y. | E-77..... | i, 177 | | | |
| (See notes, ii, 2792.) | | | | | |
| Appro..... | | ii, 2289 | | | |

S.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Sabbath Day H., Me. | A-110..... | i, 28 | Sacketts H., N. Y. | RR-58..... | i, 1493, 1532 |
| Sabine and Neches Can- al, Tex. | T-7..... | i, 717 | Appro..... | | ii, 2299 |
| Sabine and Neches Rs., Tex. (mouths of), to Port Arthur Canal (channel from)..... | T-3-a..... | i, 717 | Saco B., Me. | A-267..... | i, 29 |
| Sabine H., Tex. | U-2-b..... | i, 735 | Saco R., Me. | A-269..... | i, 29, 56 |
| Appro..... | | ii, 2295 | Appro..... | | ii, 2288 |
| Sabine, La.: | | | Sacramento City, Cal., to mouth of Sacramento R. | UU-55-b..... | i, 1589 |
| Bridges..... | | ii, 2225 | Sacramento R., Cal. | TT-73..... | i, 1555 |
| Sabine Lake and Cal- casieu Lake (between), Black Bayou, La. | S-799..... | i, 714 | UU-55..... | i, 1577, 1585 | |
| Sabine Lake, La. and Tex. | T-3..... | i, 717 | UU-55-a..... | | i, 1586 |
| (See notes, ii, 2805, 2806.) | | | (See notes, ii, 2840, 2841.) | | |
| Appro..... | | ii, 2294, 2295 | Appro..... | | ii, 2300 |
| Sabine Lake to Galveston B., Tex. | U-7..... | i, 737 | Bridges..... | | ii, 2225 |
| Sabine-Neches Canal, in- cluding Sabine R. to Orange and Neches R. to Beaumont, Tex. | T-3-b..... | i, 719 | Débris..... | | ii, 2041, 2108 |
| (See notes, ii, 2806.) | | | Sacramento R., Cal., Sac- ramento to mouth..... | UU-55-b..... | i, 1589 |
| Bridges..... | | ii, 2225 | Sacramento R., Cal. (see Cal. Débris Comm.)..... | | i, 1580 |
| Navigation rules..... | | ii, 2041, 2107 | Sacramento Valley, Cal. | UU-6-g..... | i, 1583 |
| Sabine Pass H., Tex. | T-9..... | i, 717, 722 | Irrigation..... | | ii, 2040, 2087 |
| (See notes, ii, 2806.) | | | Sac R., Mo. | GG-1494..... | i, 1036 |
| Appro..... | | ii, 2294 | (See notes, ii, 2824.) | | |
| Sabine Pass, La. and Tex. | T-2..... | i, 717 | Saddle Cr., S. Dak. | GG-295..... | i, 1027 |
| T-2-a..... | | i, 717 | Saddle R., N. J. | G-17..... | i, 247 |
| (See notes, ii, 2805.) | | | Safety H., Fla. | P-311..... | i, 571 |
| Forts..... | | ii, 1796, 1976 | Sagadahoc B., Me. | A-218..... | i, 28 |
| Harbor lines..... | | ii, 2259 | (See notes, ii, 2783.) | | |
| Wrecks..... | | ii, 2276 | Saganaga Lake, Minn. and Canada. | KK-239..... | i, 1249 |
| Sabine R.-Calcasieu R., La. (Inland waterway canal)..... | S-858..... | i, 688 | Saganing B., Mich. | PP-61..... | i, 1419 |
| U-2-b..... | | i, 735 | Sag B. and Sag Cove H., N. Y.: | | |
| Sabine R., La. and Tex. ... | T-2-e..... | i, 717 | Bridges..... | | ii, 2225 |
| T-5..... | | i, 717, 719 | Sage Cr., Mont. | GG-447..... | i, 1028 |
| (See notes, ii, 2805, 2806.) | | | GG-472..... | | i, 1028 |
| Appro..... | | ii, 2294, 2295 | (See notes, ii, 2815, 2816.) | | |
| Bridges..... | | ii, 2225 | Sage Cr., S. Dak. | GG-846..... | i, 1031 |
| Sabine R., La. and Tex., to Mermentau R. (wa- terway)..... | S-696-d..... | i, 710 | Sage Cr., S. Dak. and Wyo.: | | |
| Sabine R. to Orange, Tex. | T-2-b..... | i, 719 | (See notes, ii, 2819, 2820.) | | |
| Sable Isld. | (HH)..... | i, 1078* | Sage Cr., Wyo. | GG-847..... | i, 1031 |
| Sable Pt. | (HH)..... | i, 1078* | GG-1058..... | | i, 1033 |
| Sabula | (HH)..... | i, 1078* | GG-598..... | | i, 1029 |
| Sachem Cr., Mass. | B-136..... | i, 70 | (See notes, ii, 2817.) | | |
| Bridges..... | | ii, 2225 | Sage Hen Cr., Wyo. | GG-1005..... | i, 1033 |
| | | | (See notes, ii, 2820.) | | |
| | | | Sag H., N. Y. | F-41..... | i, 215, 225 |
| | | | Sag H. Cove, N. Y.: | | |
| | | | Bridges..... | | ii, 2225 |
| | | | Sag H., N. Y.: | | |
| | | | Appro..... | | ii, 2289 |
| | | | Wrecks..... | | ii, 2276 |
| | | | Saginaw B., Mich. | PP-54..... | i, 1419 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|----------------------|
| Saginaw B., Mich. (con.) | PP-76..... | i, 1438 | St. Clair City, Mich. | PP-91..... | i, 1419, 1446 |
| Appro..... | ..... | ii, 2299 | Appro..... | ..... | ii, 2299 |
| Saginaw B., Mich., Pine | | | St. Clair Flats and Ship | | |
| R..... | PP-60..... | i, 1435 | Canal, Mich..... | PP-98..... | i, 1420, 1448 |
| Saginaw H., Mich. | PP-67..... | i, 1419 | PP-98-a..... | ..... | i, 1448 |
| Harbor lines..... | ..... | ii, 2259 | St. Clair Flats Canal, | | |
| Saginaw R., Mich. | PP-64..... | i, 1419, 1435 | Mich..... | | |
| Appro..... | ..... | ii, 2299 | Appro..... | ..... | ii, 2299 |
| Bridges..... | ..... | ii, 2225 | Navigation rules..... | ..... | ii, 2041, 2107 |
| Harbor lines..... | ..... | ii, 2259 | Wrecks..... | ..... | ii, 2276 |
| Wrecks..... | ..... | ii, 2276 | St. Clair Flats Canal, | | |
| Sallors Cr., Mich. | PP-10..... | i, 1419 | Mich. (operating and | | |
| Sallors Encampment | | | care)..... | PP-98-b..... | i, 1450 |
| Isld., Mich.: | | | St. Clair Lake, Mich.: | | |
| Harbor lines..... | ..... | ii, 2259 | Bridges..... | ..... | ii, 2226 |
| St. Albans B., Vt. | E-120..... | i, 178 | Harbor lines..... | ..... | ii, 2259 |
| St. Albans H., Vt. | E-120..... | i, 210 | St. Clair R., Mich. | PP-88..... | i, 1419, 1444 |
| (See notes, ii, 2792.) | | | PP-89..... | ..... | i, 1444 |
| Appro..... | ..... | ii, 2289 | Appro..... | ..... | ii, 2299 |
| St. Andrews B. and Apa- | | | Discharge..... | ..... | ii, 2041, 2132 |
| lachicola R., Fla. (chan- | | | Great Lakes regulation..... | ..... | ii, 2041, 2124 |
| nel between) | Q-26..... | i, 623 | Navigation rules..... | ..... | ii, 2041, 2108 |
| St. Andrews B., Fla. | Q-29..... | i, 611, 624 | Wrecks..... | ..... | ii, 2276 |
| Appro..... | ..... | ii, 2293 | St. Clair R., Mich., at Al- | | |
| St. Andrews B., Fla., and | | | gonac..... | PP-93..... | i, 1448 |
| St. Marys R., Fla..... | P-1-a..... | i, 572 | St. Clair R., mouth of | | |
| St. Andrews B., Fla., to | | | Black R., Mich..... | PP-89-a..... | i, 1444 |
| Apalachicola R. (water- | | | St. Clair R., North Chan., | | |
| way) | Q-26..... | i, 611 | Mich..... | PP-94..... | i, 1420 |
| St. Andrews B. to Choctaw- | | | St. Clair R., South Chan., | | |
| tawhatchee R. and B., | | | Mich..... | PP-97..... | i, 1420 |
| Fla. | Q-30..... | i, 611, 624 | St. Clair Ship Canal, | | |
| St. Andrews Sound, Ga. | O-461..... | i, 536 | Mich.: | | |
| St. Anthony | (HH)..... | i, 1078* | Appro..... | ..... | ii, 2299 |
| St. Anthony's Falls (HH): | | | St. Clement B., Md. | K-63..... | i, 373 |
| (See notes, ii, 2827.) | | | St. Cloud | (HH)..... | i, 1078* |
| St. Aubert, Missouri R.: | | | (See notes, ii, 2828.) | | |
| (See notes, ii, 2824.) | | | St. Croix Lake and R., | | |
| St. Auberts Bend | (GG-2)..... | i, 1039* | Minn. and Wis..... | KK-47..... | i, 1247, 1251 |
| St. Auberts Isld. | (GG-2)..... | i, 1039* | (See notes, ii, 2834.) | | |
| St. Augusta Cr., Minn. | KK-126..... | i, 1248 | Appro..... | ..... | ii, 2297 |
| St. Augustine Cr., Ga. | O-77..... | i, 533, 547 | Booms, logs, etc..... | ..... | ii, 2250 |
| (See notes, ii, 2798.) | | | Bridges..... | ..... | ii, 2226 |
| Appro..... | ..... | ii, 2293 | St. Croix R. | (HH)..... | i, 1078* |
| Bridges..... | ..... | ii, 2143, 2226 | St. Croix R., Me. | A-3..... | i, 27, 30 |
| St. Augustine H., Fla. | P-84..... | i, 569, 584 | Appro..... | ..... | ii, 2287 |
| Appro..... | ..... | ii, 2293 | St. Croix R., Minn. and | | |
| Forts..... | ..... | ii, 1955 | Wis.: | | |
| Harbor lines..... | ..... | ii, 2259 | (See notes, ii, 2834.) | | |
| St. Augustine Inlet, Fla. | P-83..... | i, 569 | Appro..... | ..... | ii, 2297 |
| St. Catherine Sound, Md. | K-65..... | i, 373 | Booms, logs, etc..... | ..... | ii, 2041, 2109, 2250 |
| St. Catherines Sound, Ga. | O-164..... | i, 534 | Bridges..... | ..... | ii, 2226 |
| St. Charles | (GG-2)..... | i, 1039* | Navigation rules..... | ..... | ii, 2041, 2108 |
| St. Charles Bayou | (HH)..... | i, 1071* | St. Denis Bayou, La. | S-349..... | i, 684 |
| St. Charles B., Tex., Aran- | | | St. Francis | (HH)..... | i, 1078* |
| sas B. | U-67-d..... | i, 772 | St. Francis Barracks, Fla...... | ..... | ii, 1955 |
| St. Charles Bend | (GG-2)..... | i, 1039* | St. Francis Basin | (HH)..... | i, 1078* |
| St. Charles Cr., Fla. | P-15..... | i, 569 | St. Francis B., Ark. | Y-54..... | i, 818, 839 |
| St. Charles Isld. | (GG-2)..... | i, 1039* | St. Francis Lake, Ark.: | | |
| St. Charles, Mo. | (GG-2)..... | i, 1037* | Bridges..... | ..... | ii, 2226 |
| St. Charles R., Mass.: | | | St. Francis Levee (HH): | | |
| Bridges..... | ..... | ii, 2226 | (See notes, ii, 2828.) | | |
| St. Clair | (GG-2)..... | i, 1039* | | | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| St. Francis (Little R., Ark. and Mo., from Ho- mersville to junction) | Y-52 | i, 839 | St. Johns, Fla., to St. Marys, Ga. (inland wa- terway) | O-511 | i, 537 |
| St. Francis R., Ark. and Mo. | Y-47 | i, 818 | | O-511-a | i, 566 |
| | Y-23 | i, 827 | (See notes, ii, 2799.) | | |
| | Y-47 | i, 836 | St. Johns R., Fla. | P-10 | i, 569, 575 |
| (See notes, ii, 2808, 2828.) | | | (See notes, ii, 2799.) | | |
| Appro. | | ii, 2295 | Appro. | | ii, 2293 |
| Bridges | | ii, 2216, 2226 | Bridges | | ii, 2226-2227 |
| St. Francis R., Minn. | KK-67 | i, 1247 | Forts | | ii, 1955 |
| St. Francis R., Mo. | Y-47-c | i, 838 | Harbor lines | | ii, 2259 |
| St. Francisville | (HH) | i, 1078* | Navigation rules | | ii, 2041, 2108 |
| St. Geneleve | (HH) | i, 1078* | Wrecks | | ii, 2276 |
| St. George Ferry Termi- nal, N. Y.: | | | St. Johns R., Fla., to Cumberland Sound (waterway) | P-2 | i, 569 |
| Harbor lines | | ii, 2259 | St. Johns R., Fla., to Jupiter Inlet, Fla. (ca- nal) | P-10-h | i, 582 |
| St. George R., Md. | K-57 | i, 373 | St. Johns R., Fla. (water- way to Charlotte H., Fla.) | P-258-b | i, 595 |
| St. Georges R., Md.: | | | St. Johns R., Fla., to Fern- andina, Fla. (inside passage between) | P-2 | i, 575 |
| Wrecks | | ii, 2276 | St. Johns R., Me. | A-1 | i, 27 |
| St. Georges R., Me. | A-155 | i, 28 | St. Johns R., Me., Big Rapids | A-1 | i, 29 |
| St. Georges R., Me. (War- ren to Thomaston) | A-155 | i, 45 | St. Jones R., Del. | I-68 | i, 299, 320 |
| St. Georges Sound, Fla. | Q-15 | i, 611, 613 | Appro. | | ii, 2290 |
| (See notes, ii, 2800.) | | | Bridges | | ii, 2156, 2227 |
| Harbor lines | | ii, 2259 | Wrecks | | ii, 2276 |
| St. George, Staten Isl., N. Y.: | | | St. Joseph | (GG-2) | i, 1039* |
| Harbor lines | | ii, 2259 | | (HH) | i, 1078* |
| St. Helen | (WW-2) | i, 1617* | St. Joseph (GG): | | |
| (See notes, ii, 2841.) | | | (See notes, ii, 2825.) | | |
| St. Helens Bar | (WW-2) | i, 1617* | St. Joseph H. and R., Mich. | OO-2 | i, 1377, 1378 |
| (See notes, ii, 2842.) | | | | OO-2-c | i, 1381 |
| St. Helens Jetty | (WW-2) | i, 1617* | Appro. | | ii, 2298 |
| St. Helens, Oreg.: | | | St. Joseph H., Mich. | OO-2 | i, 1377 |
| (See notes, ii, 2841.) | | | | OO-2-a | i, 1379 |
| St. Ignace H., Mich. | PP-28 | i, 1419 | Bridges | | ii, 2227 |
| St. Jean Charles Bayou, La. | S-442 | i, 685 | Harbor lines | | ii, 2260 |
| St. Jean de Jean Bayou, La. | S-564 | i, 686 | Navigation rules | | ii, 2041, 2108 |
| St. Jerome B., Md. | K-45 | i, 373 | Wrecks | | ii, 2276 |
| | K-45-b | i, 377 | St. Joseph, Mo. | (GG-2) | i, 1037* |
| St. Jerome Cr., Md. | K-45 | i, 373 | Harbor lines | | ii, 2259 |
| | K-45-a | i, 376 | St. Joseph Reach | (GG-2) | i, 1039* |
| Appro. | | ii, 2291 | St. Joseph R., Mich. | OO-2-b | i, 1381 |
| Wrecks | | ii, 2276 | (See notes, ii, 2838.) | | |
| St. Joe R., Idaho | XX-108 | i, 1656 | Bridges | | ii, 2227 |
| St. John Bayou, La. | S-134 | i, 682, 694 | Dams, private | | ii, 2250 |
| (See notes, ii, 2805.) | | | Wrecks | | ii, 2276 |
| St. John Bayou, The Rigolets, and Lake Pontchartrain (con- necting ship canal) | R-110 | i, 678 | St. Joseph R., Mich. and Ind. | OO-3 | i, 1377, 1378 |
| St. John Cr., Md. | J-226 | i, 332 | St. Joseph R., Ohio and Mich. | QQ-8 | i, 1461 |
| | K-9 | i, 373 | St. Josephs B., Fla. | Q-28 | i, 611 |
| | K-39 | i, 373 | Appro. | | ii, 2293 |
| St. Johns | (WW-2) | i, 1617* | St. Josephs B., Fla. (en- trance to) | Q-28 | i, 623 |
| St. Johns Bayou | (HH) | i, 1071* | | | |
| St. Johns Branch, Del. | J-126 | i, 332 | | | |
| St. Johns Cr., Mo. | GG-1546 | i, 1037 | | | |
| (See notes, ii, 2824.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|---------------------------------------|---------------------|-------------------|
| St. Joseph Sound, Fla. | P-327..... | i, 571 | St. Marys R., Ga. and | | |
| St. Josephs R., Idaho | XX-108-a..... | i, 1676 | Fla. | O-510..... | i, 537, 565 |
| St. Julian Cr., Va. | L-180..... | i, 412 | Appro. | | ii, 2293 |
| St. Lawrence R., N. Y. | RR-63..... | i, 1493, 1533 | Bridges | | ii, 2228, 2293 |
| Appro. | | ii, 2299 | St. Marys R., Md. | K-53..... | i, 373 |
| Bridges | | ii, 2227 | St. Marys R., Mich. | PP-3..... | i, 1419, 1422 |
| Dams | | ii, 2250 | | PP-3-a..... | i, 1422 |
| Discharge | | ii, 2041, 2132 | | PP-3-b..... | i, 1427 |
| Great Lakes regulation | | ii, 2041, 2124 | Appro. | | ii, 2287, 2299 |
| Harbor lines | | ii, 2260 | Bridges | | ii, 2228 |
| Wrecks | | ii, 2276 | Discharge | | ii, 2041, 2132 |
| St. Leonards Cr., Md. | K-14..... | i, 373, 376 | Great Lakes regulation | | ii, 2041, 2124 |
| St. Louis | (GG-2)..... | i, 1039* | Harbor lines | | ii, 2260 |
| | (HH)..... | i, 1078*, 1079* | Navigation rules | | ii, 2041, 2108 |
| (See notes, ii, 2827, 2828, 2833.) | | | Wrecks | | ii, 2276 |
| St. Louis Bay, Miss.: | | | St. Marys R., Ohio | QQ-9..... | i, 1461, 1465 |
| Bridges | | ii, 2144 | St. Marys R. to Gulf of | | |
| St. Louis B., Wis. | LL-18-d..... | i, 1274 | Mexico, Fla. (canal) | O-510-c..... | i, 566 |
| (See notes, ii, 2835.) | | | (See notes, ii, 2799.) | | |
| Bridges | | ii, 2227 | St. Michael Canal, Alas- | | |
| Harbor lines | | ii, 2260 | ka. | XX-239..... | i, 1657, 1681 |
| St. Louis Chain | (HH)..... | i, 1079* | Appro. | | ii, 2301 |
| St. Louis, Mo.: | | | St. Paul | (HH)..... | i, 1079* |
| Appro. | | ii, 2297 | (See notes, ii, 2828, 2829, 2833.) | | |
| Harbor lines | | ii, 2260 | St. Paul, Minn.: | | |
| St. Louis, Mo., district | II (with map)..... | i, 1227, 1229 | Harbor lines | | ii, 2280 |
| (See notes, ii, 2829, 2834.) | | | St. Paul, Minn., district: | | |
| Appro. | | ii, 2297 | (See notes, ii, 2829, 2834.) | | |
| St. Louis, Mo., to Lock- | | | Appro. | | ii, 2297 |
| port, Ill. | NN-1-c..... | i, 1353 | St. Petersburg H., Fla. | P-314..... | i, 571, 601 |
| St. Louis R., Minn. and | | | Appro. | | ii, 2293 |
| Wis | LL-19..... | i, 1265 | St. Peters Cr., Md. | J-75..... | i, 331 |
| | LL-19-a..... | i, 1279 | St. Phillips, La.: | | |
| Booms | | ii, 2250 | Forts | | ii, 1803, 1976 |
| Bridges | | ii, 2227-2228 | St. Regis R., N. Y. | RR-77..... | i, 1493 |
| St. Lucie Inlet, Fla. | P-125..... | i, 570 | St. Simons Sound, Ga. | O-437..... | i, 536 |
| | P-125-a..... | i, 586 | | O-437-a..... | i, 558 |
| St. Lucie R., Fla. | P-126..... | i, 570 | St. Simons Sound, Ga., | | |
| | P-125-a..... | i, 586 | to Cumberland Sound. | O-501-a..... | i, 561 |
| Bridges | | ii, 2228 | St. Tammany Parish, | | |
| St. Malo Bayou, La. | S-151..... | i, 682 | La., Bonfuca Bayou | S-10..... | i, 689 |
| St. Marks R., Fla. | Q-9..... | i, 611, 612 | St. Vrain Cr., Colo. | GG-1087..... | i, 1033 |
| Appro. | | ii, 2293 | (See notes, ii, 2820.) | | |
| Bridges | | ii, 2228 | Sakonnet H., R. I.: | | |
| St. Martins R., Md. | I-83..... | i, 328 | Wrecks | | ii, 2276 |
| Bridges | | ii, 2228 | Sakonnet Pt. H., R. I. | C-64..... | i, 107, 120 |
| St. Martins R., Va. | I-83..... | i, 299 | Sakonnet Pt., R. I.: | | |
| St. Mary-Iberia Canal, | | | (See notes, ii, 2786.) | | |
| La. | S-701..... | i, 687 | Appro. | | ii, 2288 |
| St. Marys Falls Canal, | | | Sakonnet R., R. I. | C-63..... | i, 107, 119 |
| Mich. | PP-5..... | i, 1419 | (See notes, ii, 2786.) | | |
| | PP-3..... | i, 1422 | Appro. | | ii, 2288 |
| Appro. | | ii, 2299 | Bridges | | ii, 2228 |
| Bridges | | ii, 2228 | Salamonie R., Ind. | BB-31..... | i, 891 |
| Navigation rules | | ii, 2041, 2108 | Salcha R., Alaska | XX-203..... | i, 1656 |
| St. Marys, Ga., to St. | | | Sale B. Bayou, La. | S-675..... | i, 687 |
| Johns, Fla. (inland wa- | | | Sale Bayou, La. | S-676..... | i, 687 |
| terway). | O-511..... | i, 537 | Sale Cr., Tenn. | AA-181..... | i, 849 |
| | O-511-a..... | i, 566 | Salem Cr., N. J.: | | |
| St. Marys R., Fla., and | | | Bridges | | ii, 2228, 2230 |
| St. Andrews B., Fla. | P-1-a..... | i, 572 | Salem H., Mass. | B-100..... | i, 69, 81 |
| | | | (See notes, ii, 2784.) | | |
| | | | Appro. | | ii, 2288 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Salem R., N. J. | I-43..... | i, 299, 308 | Salt Cr., Mo. (continued) .. | GG-1469..... | i, 1036 |
| | I-43-a..... | i, 309 | (See notes, ii, 2813.) | | |
| Appro..... | | ii, 2290 | Salt Cr., Mont. | GG-565..... | i, 1029 |
| Bridges..... | | ii, 2228 | (See notes, ii, 2816.) | | |
| Wrecks..... | | ii, 2276 | Salt Cr., Nebr.: | | |
| Salinas R., Cal. | TT-8..... | i, 1555 | (See notes, ii, 2820.) | | |
| (See notes, ii, 2845.) | | | Salt Cr., Ohio. | DD-349..... | i, 961 |
| Saline Cr., Ky. and Tenn. | AA-315..... | i, 850 | | DD-400..... | i, 962 |
| Saline Cr., Mo.: | | | | DD-449..... | i, 962 |
| (See notes, ii, 2824.) | | | | DD-450..... | i, 962 |
| Saline R. | (CC)..... | i, 910* | | DD-452..... | i, 962 |
| Saline R., Ark. | X-38..... | i, 785, 810 | Salt Cr., Wyo. | GG-697..... | i, 1030 |
| Appro..... | | ii, 2295 | | GG-732..... | i, 1030 |
| Bridges..... | | ii, 2216, 2228 | (See notes, ii, 2817, 2818.) | | |
| Saline R., Ill. | BB-38..... | i, 891 | Salters Cr., N. C. | M-235..... | i, 456 |
| Saline R., Kans.: | | | Salters Cr., Va. | L-103..... | i, 412 |
| (See notes, ii, 2822.) | | | Salt Fork, Mo. | GG-110..... | i, 1026 |
| Saline R., La. | X-45..... | i, 785 | | GG-1437..... | i, 1036 |
| Salsbury H., Md.: | | | (See notes, ii, 2813, 2823.) | | |
| Wrecks..... | | ii, 2276 | Salt Fork, Ohio. | DD-358..... | i, 962 |
| Salkehatchie R., S. C. | N-255..... | i, 527 | Salt Fork, Okla. | Y-16..... | i, 818 |
| (See notes, ii, 2798.) | | | Salthouse Cove, Md. | J-423..... | i, 334 |
| Appro..... | | ii, 2292 | Salt Lake Run, Fla. | P-68..... | i, 569 |
| Bridges..... | | ii, 2143, 2228 | Salt Lick Cr., Ky. | DD-239..... | i, 961 |
| Salle Bayou, La. | S-461..... | i, 685 | Salt Lick Cr., Pa. | J-654..... | i, 336 |
| Sally Bayou, La. | T-2-dd..... | i, 717 | Saltlick Cr., W. Va. | EE-168..... | i, 984 |
| (See notes, ii, 2805.) | | | Salt peter Cr., Md. | J-1052..... | i, 339 |
| Salmon B., Wash.: | | | Salt Pond, Me. | A-67..... | i, 27 |
| Bridges..... | | ii, 2219 | Salt Pond, Mass. | C-5-a..... | i, 108 |
| Salmon B. Waterway, | | | (See notes, ii, 2786.) | | |
| Wash.: | | | Salt R. | (CC)..... | i, 910* |
| Bridges..... | | ii, 2228 | | (HH)..... | i, 1079* |
| Salmon Cr., Cal. | TT-135..... | i, 1556 | Salt R., Ky. | BB-13..... | i, 891, 898 |
| Salmon Cr., N. C. | L-340..... | i, 413 | Bridges..... | | ii, 2228 |
| Salmon Cr., N. Y. | RR-43..... | i, 1493 | Salt R., Mo. | JJ-78..... | i, 1234 |
| Salmon Falls R., Me. and | | | Salt R., N. Dak. | KK-178..... | i, 1248 |
| N. H. | A-282..... | i, 29 | Salt Slough, Cal. | TT-172..... | i, 1556 |
| Salmon R., Conn. | D-31..... | i, 141 | Saltworks Cr., Md. | J-1233..... | i, 340 |
| Bridges..... | | ii, 2228 | Saluda R., above Colum- | | |
| Salmon R., Idaho. | VV-92..... | i, 1594 | bla, S. C. | N-147-b..... | i, 517 |
| Salmon R., N. H. | B-31..... | i, 69 | Saluda R., S. C. | N-172..... | i, 500, 518 |
| Salmon R., N. Y. | RR-51..... | i, 1493, 1531 | Saluda R., S. C., Middle | | |
| | RR-78..... | i, 1493 | Fork..... | N-180..... | i, 500 |
| Appro..... | | ii, 2299 | Saluda R., S. C., North | | |
| Salmon R., N. Y., below | | | Fork..... | N-179..... | i, 500 |
| Fort Covington, N. Y. | RR-78..... | i, 1539 | Saluda R., S. C., South | | |
| Salmon R., Ore. | VV-56..... | i, 1593 | Fork..... | N-181..... | i, 500 |
| Salmons Isld. Thorofare, | | | Samar Isld. | YY-110..... | i, 1686 |
| N. J.: | | | Samish B., Wash. | XX-100..... | i, 1655 |
| Bridges..... | | ii, 2228 | Samish R., North Fork, | | |
| Salmon Slough, Cal. | TT-178..... | i, 1556 | Wash. | XX-102..... | i, 1655 |
| | UU-20..... | i, 1577 | Samish R., Wash. | XX-101..... | i, 1655 |
| Salmon Trout R., Alaska. | XX-214..... | i, 1656 | Sammamish R., Wash. | XX-78..... | i, 1655 |
| Salt Bayou, La. | S-9..... | i, 681 | | XX-78-a..... | i, 1671 |
| Salt Cr., Fla. | P-275..... | i, 571 | Bridges..... | | ii, 2228 |
| | P-361..... | i, 572 | Sammys Cr., Miss. | S-288..... | i, 683 |
| Salt Cr., Kans. | GG-1166..... | i, 1034 | Sam Phillips. | (HH)..... | i, 1079* |
| | GG-1237..... | i, 1034 | Sampt R., Georgetown | | |
| | GG-1283..... | i, 1035 | H., S. C. | N-99..... | i, 511 |
| (See notes, ii, 2821, 2822.) | | | Sampt R., S. C. | N-98..... | i, 499, 510 |
| Salt Cr., Mich. | PP-102..... | i, 1420 | Appro..... | | ii, 2292 |
| Salt Cr., Mo. | GG-108..... | i, 1026 | Sampson Cr., Mo.: | | |
| | GG-135..... | i, 1026 | (See notes, ii, 2814.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------------|--|---------------------|-------------------|
| Sampsons Cr., Va. | L-184..... | i, 412 | San Diego H. and adja- cent waters, Cal.: | | |
| Sanallcum Cr.: | | | Harbor lines..... | ii, 2260 | |
| Bridges..... | | ii, 2228 | San Diego H. and adja- cent waters, Cal.: | | |
| Sanallcum Cr. Water- way, Wash.: | | | Harbor lines..... | ii, 2260 | |
| Bridges..... | | ii, 2244 | San Diego R., Cal. | SS-12..... | i, 1543 |
| San Antonio B., P. I. | YY-145..... | i, 1686 | Sand Isld. | (CC)..... | i, 910* |
| San Antonio B., Tex. | U-60..... | i, 735 | (WW-2)..... | i, 1617* | |
| San Antonio Cr., Cal. | TT-123..... | i, 1556 | Sand Ledge Cr., S. Dak. ... | GG-813..... | i, 1031 |
| San Antonio Cr., Oak- land H., Cal. | TT-57..... | i, 1555 | (See notes, ii, 2818.) | | |
| San Antonio R., Tex. | U-64..... | i, 735, 769 | Sand Lick Cr., Ky. | DD-137..... | i, 960 |
| Appro..... | | ii, 2295 | Sand Mound Slough, Cal. | UU-14..... | i, 1577 |
| San Bernardino Straits, P. I. | YY-95..... | i, 1686 | Sand Mountain. | (CC)..... | i, 910* |
| San Bernard R., Tex. | U-45..... | i, 735, 765 | San Domingo Cr., Md. ... | J-340..... | i, 333 |
| San Bernardo R., Tex.: | | | Sand Prairie. | (HH)..... | i, 1079* |
| Bridges..... | | ii, 2228 | Sand R., Minn. | KK-59..... | i, 1247 |
| San Bruno Canal, Cal.: | | | Sand Shoal Chan. | L-38..... | i, 411 |
| Harbor lines..... | | ii, 2260 | Sand Shoal Inlet, Va. ... | L-34..... | i, 411 |
| San Bruno Cr., Cal. | TT-17..... | i, 1555 | Sandusky. | (HH)..... | i, 1079* |
| San Buenaventura H., Cal. | SS-24..... | i, 1550 | (See notes, ii, 2828.) | | |
| San Buenaventura, Cal. ... | SS-24..... | i, 1543 | Sandusky R., Ohio: | | |
| San Carlos B., Fla. | P-230..... | i, 571 | Bridges..... | ii, 2228 | |
| Sand Branch, Mo. | GG-206..... | i, 1026 | Sandusky City H., Ohio. ... | QQ-17..... | i, 1468 |
| Sand Coulee Cr., Mont. ... | GG-547..... | i, 1029 | Appro..... | ii, 2299 | |
| (See notes, ii, 2816.) | | | Sandusky H., Ohio. | QQ-17..... | i, 1461 |
| Sand Cr. | (CC)..... | i, 910* | Harbor lines..... | ii, 2260 | |
| Sand Cr., Kans. | GG-1332..... | i, 1035 | Navigation rules..... | ii, 2041, 2108 | |
| (See notes, ii, 2820, 2822.) | | | Wrecks..... | ii, 2276 | |
| Sand Cr., Minn. | KK-77..... | i, 1247 | Sandusky R., Ohio. | QQ-16..... | i, 1461, 1468 |
| Sand Cr., Mont. | GG-619..... | i, 1029 | Appro..... | ii, 2299 | |
| GG-641..... | i, 1030 | | Sandwich H., Mass. | B-177..... | i, 70, 100 |
| (See notes, ii, 2817.) | | | Sandy B., Mass. | B-77..... | i, 69, 76 |
| Sand Cr., Nebr. | GG-1112..... | i, 1033 | (See notes, ii, 2784.) | | |
| GG-1118..... | i, 1033 | | Appro..... | ii, 2288 | |
| GG-1139..... | i, 1034 | | Sandy Bayou, La. | S-75..... | i, 681 |
| (See notes, ii, 2820.) | | | S-248..... | i, 683 | |
| Sand Cr., N. Dak. | GG-765..... | i, 1031 | Sandy Cr., Ga. | O-364..... | i, 535 |
| Sand Cr., S. Dak. | GG-910..... | i, 1032 | O-381..... | i, 536 | |
| Sand Cr., W. Va. | DD-313..... | i, 961 | Sandy Cr., La. | S-83..... | i, 681 |
| Sand Cr., Wyo. | GG-1016..... | i, 1033 | S-259..... | i, 683 | |
| (See notes, ii, 2820.) | | | S-273..... | i, 683 | |
| Sand Cut, Fla. | P-174..... | i, 570 | S-826..... | i, 688 | |
| Sanders Cr., N. C. | M-282..... | i, 456 | T-2-z..... | i, 717 | |
| Sanders Cr., S. C. | N-117..... | i, 500 | Sandy Cr., Mich. | PP-123..... | i, 1420 |
| Sand Fork Cr., W. Va. ... | EE-171..... | i, 984 | Sandy Cr., Miss. | S-286..... | i, 683 |
| Sand Fork, Ohio. | DD-420..... | i, 962 | Sandy Cr., Nebr.: | | |
| Sand Hill Cr., S. Dak. ... | GG-333..... | i, 1027 | (See notes, ii, 2822.) | | |
| (See notes, ii, 2815.) | | | Sandy Cr., N. Y. | RR-33..... | i, 1493 |
| Sand Hill Lake, Iowa. ... | GG-268..... | i, 1027 | RR-50-b..... | i, 1531 | |
| (See notes, ii, 2814.) | | | Appro..... | ii, 2299 | |
| Sand Hill R., Minn. | KK-197..... | i, 1248 | Sandy Cr., N. Dak. | GG-409..... | i, 1028 |
| San Diego B., Cal. | SS-10..... | i, 1543 | (See notes, ii, 2815.) | | |
| San Diego, Cal. | SS-11..... | i, 1543 | Sandy Cr., Ohio. | DD-374..... | i, 962 |
| Navigation rules..... | | ii, 2041, 2108 | Sandy Cr., Pa. | J-800..... | i, 337 |
| San Diego H., Cal. | SS-11..... | i, 1545 | Sandy Cr., Tex.: | | |
| (See notes, ii, 2839.) | | | (See notes, ii, 2806.) | | |
| Appro..... | | ii, 2300 | Sandy Fly Pass, Fla. | P-210..... | i, 570 |
| Forts..... | | ii, 1796, 1802, 1823, 2001 | Sandy Hook. | (GG-2)..... | i, 1039* |
| Harbor lines..... | | ii, 2260 | Sandy Hook B., N. J. ... | G-46..... | i, 247 |
| Navigation rules..... | | ii, 2041, 2108 | G-48..... | i, 247 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|--|-------------------|-------------------------------------|---------------------|-------------------|
| Sandy Hook B., N.J. (con.). | G-50..... | i, 274 | San Joaquin and Sacra- | | |
| Harbor lines..... | | ii, 2260 | mento R., Cal. | TT-73..... | i, 1555 |
| Sandy Hook Entrance, | | | San Joaquin R., Cal. | UU-6..... | i, 1577 |
| New York H., N. Y. | | | | UU-6-a..... | i, 1578 |
| (removal of wrecks)..... | F-105-b..... | i, 235 | (See notes, ii, 2840.) | | |
| Sandy Hook, N. J.: | | | Appro..... | ii, 2300 | |
| Ports..... | ii, 1806, 1881 | | Bridges..... | ii, 2229 | |
| Sandy Huss Cr., N. C. | M-211..... | i, 455 | Débris..... | ii, 2041, 2108 | |
| Sandy Lake. | (HH)..... | i, 1079* | Wrecks..... | ii, 2276 | |
| Sandy Lake Dam (HH): | | | San Joaquin R., Cal., Old | | |
| (See notes, ii, 2828.) | | | R. Branch. | UU-6-c..... | i, 1580 |
| Sandy Lake, Ga. | O-475..... | i, 536 | San Joaquin R., Cal. (see | | |
| Sandy Lick Cr., Pa. | FF-28..... | i, 1020 | Cal. Débris Comm.) | | i, 1580 |
| Sandy R. | (HH)..... | i, 1079* | San Joaquin R., Cal. | | |
| Sandy R., Minn. | KK-82..... | i, 1247 | (Stockton and Mormon | | |
| Sandy R., Oreg. | VV-78..... | i, 1593 | Chans.) | UU-6-b..... | i, 1579 |
| Sandy R., S. C. | N-153..... | i, 500 | San Joaquin Valley, Cal. | UU-6-g..... | i, 1583 |
| Sandy Run Cr., Ga. | O-61..... | i, 533 | (See notes, ii, 2840.) | | |
| Sandy Run Cr., S. C. | N-195..... | i, 500 | San Jose, P. I. | YY-139..... | i, 1686 |
| Sandy Run, Ga. | O-68..... | i, 533 | San Juan H., P. R. | YY-2..... | i, 1685, 1687 |
| Sanfords Cr., Mo. | GG-1458..... | i, 1036 | Appro..... | ii, 2287, 2301 | |
| San Fernando, P. I. | YY-105..... | i, 1686 | Bridges..... | ii, 2229 | |
| San Francisco B., Cal. | TT-126..... | i, 1556 | "Cristobal Colon," re- | | |
| | UU-2..... | i, 1577 | moval of wreck..... | ii, 2041, 2116 | |
| Appro..... | ii, 2300 | | Ports..... | ii, 1823 | |
| Bridges..... | ii, 2229 | | Navigation rules..... | ii, 2041, 2108 | |
| Harbor lines..... | ii, 2260 | | Wrecks..... | ii, 2276 | |
| Wrecks..... | ii, 2276 | | Sankaty Head, Mass.: | | |
| San Francisco, Cal.: | | | Wrecks..... | ii, 2276 | |
| Ports..... | ii, 1796, 2005 | | Sanke Cr., Minn. | JJ-44..... | i, 1234 |
| San Francisco, Cal., 1st | | | San Leandro B., Cal. | TT-55..... | i, 1555 |
| district. | TT(with map) i, 1553, | 1555 | Bridges..... | ii, 2229 | |
| (See notes, ii, 2840.) | | | San Leandro Cr., Cal. | TT-56..... | i, 1555 |
| Appro..... | ii, 2300 | | San Lorenzo Cr., Cal. | TT-54..... | i, 1555 |
| San Francisco, Cal., 3d | | | San Luis Obispo H., Cal. | SS-28..... | i, 1543, 1551 |
| district. | UU(with map) i, 1575, | 1577 | (See notes, ii, 2839.) | | |
| (See notes, ii, 2840.) | | | Appro..... | ii, 2300 | |
| Appro..... | ii, 2300 | | San Luis Pass, Tex. | U-35..... | i, 735 |
| San Francisco H. and B., | | | San Marcos B., Tex. | U-62..... | i, 735 |
| Cal. | TT-15..... | i, 1555 | San Mateo Cr., Cal. | TT-18..... | i, 1555 |
| San Francisco H., Cal. | TT-15..... | i, 1558 | San Mateo R., Cal. | TT-18..... | i, 1561 |
| (See notes, ii, 2840.) | | | San Mateo Slough, Cal. | TT-19..... | i, 1555 |
| Appro..... | ii, 2287, 2300 | | San Miguel B., P. I. | YY-94..... | i, 1686 |
| Bridges..... | ii, 2229 | | San Miguel Bayou, La. | T-2-hh..... | i, 717 |
| Ports..... | ii, 1796, 1801, 1809, 1814, 1823, 2005 | | (See notes, ii, 2805.) | | |
| Harbor lines..... | ii, 2255, 2260 | | San Pablo B., Cal. | TT-61..... | i, 1555 |
| San Francisco H. (South), | | | | TT-104..... | i, 1556, 1565 |
| Cal. | TT-17-a..... | i, 1561 | | UU-3..... | i, 1577 |
| San Gabriel R., Cal. | SS-16..... | i, 1543, 1546 | Appro..... | ii, 2300 | |
| Bridges..... | ii, 2229 | | Harbor lines..... | ii, 2260 | |
| Sangamon R., Ill. | JJ-4..... | i, 1234 | San Pablo B., P. I. | YY-148..... | i, 1686 |
| | NN-2..... | i, 1349, 1355 | San Pablo Cr., Cal. | TT-62..... | i, 1555 |
| San Gregorio Cr., Cal. | TT-13..... | i, 1555 | San Patricio Bayou, La. | T-2-ii..... | i, 717 |
| San Jacinto B., Tex.: | | | (See notes, ii, 2805.) | | |
| Harbor lines..... | ii, 2260 | | San Pedro H., Cal. | SS-20-b..... | i, 1549 |
| San Jacinto, Fort: | | | Harbor lines..... | ii, 2260 | |
| Harbor lines..... | ii, 2255 | | Wrecks..... | ii, 2276 | |
| San Jacinto R., Tex. | U-15..... | i, 735 | San Pedro (Inner) H., | | |
| Bridges..... | ii, 2229 | | Cal.: | | |
| Harbor lines..... | ii, 2255 | | Harbor lines..... | ii, 2260 | |
| San Jose, P. I. | | | San Poll R. | (WW-8)..... | i, 1617* |
| | | | San Poll R., Wash. | XX-114..... | i, 1656 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| San Rafael Cr., Cal. | TT-127..... | i, 1556 | Sasanoa R., Me. | A-221..... | i, 28 |
| Bridges..... | ..... | ii, 2229 | Appro..... | ..... | ii, 2288 |
| San Rafael Cr. or R., Cal. | TT-127..... | i, 1568 | Sasanoa R., Me. (gut op- | | |
| San Saba R., Tex. | U-50..... | i, 735 | posite Bath, Me.) | A-221..... | i, 50 |
| San Sebastian R., Fla.: | | | Sassacus Cr., Nebr.: | | |
| Bridges..... | ..... | ii, 2229 | (See notes, ii, 2822.) | | |
| San Simeon B., Cal. | SS-30..... | i, 1543, 1552 | Sassafras R., Md. | J-509..... | i, 334, 359 |
| Santa Ana R., Cal. | SS-14..... | i, 1543 | Wrecks..... | ..... | ii, 2276 |
| Santa Barba, Cal. | SS-25..... | i, 1543 | Satilla R., Ga. | O-462..... | i, 536, 561 |
| ..... | SS-25-b..... | i, 1551 | Appro..... | ..... | ii, 2293 |
| Santa Barbara Chan. and | | | Bridges..... | ..... | ii, 2208, 2229 |
| H., Cal. | SS-25..... | i, 1551 | Satinas R., P. E. | YY-9..... | i, 1685 |
| (See notes, ii, 2839.) | | | Satsop R., East Branch, | | |
| Santa Clara R., Cal. | SS-23..... | i, 1543 | Wash. | XX-18..... | i, 1655 |
| Santa Cruz B., Cal. | TT-11..... | i, 1557 | Satsop R., Wash. | XX-17..... | i, 1655 |
| (See notes, ii, 2840.) | | | Sauerweins | (HH)..... | i, 1079* |
| Santa Cruz H., Cal. | TT-11..... | i, 1555 | Saugatuck H., Conn. | D-79..... | i, 168 |
| (See notes, ii, 2840.) | | | Saugatuck H., Mich. | OO-15..... | i, 1385 |
| Santa Fe R., Fla. | P-356..... | i, 571 | ..... | OO-21..... | i, 1377 |
| Santa Maria R., Cal. | SS-27..... | i, 1543 | Appro..... | ..... | ii, 2298 |
| Santa Monica B., Cal. | SS-22..... | i, 1543 | Navigation rules..... | ..... | ii, 2041, 2108 |
| (See notes, ii, 2839.) | | | Saugatuck R., Conn. | D-78..... | i, 141 |
| Santa Rosa Sound Chan., |  |  | ..... | D-79..... | i, 168 |
| Fla. | Q-31..... | i, 624 | (See notes, ii, 2791.) | | |
| Appro..... | ..... | ii, 2293 | Appro..... | ..... | ii, 2289 |
| Santa Ynez R., Cal. | SS-26..... | i, 1543 | Bridges..... | ..... | ii, 2229 |
| Santee R., Ga.: | | | Saugerties H., N. Y. | E-63..... | i, 199 |
| Bridges..... | ..... | ii, 2229 | (See notes, ii, 2792.) | | |
| Santee R., S. C. | N-101..... | i, 499, 511 | Appro..... | ..... | ii, 2289 |
| Appro..... | ..... | ii, 2292 | Wrecks..... | ..... | ii, 2276 |
| Bridges..... | ..... | ii, 2229 | Saugus R., Mass. | B-109..... | i, 70, 83 |
| Santee R. to Charleston | | | (See notes, ii, 2784, 2785.) | | |
| H., including Owendaw | | | Bridges..... | ..... | ii, 2229 |
| Cr. (inland waterways) | N-202..... | i, 500 | Sauk Rapids | (HH)..... | i, 1079* |
| Santiam R., Oreg. | WW-38..... | i, 1615, 1649 | Sauk R., Minn. | KK-125..... | i, 1248 |
| Sapelo, Ga., to Doboy (in- | | | Sauk R., Wash. | XX-93..... | i, 1655 |
| side route). | O-210-a..... | i, 549 | Sault Ste. Marie, Mich. | | |
| Sapelo H., Ga. | O-199..... | i, 534, 549 | (see St. Mary R., Mich.): | | |
| Sapelo R., Ga. | O-199..... | i, 534, 549 | Harbor lines..... | ..... | ii, 2260 |
| Sapelo R. and H., Ga.: | | | Saunders Cr., N. C. | M-288..... | i, 456 |
| Appro..... | ..... | ii, 2293 | Sausal Cr., Cal. | TT-59..... | i, 1555 |
| Sapelo Sound, Ga. | O-190..... | i, 534 | Sauty Cr., Ala. | AA-56..... | i, 848 |
| Sappa Cr., Kans. and | | | Sauvage Bayou, La. | S-142..... | i, 682 |
| Nebr. | GG-1305..... | i, 1035 | Sauvies Islds. | (WW-2)..... | i, 1617* |
| (See notes, ii, 2822.) | | | Savage Cr., Ga. | O-342..... | i, 535 |
| Sappho R., Ga. | O-324..... | i, 535 | Savanna | (HH)..... | i, 1079* |
| Sappony Cr., Va. | L-319..... | i, 413 | Savannah, Ga., and Fer- | | |
| Saquette Bayou, La. | S-586..... | i, 686 | nandina, Fla. (inside | | |
| Sara Bayou. | (HH)..... | i, 1071* | water route between)... | O-2-g..... | i, 546 |
| Sara Bayou, Ala. | R-43..... | i, 646 | Savannah, Ga.: | | |
| Sara Bayou, La. | S-269..... | i, 683 | Appro..... | ..... | ii, 2287 |
| Bridges..... | ..... | ii, 2144 | Bridges..... | ..... | ii, 2143 |
| Sarah Cr., Va. | K-299..... | i, 375 | Forts..... | ..... | ii, 1823, 1948 |
| Saranac R., N. Y. | E-88..... | i, 177 | Harbor lines..... | ..... | ii, 2260 |
| Saranac R., N. Y. (har- | | | Navigation rules..... | ..... | ii, 2041, 2108 |
| bor of refuge, inner | | | Wrecks..... | ..... | ii, 2276 |
| bay). | E-88..... | i, 205 | Savannah, Ga., district... | O (with map)..... | i, 531, |
| Sarangani B., P. I. | YY-160..... | i, 1686 | ..... | ..... | 533 |
| Sarasota B., Fla. | P-290..... | i, 571, 599 | (See notes, ii, 2798.) | | |
| Appro..... | ..... | ii, 2293 | Appro..... | ..... | ii, 2293 |
| Sarasota Pass, Fla. | P-289..... | i, 571 | Savannah, Ga., to Fer- | | |
| Sarem Cr., N. C. | L-306..... | i, 413 | nandina, Fla.: | | |
| Sarpy Cr., Mont. | GG-705..... | i, 1030 | Navigation rules..... | ..... | ii, 2041, 2108 |
| (See notes, ii, 2817.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|----------------------------|-------------------|
| Savannah, Ga., to Louis- ville, Ga. (waterway) | O-2-h..... | i, 547 | Schoodic H., Me. | A-42..... | i, 27 |
| Savannah Lake, Md. | J-136..... | i, 332 | School Cr., Kans. | GG-1285..... | i, 1035 |
| Savannah H., Ga. | O-2..... | i, 533, 537 | (See notes, ii, 2822.) | | |
| Savannah R. and H., Ga.: (See notes, ii, 2798.) | | | School, Engineer. | ii, 2039, 2053, 2057, 2065 | |
| Appro..... | ii, 2293 | | Schools, Officers': Engineer equipment..... | ii, 2041, 2133 | |
| Bridges..... | ii, 2229-2230 | | School, U. S. Engineer: Estimates..... | ii, 2039, 2042 | |
| Harbor lines..... | ii, 2260 | | Schooner Bayou, La. | S-733..... | i, 687 |
| Wrecks..... | ii, 2277 | | Schooner Cr., N. C. | M-110..... | i, 455 |
| Savannah R., Ga. | O-2..... | i, 533, 537 | Schooner Cr., S. C. | N-17..... | i, 499 |
| Savannah R., S. C.: Dams, private..... | ii, 2250 | | | N-21..... | i, 499 |
| Savannah, Tenn. | AA-18..... | i, 855 | Schooner Ledge, Pa.: Navigation rules..... | ii, 2041, 2107 | |
| Savannah, Tennessee and Hwassee Rs., Ga. and Tenn. (canal connect- ing the headwa- ters) | O-2-j..... | i, 547 | Schuber Run, Pa. | J-881..... | i, 337 |
| Savannah to Augusta, Ga., Savannah R. | O-2-c..... | i, 542 | Schultz Cr., Mont. | GG-488..... | i, 1028 |
| Saverton. | (HH)..... | i, 1079* | (See notes, ii, 2816.) | | |
| Saw Kill, N. Y. | E-62..... | i, 177 | Schuyler, Fort, N. Y. | ii, 1807, 1881 | |
| Sawmill Branch, Md. | J-990..... | i, 338 | Schuykill Canal. | (CC)..... | i, 910* |
| Sawmill Brook, N. H. | B-20..... | i, 69 | Schuykill R., Pa. | H-20..... | i, 271, 288 |
| Sawmill Cove, Md. | J-320..... | i, 333 | Appro..... | ii, 2290 | |
| Saw Mill Cr., N. J. | G-15..... | i, 247 | Bridges..... | ii, 2230 | |
| Sawmill Cr., Md. | J-516..... | i, 335 | Harbor lines..... | ii, 2260 | |
| | J-1159..... | i, 339 | Wrecks..... | ii, 2277 | |
| Sawney Cove, Md. | J-196..... | i, 332 | Schwabon Cr., Pa. | J-609..... | i, 335 |
| Sawneys Cr., S. C. | N-138..... | i, 500 | Sciences, National Acad- emy: Surveys..... | ii, 2041, 2120 | |
| Sawsanes Cr., Nebr. | GG-1294..... | i, 1035 | Scioto R. (mouth of) to Little Marietta, Ohio R. | DD-484..... | i, 963 |
| Sawyer Bend. | (HH)..... | i, 1079* | Scioto R., Ohio. | (CC)..... | i, 910* |
| Sawyer Cr., Wis.: Bridges..... | ii, 2230 | | | DD-446..... | i, 979 |
| Saxis Isld. H., Va. | J-7..... | i, 331 | Scioto R., Ohio (Ports- mouth). | DD-446..... | i, 962 |
| Saxon, Minn. | LL-10..... | i, 1268 | Seituate H., Mass. | B-151..... | i, 70, 95 |
| Saville, N. Y. | F-58..... | i, 227 | (See notes, ii, 2785.) | | |
| Scaffold Cr., Md. | J-1270..... | i, 340 | Appro..... | ii, 2288 | |
| Scalp Cr., S. Dak. | GG-901..... | i, 1032 | Scotfield B., La. | S-318..... | i, 683 |
| (See notes, ii, 2819.) | | | Seorton H. Cr., Mass. | B-183..... | i, 70 |
| Scajaquada Cr., N. Y. | RR-18..... | i, 1493, 1512 | Scotch Bonnet Thor- oughfare, N. J.: Bridges..... | ii, 2171, 2230 | |
| Scammel, Fort, Me. | ii, 1804, 1841 | | Scotchman Cr., Md. | J-528..... | i, 335 |
| Scape Cr. Swamp, S. C. | N-89..... | i, 499 | Scotland Cr., Md. | J-144..... | i, 332 |
| Scappoose B. | (WW-2)..... | i, 1617* | Scott Cr., Va. | L-176..... | i, 412 |
| (See notes, ii, 2841, 2844.) | | | Scotts Bluff. | (HH)..... | i, 1079* |
| Scappoose B. and Cr., Oreg.: (See notes, ii, 2844.) | | | Scotts Cove, Conn. | D-86..... | i, 141 |
| Scappoose B., Oreg. | WW-26..... | i, 1615, 1641 | Scotts Cr., La. | S-271..... | i, 683 |
| Scappoose Cr., Oreg. | WW-26..... | i, 1641 | Scotts Cr., Pa. | H-13..... | i, 271 |
| Scarborough R., Me. | A-268..... | i, 29 | Scotts Cr., Va.: Bridges..... | ii, 2230 | |
| Scarlet Brook, Mass. | B-16..... | i, 69 | Scotts Landing. | (HH)..... | i, 1079* |
| Schackelford Br., Mo. | GG-179..... | i, 1026 | Scotts Level Branch, Md. | J-1105..... | i, 339 |
| SCHERMERHORN, ASST. ENGR. L. Y.: Robert Index..... | i, 9 | | Scow Slough, Oreg. | VV-55..... | i, 1593 |
| SCHERMERHORN, HOLDEN B.: Robert Index..... | i, 9 | | Scribner Cr., Kans. | GG-1281..... | i, 1035 |
| Schlegels Cr., Nebr. | GG-926..... | i, 1032 | (See notes, ii, 2822.) | | |
| Schodack Cr., N. Y. | E-49..... | i, 177 | Scriven, Fort, Ga. | ii, 1950 | |
| Schofield R., Oreg. | VV-31..... | i, 1593 | Scrubby Bluff Cr., Ga. | O-516..... | i, 537 |
| | | | Scrub Grass Cr., Pa. | J-878..... | i, 337 |
| | | | Seuffletown. | (CC)..... | i, 910* |
| | | | Seulls Cr., Ga. | O-141..... | i, 534 |
| | | | Scuppernong R., N. C. | M-6..... | i, 454, 457 |
| | | | Appro..... | ii, 2292 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|---------------------|------------------------|---------------------------------------|---------------------|-------------------|
| Scuppernong R., N. C.— | | | Second Mine Branch, | | |
| Continued. | | | Md. | J-1010..... | i, 338 |
| Bridges..... | | ii, 2230 | Second Rapids (WW): | | |
| Wrecks..... | | ii, 2277 | (See notes, ii, 2841.) | | |
| Scusset Mill Cr., Mass. | B-174..... | i, 70 | Second R., Minn. | KK-90..... | i, 1248 |
| Seabolt Cr., Ala. | AA-200..... | i, 849 | Second R., N. J. | G-20..... | i, 247 |
| Seabright, N. J.: | | | Secretary Cr., Md. | J-264..... | i, 333, 351 |
| Harbor lines..... | | ii, 2260 | Secretary of War: | | |
| Wrecks..... | | ii, 2277 | Letter of transmittal, In- | | |
| Seacoast Defenses | | ii, 1812, 1813, 1818 | dex, to Congress..... | | i, 5 |
| Seaconnet R., R. I.: | | | Sedger Cr., Va. | K-298..... | i, 375 |
| Bridges..... | | ii, 2228 | Seekonk (Pawtucket) R., | | |
| Seaford B., N. Y. | F-67..... | i, 215, 229 | R. I. | C-83..... | i, 107 |
| Seaford B., N. Y. | F-67..... | i, 215 | Seekonk R., R. I. | C-83..... | i, 128 |
| Seal B., Me. | A-114..... | i, 28 | Bridges..... | | ii, 2230-2231 |
| Seal Cove, Me. | A-58..... | i, 27 | Harbor lines..... | | ii, 2260 |
| | A-74..... | i, 27 | Seely Cr., N. Y. and Pa. | J-679..... | i, 336 |
| | A-123..... | i, 28 | Segge Bayou, La. | S-615..... | i, 686 |
| | A-190..... | i, 28 | Segnette Bayou, La. | S-366..... | i, 684 |
| | A-241..... | i, 29 | Segreganset R., Mass. | C-74..... | i, 107 |
| Seal Cr., Cal. | TT-68..... | i, 1555 | Segur Bayou, La. | S-513..... | i, 685 |
| Seal H., Me. | A-133..... | i, 28 | Sehrt Cr., Mo. | GG-10..... | i, 1025 |
| | A-149..... | i, 28 | (See notes, ii, 2813.) | | |
| Wrecks..... | | ii, 2277 | Seine R., France: | | |
| Searchlights, forts | | ii, 1796, | Bridges..... | | ii, 2231, 2237 |
| | | 1799, 1810, 1824, 1832 | Sekiu R., Wash. | XX-40..... | i, 1655 |
| Searey Branch, Mo. | GG-197..... | i, 1026 | Selby R., Md. | J-1260..... | i, 340 |
| Sears Cr., Mont.: | | | Sells Bayou, La. | T-2-bb..... | i, 717 |
| (See notes, ii, 2817.) | | | (See notes, ii, 2805.) | | |
| Searsport H., Me. | A-136..... | i, 28 | Sellers Cr., Kans. | GG-1348..... | i, 1035 |
| Seattle H., Wash. | XX-72..... | i, 1655, 1671 | (See notes, ii, 2823.) | | |
| Appro..... | | ii, 2287 | Seneca Cr., Md. | J-1055..... | i, 339 |
| Bridges..... | | ii, 2230 | Seneca Cr., Va. | L-372..... | i, 414 |
| Harbor lines..... | | ii, 2260 | Seneca Falls Cr., Ohio | DD-355..... | i, 962 |
| Seattle, Wash., district | XX (with map).... | | Seneca R., S. C. | O-12..... | i, 533 |
| | | i, 1653, 1655 | Senleurs (GG): | | |
| (See notes, ii, 2845.) | | | (See notes, ii, 2826.) | | |
| Appro..... | | ii, 2301 | Sequatchie R., Tenn. | AA-191..... | i, 849, 877 |
| Sea walls, forts. | | ii, 1796, | Sequines Pt.: | | |
| | | 1797, 1799, 1813, 1838 | Harbor lines..... | | ii, 2260 |
| Sebastian Cr., Fla. | P-124..... | i, 570 | Sergt. Floyd, monument | | ii, 2040, 2095 |
| Sebastian R., Fla. | P-89..... | i, 569 | Serpent Bayou, La. | S-807..... | i, 688 |
| Bridges..... | | ii, 2230 | Serritos Slough, Cal.: | | |
| Sebastopol Coulee, La. | S-728..... | i, 687 | Bridges..... | | ii, 2231 |
| Sebbins Brook, N. H. | B-36..... | i, 69 | Sessions of Congress, | | |
| Sebewaing Cr., Mich. | PP-76..... | i, 1419 | List..... | | ii, 2781 |
| Sebewaing H., Mich. | PP-76..... | i, 1438 | Sesuit H., Mass. | B-193..... | i, 70 |
| Appro..... | | ii, 2299 | Setauket H., N. Y. | F-23..... | i, 215 |
| Sebewaing R., Mich. | PP-76..... | i, 1438 | Sevan Pond R., Mass. | C-6..... | i, 107 |
| Second Bayou, La. | S-236..... | i, 683 | Seven Blackfeet Cr., | | |
| Second Chan., Va. | L-33..... | i, 411 | Mont. | GG-603..... | i, 1029 |
| Second Cr., Ala. and | | | (See notes, ii, 2817.) | | |
| Tenn. | AA-211..... | i, 850 | Seven Creeks, S. C. | N-12..... | i, 499 |
| Second Cr., Ky. | DD-147..... | i, 960 | Seven Devils mining dis- | | |
| | DD-150..... | i, 960 | trict to Huntington Br., | | |
| Second Cr., Md. | K-37..... | i, 373 | Snake R., Idaho. | VV-84-c..... | i, 1611 |
| Second Cr., Mo. | GG-1533..... | i, 1037 | Seven Mile Cr., Kans. | GG-1171..... | i, 1034 |
| (See notes, ii, 2824.) | | | | GG-1273..... | i, 1035 |
| Second Cr., N. C. | M-9..... | i, 454 | (See notes, ii, 2821, 2822.) | | |
| Second Cr., Tenn. and | | | Seven Mile Slough, Cal. | UU-53..... | i, 1577 |
| Ala. | AA-220..... | i, 850 | Seventeen Mile Cr., Ga. | O-480..... | i, 536 |
| Second Cr., W. Va. | EE-109..... | i, 984 | Seventeenth St. Canal, | | |
| Second Hay Cr., N. Dak. | | | La. | S-132..... | i, 682 |
| and Mont.: | | | Seventh Rapids | (WW-2)..... | i, 1617* |
| (See notes, ii, 2817.) | | | Seventh St. Slough. | (HH)..... | i, 1079* |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Seventy-six Landing | (HH)..... | i, 1079* | Sheboygan H., Wis | MM-31-a..... | i, 1328 |
| Seyvern Cr., Ky | DD-191..... | i, 960 | Appro..... | | ii, 2298 |
| Seyvern R., Md | J-1211..... | i, 340 | Logs, floating of..... | ii, 2041, 2109 | |
| Bridges..... | | ii, 2231 | Navigation rules..... | ii, 2041, 2108 | |
| Harbor lines..... | | ii, 2260 | Wrecks..... | ii, 2277 | |
| Wrecks..... | | ii, 2277 | Sheboyganning Cr., Mich | PP-74..... | i, 1419 |
| Seyvern R., Va. | K-288..... | i, 375 | Sheboygan R., Wis | MM-31..... | i, 1297 |
| Seyvern Run, Md | J-1221..... | i, 340 | Bridges..... | ii, 2231 | |
| Sewell, Fort | | ii, 1855 | Logs, floating of..... | ii, 2041, 2109 | |
| Sewell Pt., Va.: | | | Sheenjek R., Alaska | XX-215..... | i, 1656 |
| Harbor lines..... | | ii, 2260 | Sheep Cr., Mont | GG-541..... | i, 1029 |
| Sewer Shoal, N. J. and | | | | GG-739..... | i, 1030 |
| Pa..... | H-3-o..... | i, 287 | (See notes, ii, 2816, 2818.) | | |
| Sexton Cr., Ky | DD-30..... | i, 959 | Sheep Cr., Wyo | GG-1053..... | i, 1033 |
| Shaddocks Cr., Va | L-313..... | i, 413 | (See notes, ii, 2820.) | | |
| Shade R. | (CC)..... | i, 910* | Sheep Pen Hill, Va.: | | |
| Shade R., Ohio | DD-443..... | i, 962 | Wrecks..... | ii, 2277 | |
| Shadow Cr., Mont | GG-623..... | i, 1030 | Sheepscot R., Me | A-199..... | i, 28 |
| Shad R., Ga | O-90..... | i, 533 | Bridges..... | ii, 2231 | |
| Shadwell Cr., Mont. and | | | Sheepshead B., N. Y | F-102..... | i, 216, 232 |
| N. Dak..... | GG-747..... | i, 1031 | | F-78-a..... | i, 230 |
| (See notes, ii, 2818.) | | | Appro..... | ii, 2289 | |
| Shaffer Bayou, La. | S-496..... | i, 685 | Harbor lines..... | ii, 2260 | |
| Shag Slough, Cal | UU-65..... | i, 1577 | Wrecks..... | ii, 2277 | |
| Shakit Cr., Fla.: | | | Sheepshead H., Md | J-180..... | i, 332 |
| Bridges..... | | ii, 2231 | Shelburne B., Vt | E-114..... | i, 178 |
| Shallotte R., N. C | M-329..... | i, 456, 495 | Shelby Cr., Ky | DD-249..... | i, 961 |
| Appro..... | | ii, 2292 | Shellbine Cr., Ga | O-506..... | i, 536 |
| Shallowbag B., N. C | M-21..... | i, 454, 458 | Shell Bluff Cr., Ga | O-206..... | i, 534 |
| (See notes, ii, 2797.) | | | Shell Cr., Fla | P-261..... | i, 571 |
| Appro..... | | ii, 2292 | Shell Cr., Nebr | GG-966..... | i, 1032 |
| Shallow Bayou, La.: | | | (See notes, ii, 2819.) | | |
| (See notes, ii, 2805.) | | | Shell Cr., N. Dak | GG-403..... | i, 1028 |
| Shallow Cr., Md | J-1078..... | i, 339 | (See notes, ii, 2815.) | | |
| Bridges..... | | ii, 2179, 2231 | Shell Cr., Wyo | GG-696..... | i, 1030 |
| Shallow Cr., Mont | GG-554..... | i, 1029 | (See notes, ii, 2817.) | | |
| (See notes, ii, 2816.) | | | Shell Isld. B., La | S-324..... | i, 683 |
| Shamokawa R.: | | | Shell Isld. Pass, La | S-657..... | i, 686 |
| (See notes, ii, 2841.) | | | Shell Run, Minn | KK-111..... | i, 1248 |
| Shamokin Cr., Pa | J-612..... | i, 335 | Shellstone Cr., Ga | O-340..... | i, 535 |
| Shanaska Cr., Minn | KK-164..... | i, 1248 | Shelter Cove, Cal | TT-131-a..... | i, 1568 |
| Shanks Branch, Mo | GG-223..... | i, 1026 | Shelter Cove Cr., Cal | TT-155..... | i, 1556 |
| Shanks Cr., Md | J-195..... | i, 332 | Shelter Cr., Kans | GG-1346..... | i, 1035 |
| Shark Bayou, La | S-698..... | i, 687 | (See notes, ii, 2823.) | | |
| Shark R., Fla | P-202..... | i, 570 | Shelter Cr., N. Y.: | | |
| Shark R., N. J | G-59..... | i, 247, 266 | Wrecks..... | ii, 2277 | |
| Sharks Cr., Kans | GG-1360..... | i, 1035 | Shelter Isld. Sound, N. | | |
| (See notes, ii, 2823.) | | | Y..... | F-34..... | i, 215 |
| Sharps Isld. Lighthouse, | | | Shelter R., N. C | M-310..... | i, 456 |
| Md.: | | | Shelton, Wash.: | | |
| Wrecks..... | | ii, 2277 | Harbor lines..... | ii, 2260 | |
| Sharptown to Delaware | | | Shem R., S. C | N-207..... | i, 500, 523 |
| Canal..... | I-43-a..... | i, 309 | Shenandoah R., Va. and | | |
| Shaver Cr., Pa | J-864..... | i, 337 | W. Va..... | K-90-a..... | i, 373, 389 |
| Shavers Cr., Pa | J-884..... | i, 337 | Appro..... | ii, 2291 | |
| Shaw B., Md | J-379..... | i, 334 | Shenango R., Ohio and | | |
| Shawneetown | (CC)..... | i, 910* | Pa..... | FF-40..... | i, 1003 |
| Shaws Cove, Conn | D-9..... | i, 141, 146 | Shench Cr., Ohio | DD-416..... | i, 962 |
| Harbor lines..... | | ii, 2260 | Sheridan Pt | (WW-2)..... | i, 1617* |
| Shaws Cr., S. C | N-242..... | i, 501 | Sherman Cr., N. Y | E-27..... | i, 177 |
| Shaws Cr., Va | K-239..... | i, 375 | Sherman Cr., Pa | J-897..... | i, 337 |
| Shawsheen R., Mass | B-49..... | i, 69 | Sherman Run, Pa | J-885..... | i, 337 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------|---------------------|-------------------|----------------------------|---------------------|-------------------|
| Shetucket R., Conn. | D-14 | i, 141 | Sholderbone Cr., Ga. | O-281 | i, 535 |
| Shenoyenne R., N. Dak. | KK-186 | i, 1248 | Shonganunga Cr., Kans. | GG-1390 | i, 1036 |
| Shilawasse R., Mich. | PP-69 | i, 1419 | (See notes, ii, 2823.) | | |
| Shields, Brig. Gen.: | PP-69-a | i, 1438 | Shonkin Bar | (GG-2) | i, 1039* |
| Monument | | ii, 2040, 2095 | Shonkin Cr., Mont. | GG-553 | i, 1029 |
| Shingle Cr., Minn. | KK-135 | i, 1248 | (See notes, ii, 2816.) | | |
| Shingle Cr., Va. | L-167 | i, 412 | Shooters Isld. Chan., N. | | |
| Shinnecock B., N. Y. | F-51 | i, 215 | Y. and N. J. | G-22 | i, 247 |
| Shinnecock Canal, N. Y. | F-39 | i, 215 | Shooters Isld. (channel | | |
| Bridges | | ii, 2231 | north of) | G-27 | i, 253 |
| Ship Isld. H., Miss. | R-86 | i, 671 | | G-27-d | i, 256 |
| (See notes, ii, 2803.) | | | Shooters Isld., N. Y.: | | |
| Appro. | | ii, 2294 | Harbor lines | | ii, 2260 |
| Forts | | ii, 1805, 1970 | Shootman Cr., Mo.: | | |
| Wrecks | | ii, 2277 | (See notes, ii, 2814.) | | |
| Ship Isld. H., Miss., to | | | Short Cove, Md. | J-406 | i, 334 |
| Gulfport. | R-87 | i, 672 | Short Cr. | (CC) | i, 910* |
| Ship Isld. H. and Pass, | | | Short Cr., Ala. | AA-54 | i, 848 |
| Miss.: | | | Short Cr., Ky. | DD-75 | i, 959 |
| Appro. | | ii, 2294 | Short Cr., Mont. | GG-644 | i, 1030 |
| Ship Isld. Pass, Miss. | R-86 | i, 646, 671 | (See notes, ii, 2817.) | | |
| Ship Isld. to Mississippi | | | Short Cr., N. C. | M-108 | i, 455 |
| City H., Miss. | R-86-a | i, 671 | Shorts Cr., Md. | J-1202 | i, 340 |
| Shipland | (HH) | i, 1079* | Shoshone R., Wyo. | GG-682 | i, 1030 |
| Shipman Cr., Cal. | TT-159 | i, 1556 | (See notes, ii, 2817.) | | |
| Shippen Cr., Md. | J-460 | i, 334 | Shovelful Shoals, Mass.: | | |
| Shipping Cr., Md. | J-406 | i, 334 | Wrecks | | ii, 2277 |
| Ship Shoal Inlet, Va. | L-48 | i, 411 | Shrader Branch, Pa. | J-686 | i, 336 |
| Shipyard Cr., Md. | J-474 | i, 334 | Shreveport, La.: | | |
| | J-491 | i, 334 | (See notes, ii, 2807.) | | |
| Shipyard Cr., S. C. | N-206 | i, 523 | Appro. | | ii, 2294 |
| Shippard Cr., Va. | L-123 | i, 412 | Shreveport, La., and Jef- | | |
| Shippard R., S. C. | N-206 | i, 500, 523 | erson, Tex. (waterway). | T-18-a | i, 729 |
| Shirley Gut, Mass. | B-112 | i, 70 | Shreveport, Red R. | X-28-e | i, 801 |
| Shirtpond Cove, Md. | J-62 | i, 331 | Shrewsbury R., N. J. | G-48 | i, 247, 264 |
| Shoal Cr., Ala. | AA-51 | i, 848 | (See notes, ii, 2793.) | | |
| Shoal Cr., Ala. and Tenn. | AA-215 | i, 850 | Appro. | | ii, 2290 |
| Shoal Cr., Ga. | O-23 | i, 533 | Bridges | | ii, 2231 |
| | O-208 | i, 534 | Harbor lines | | ii, 2260 |
| | O-285 | i, 535 | Wrecks | | ii, 2277 |
| Shoal Cr., Md. | J-259 | i, 333 | Shrewsbury R., N. J., | | |
| Shoal Cr., Mo. | GG-143 | i, 1026 | South Branch | G-53 | i, 247 |
| | GG-192 | i, 1026 | Shumac Cr., N. C.: | | |
| (See notes, ii, 2814.) | | | Bridges | | ii, 2231 |
| Shoal Cr., N. J.: | | | Shunk Cr., Mich. | PP-6 | i, 1419 |
| Appro. | | ii, 2290 | Shutes Folly Isld., S. C.: | | |
| Shoal Cr., Tenn. | AA-187 | i, 849 | Forts | | ii, 1940 |
| Shoal H., N. J. | G-46 | i, 263 | Stanal Cove, Md. | J-473 | i, 334 |
| Shoal H., N. J., Sandy | | | Sibley | (GG-2) | i, 1039* |
| Hook B. | G-46 | i, 247 | Sibley, Mo. | (GG-2) | i, 1037* |
| Shoalwater B. to Colum- | | | Sibleys Cr., Va.: | | |
| bla R., Ore. | XX-2-a | i, 1657 | (See notes, ii, 2795.) | | |
| Shoalwater B., Wash. | WW-69 | i, 1652 | Sibugay B., P. I. | YY-167 | i, 1686 |
| | XX-2 | i, 1655 | Scogon B., P. I. | YY-171 | i, 1686 |
| Shoalwater R. and H., | | | Sidney, Wash.: | | |
| Wash. | XX-9 | i, 1657 | Harbor lines | | ii, 2260 |
| Appro. | | ii, 2301 | Siegners Reach | (GG-2) | i, 1039* |
| Shootman Cr., Mo. | GG-150 | i, 1026 | Signal Corps; fire control | | ii, 1812 |
| Shoe Cr., S. Dak. | GG-309 | i, 1027 | Silas Cr., N. C. | M-92 | i, 454 |
| Shoe Heel Swamp, S. C. | | | Siletz B., Ore. | VV-53 | i, 1593 |
| and N. C. | N-37 | i, 499 | Siletz R., Ore. | VV-54 | i, 1593, 1608 |
| Shokokon Slough | (HH) | i, 1079* | Sillery B., Md. | J-1184 | i, 340 |
| | | | Silver Cr., Iowa. | GG-252 | i, 1027 |
| | | | | GG-287 | i, 1027 |
| | | | (See notes, ii, 2814.) | | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--------------------------------------|---------------------|------------------------|
| Silver Cr., Ky..... | DD-13..... | i, 959 | Siskiwit B., Wis..... | LL-28..... | i, 1265 |
| | DD-174..... | i, 960 | (See notes, ii, 2835, 2836.) | | |
| Silver Cr., La..... | R-98-v..... | i, 647 | Siskiwit B., Wis..... | LL-29..... | i, 1265 |
| Silver Cr., Minn..... | KK-129..... | i, 1248 | (See notes, ii, 2835.) | | |
| Silver Cr., Mo..... | GG-91..... | i, 1025 | Sister Isld..... | (CC)..... | i, 910* |
| | GG-122..... | i, 1026 | Sister Lake, La..... | S-470..... | i, 685 |
| (See notes, ii, 2813.) | | | Sisters..... | (CC)..... | i, 910* |
| Silver Cr., Nebr..... | GG-1117..... | i, 1033 | Sisters Cr., Fla..... | P-11..... | i, 569 |
| | GG-1134..... | i, 1034 | Sistersville, W. Va..... | (CC)..... | i, 910* |
| | GG-1138..... | i, 1034 | Sites; forts..... | | ii, 1796, |
| (See notes, ii, 2820.) | | | | | 1797, 1799, 1813, 1834 |
| Silver Cr., N. Y..... | RR-10..... | i, 1493, 1501 | Siustlaw B. and Bar, | | |
| Silver Cr., S. Dak..... | GG-332..... | i, 1027 | Oreg..... | VV-36..... | i, 1604 |
| | GG-348..... | i, 1027 | Siustlaw B., Oreg..... | VV-36..... | i, 1604 |
| (See notes, ii, 2814, 2815.) | | | Appro..... | | ii, 2300 |
| Silver Cr., Wyo..... | GG-918..... | i, 1032 | Six Mile Cr., Ala..... | AA-214..... | i, 850 |
| Silver Run, Md..... | J-1015..... | i, 338 | Six Mile Cr., Fla..... | P-21..... | i, 569 |
| Silversmith Cr., Fla..... | P-81..... | i, 569 | | P-75..... | i, 569 |
| Silverspring, Ga..... | O-334..... | i, 535 | | P-305..... | i, 571 |
| Silver Springs Run, Fla..... | P-40..... | i, 569 | Bridges..... | | ii, 2231 |
| Simmesport..... | (HH)..... | i, 1079* | Sixmile Cr., Iowa..... | GG-278..... | i, 1027 |
| Simms Bayou, Tex..... | U-23..... | i, 735 | Six Mile Cr., Ky..... | DD-6..... | i, 959 |
| Simms Cr., La..... | S-32..... | i, 681 | Six Mile Cr., La..... | S-821..... | i, 688 |
| Simons Ditch, Md..... | J-152..... | i, 332 | Six Mile Cr., Mont..... | GG-532..... | i, 1029 |
| Simpsons Branch, Mo..... | GG-40..... | i, 1025 | (See notes, ii, 2816.) | | |
| Sinclair Inlet, Wash.: Harbor lines..... | | ii, 2260 | Six Mile Cr., S. C..... | N-124..... | i, 500 |
| Sinclairs Cr., N. C..... | M-68..... | i, 454 | Skimble Lake, La..... | S-613..... | i, 686 |
| Sindangan B., P. I..... | YY-172..... | i, 1686 | Six Mile Run, Pa..... | J-819..... | i, 337 |
| Sinepuxent B., Md..... | I-80..... | i, 327 | Six Runs Cr., N. C..... | M-314..... | i, 456 |
| Bridges..... | | ii, 2231 | Sixteen Mile Cr., Mont..... | JJ-531..... | i, 1029 |
| Sinepuxent B., Va..... | I-80..... | i, 299 | (See notes, ii, 2816.) | | |
| Singletons Cut, Ga..... | O-325..... | i, 535 | Sixteenmile Cr., W. Va..... | EE-64..... | i, 983 |
| Sing Sing Cr., N. Y..... | J-663..... | i, 336 | Sixth Rapids..... | (WW-2)..... | i, 1617* |
| Sinking Cr., Mo..... | GG-101..... | i, 1025 | Skagit B., Wash..... | XX-91..... | i, 1655 |
| (See notes, ii, 2813.) | | | Skagit R., Wash..... | XX-92..... | i, 1655, 1673 |
| Sinking Cr., Tenn..... | AA-140..... | i, 849 | | XX-62-a..... | i, 1664 |
| Sinking Cr., Va..... | EE-104..... | i, 984 | Appro..... | | ii, 2301 |
| Sinnemahoning Cr., Pa..... | J-775..... | i, 336 | Bridges..... | | ii, 2231 |
| Sioux City..... | (GG-2)..... | i, 1039* | Skagit R., Wash., North Fork..... | XX-96..... | i, 1655 |
| (See notes, ii, 2825, 2826.) | | | Skamokawa Cr..... | (WW-2)..... | i, 1617* |
| Sioux City, Iowa..... | (GG-2)..... | i, 1037* | Skamokawa Cr., Wash..... | WW-63..... | i, 1615 |
| Sioux City, Iowa (above), Missouri R..... | GG-2-j..... | i, 1054 | (See notes, ii, 2841.) | | |
| Sioux City, Iowa (above), Missouri R. (removing obstructions)..... | GG-2-k..... | i, 1058 | Bridges..... | | ii, 2231 |
| Sioux City (mouth of Missouri R. to)..... | GG-2-g..... | i, 1048 | Skamokawa R..... | WW-68-a..... | i, 1652 |
| Sioux City Reach..... | (GG-2)..... | i, 1039* | Skanee, Mich..... | LL-49..... | i, 1265 |
| Sioux City to mouth of Missouri R..... | GG-2-h..... | i, 1048 | Skeleton Cr., Md..... | J-270..... | i, 333 |
| Sioux Pt..... | (GG-2)..... | i, 1039* | Skeppernawin Cr., Oreg..... | WW-3..... | i, 1615 |
| Sioux R., S. Dak..... | GG-274-b..... | i, 1060 | Skidaway Narrows, Ga..... | O-99..... | i, 533, 548 |
| Sipalay R., P. I..... | YY-131..... | i, 1686 | | O-113..... | i, 534 |
| Sipples Cr., Va..... | K-275..... | i, 375 | Appro..... | | ii, 2293 |
| (See notes, ii, 2795.) | | | Skidaway R., Ga..... | O-95..... | i, 533 |
| Sippo Cr., Ohio..... | DD-382..... | i, 962 | Skiff Cr., Va..... | L-111..... | i, 412 |
| Sipsey Fork, Ala..... | R-32..... | i, 646 | Skillet Fork, Ill..... | BB-37..... | i, 891 |
| Sipsey R., Ala..... | R-33..... | i, 646, 662 | Skilling's R., Me..... | A-49..... | i, 27 |
| Sipuco B., P. I..... | YY-170..... | i, 1686 | Skinnners Slough..... | (HH)..... | i, 1079* |
| Siskiwit B., Mich..... | LL-66..... | i, 1265 | Skipanon Cr..... | (WW-2)..... | i, 1617* |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|-------------------------------------|---------------------|-------------------|
| Skipton Cr., Md. | J-385..... | i, 334, 355 | Smith Cr., N. C.: | | |
| Skokomish R., Wash. | XX-55..... | i, 1655 | Bridges..... | ii, 2231 | |
| Skull Cr., La. | S-44..... | i, 681 | Wrecks..... | ii, 2277 | |
| Skull Cr., Mont. | GG-580..... | i, 1029 | Smith Cr., S. Dak. | GG-368..... | i, 1028 |
| (See notes, ii, 2816.) | | | (See notes, ii, 2815.) | | |
| Skull Cr., Nebr. | GG-1115..... | i, 1033 | Smith Cr., Va. | L-199..... | i, 412 |
| (See notes, ii, 2820.) | | | Bridges..... | ii, 2231 | |
| Skull Fork, Ohio. | DD-364..... | i, 962 | Harbor lines..... | ii, 2280 | |
| Skunk Cr., Iowa. | GG-288..... | i, 1027 | Wrecks..... | ii, 2277 | |
| Skunk Cr., Kans.: | | | Smithers Cr., W. Va. | EE-126..... | i, 984 |
| (See notes, ii, 2822.) | | | Smith, Fort. | ii, 1801 | |
| Skunk Cr., Mont. | GG-458..... | i, 1028 | Smith Isld. Inlet, Va. | L-56..... | i, 411 |
| (See notes, ii, 2816.) | | | Smith Lake, Ga. | O-243..... | i, 535 |
| Skunk R. | (HH)..... | i, 1079* | Smithland H., Ky. Cum- | | |
| Skunk R., Iowa. | JJ-67..... | i, 1234 | berland R. | AA-239-a..... | i, 878 |
| Skunk R., Minn. | KK-73..... | i, 1247 | Smithland, Ky. | (CC)..... | i, 910* |
| Skwentua R., Alaska. | XX-160..... | i, 1656 | Smith Pt. Shoal. | (WW-2)..... | i, 1617* |
| Skykomish R., Wash. | XX-82..... | i, 1655 | Smith R. and tributaries | | |
| Slab Fork, W. Va. | EE-33..... | i, 983 | (no names), Cal..... | TT-208..... | i, 1556 |
| Slacks Branch, Mo. | GG-90..... | i, 1025 | Smith R., Mont. | GG-546..... | i, 1029 |
| Slades Cr., N. C. | M-45..... | i, 454, 460 | Smith R., Oreg. | VV-34..... | i, 1593 |
| Sladesville, N. C., to Pun- | | | Smiths Bar. | (HH)..... | i, 1079* |
| go R. (waterway). | M-43-a..... | i, 460 | Smiths Branch, Mo. | GG-27..... | i, 1025 |
| Slanu R., Alaska. | XX-141..... | i, 1656 | (See notes, ii, 2813.) | | |
| Slash Cr., Va. | K-193..... | i, 374 | Smiths Canal, Cal. | UU-39..... | i, 1577 |
| Slate Cr., Kans.: | | | Smiths Cove, Me. | A-96..... | i, 27 |
| (See notes, ii, 2822.) | | | Smiths Cove Waterway, | | |
| Slate Cr., Va. | DD-278..... | i, 961 | Wash.: | | |
| Slate Cr., W. Va. | EE-159..... | i, 984 | Bridges..... | ii, 2231-2232 | |
| Slaughter Cr., Md. | J-230..... | i, 332, 348 | Smiths Cr., Fla. | P-98..... | i, 569 |
| Appro..... | ii, 2291 | | Smiths Cr., Mo. | GG-76..... | i, 1025 |
| Slaughterhouse Dam. | (WW-2)..... | i, 1617* | Smiths Cr., N. J. | G-34..... | i, 247 |
| Slaughter House Run, | | | Smiths Cr., N. C. | M-46..... | i, 454 |
| Md. | J-1098..... | i, 339 | M-135..... | i, 455 | |
| Slaughters Bar. | (WW-2)..... | i, 1617* | M-157..... | i, 455, 467 | |
| Sleepy Branch, Mo. | GG-1417..... | i, 1036 | M-307..... | i, 456 | |
| (See notes, ii, 2823.) | | | Appro..... | ii, 2292 | |
| Sleepy Cr., N. C. | M-248..... | i, 456 | Smiths Isld. | (HH)..... | i, 1079* |
| Slick Rock Cr., Tenn. and | | | (See notes, ii, 2828.) | | |
| N. C. | AA-98..... | i, 849 | Smiths Pt. | (WW-2)..... | i, 1617* |
| Slim Isld. | (HH)..... | i, 1079* | Smiths R., Cal. (mouth). | TT-208..... | i, 1573 |
| Slocums Cr., N. C. | M-188..... | i, 455 | Smithtown B., N. Y. | F-18..... | i, 215 |
| Sloop Chan., Va. | L-20..... | i, 411 | Smithtown H., N. Y. | F-18..... | i, 215 |
| Slough Landing. | (HH)..... | i, 1079* | F-18-a..... | i, 220 | |
| Slough (The), Cal. | TT-108..... | i, 1556 | Smoking Pt., Staten Isld., | | |
| Small Cr., Conn.: | | | N. Y.: | | |
| Bridges..... | ii, 2231 | | Harbor lines..... | ii, 2260 | |
| Small Pt. H., Me. | A-244..... | i, 29 | Smoky Hill R., Colo. and | | |
| Smith Branch, Nebr. and | | | Kans. | GG-1320..... | i, 1035 |
| Wyo. | GG-1075..... | i, 1033 | (See notes, ii, 2822.) | | |
| (See notes, ii, 2820.) | | | Smoky Hill R., Kans. | GG-1276-a..... | i, 1062 |
| Smith Cove, Conn. | D-18..... | i, 141 | Appro..... | ii, 2297 | |
| Smith Cove, Md. | J-239..... | i, 332 | Smoot Cr., Ky. | DD-139..... | i, 960 |
| J-1107..... | i, 339 | | Smoots Chute. | (HH)..... | i, 1079* |
| Smith Cr., Md. | K-52..... | i, 373, 387 | Smuggler Cove Landing, | | |
| Smith Cr., Mo. | GG-17..... | i, 1025 | H. I.: | | |
| GG-209..... | i, 1026 | | (See notes, ii, 2846.) | | |
| (See notes, ii, 2813.) | | | Smutty Nose Isld., Me. | A-291-a..... | i, 65 |
| Smith Cr., Mont. and N. | | | Smyrna Cr., N. C. | M-242..... | i, 456 |
| Dak. | GG-746..... | i, 1030 | Smyrna R., Del. | I-63..... | i, 299, 318 |
| (See notes, ii, 2818.) | | | Appro..... | ii, 2290 | |
| | | | Wrecks..... | ii, 2277 | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Snag Boats: | | | Snoqualmie R., Wash. | XX-81.....i, 1655 | |
| Appro..... | | ii, 2279 | | XX-62-a.....i, 1664 | |
| List..... | | ii, 2340 | Appro..... | | ii, 2301 |
| Snag Isld. | (WW-2)..... | i, 1617* | Bridges..... | | ii, 2232 |
| (See notes, ii, 2841.) | | | Snokomo Cr., Kans.: | | |
| Snags (see Snag Boats). | | | (See notes, ii, 2823.) | | |
| Snake Cr., Fla. | P-162..... | i, 570 | Snow Cr., Ga. | O-222..... | i, 534 |
| | P-184..... | i, 570 | Snow Cr., La. | S-28..... | i, 681 |
| Snake Cr., Mont. | GG-450..... | i, 1028 | Snow Cr., Mo. | GG-146..... | i, 1026 |
| | GG-483..... | i, 1028 | Snow Hill, Md.: | | |
| | GG-567..... | i, 1029 | Harbor lines..... | | ii, 2260 |
| (See notes, ii, 2815.) | | | Sny Isld. | (HH)..... | i, 1079* |
| Snake Cr., N. Dak.: | | | Sny Levee. | (HH)..... | i, 1079* |
| (See notes, ii, 2815.) | | | Soap Cr., Ga. | O-40..... | i, 533 |
| Snake Cr., Pa. and N. Y. | J-652..... | i, 336 | Soap Cr., Mont. | GG-701..... | i, 1030 |
| Snake Cr., S. Dak. | GG-362..... | i, 1028 | (See notes, ii, 2817.) | | |
| | GG-854..... | i, 1031 | Soapstone Branch, Md. | J-1109..... | i, 339 |
| (See notes, ii, 2815, 2819.) | | | Sobos H., P. B. | YY-8..... | i, 1685 |
| Snake Cr., Tenn. | AA-31..... | i, 848 | Socastee Cr., S. C. | N-7..... | i, 499, 504 |
| Snake Pt. | (GG-2)..... | i, 1039* | Soddy Cr., Tenn. | AA-183..... | i, 849 |
| Snake R., Alaska. | XX-244..... | i, 1657 | Sod Run, Md. | J-954..... | i, 338 |
| Bridges..... | | ii, 2232 | Sohorn Cr., Tenn. | AA-120..... | i, 849 |
| Snake R., Minn. | KK-61..... | i, 1247 | Soldier Cr., S. Dak. | GG-372..... | i, 1028 |
| | KK-68..... | i, 1247 | (See notes, ii, 2815.) | | |
| | KK-202..... | i, 1248 | Soldier R., Iowa. | GG-261..... | i, 1027 |
| | KK-61..... | i, 1253 | (See notes, ii, 2814.) | | |
| Snake R., Nebr. | GG-923..... | i, 1032 | Sol Duc R., Wash. | XX-35..... | i, 1655 |
| (See notes, ii, 2819.) | | | Solltude Cr., Md. | J-339..... | i, 333 |
| Snake R., North Fork, S. | | | Solomon R., Kans. | GG-1323..... | i, 1035 |
| Dak. | GG-326..... | i, 1027 | (See notes, ii, 2822.) | | |
| Snake R., Oreg., Wash., | | | Solomons Bayou, La. | S-306..... | i, 683 |
| and Idaho. | (WW-2)..... | i, 1617* | Solomons Cr., N. J. | G-57..... | i, 247 |
| | VV-84..... | i, 1593 | Solo Slough, Wash. | WW-53..... | i, 1615 |
| | VV-84..... | i, 1611 | Somers Cove, Md.: | | |
| Appro..... | | ii, 2300 | Bridges..... | | ii, 2232 |
| Bridges..... | | ii, 2232 | Somerset Cr., Md. | J-90..... | i, 331 |
| Dams, private..... | | ii, 2250 | Somerville, Mass.: | | |
| Snake R., S. Dak. | GG-325..... | i, 1027 | Harbor lines..... | | ii, 2260 |
| (See notes, ii, 2815.) | | | Somes Sound, Me. | A-54..... | i, 27 |
| Snake R. (WW): | | | Somo R., Wis. | KK-13..... | i, 1247 |
| (See notes, ii, 2841, 2842, | | | Sones Cr., Mo. | GG-1454..... | i, 1036 |
| 2843.) | | | (See notes, ii, 2823.) | | |
| Snake R., South Fork, | | | Sonoma Cr., Cal. | TT-117..... | i, 1567 |
| S. Dak. | GG-327..... | i, 1027 | Bridges..... | | ii, 2232 |
| Snake R., Wyo.: | | | Sonoma Slough, Cal. | TT-117..... | i, 1556 |
| Roads, military..... | | ii, 2041, 2119 | Sonora Chute. | (GG-2)..... | i, 1039* |
| Snake Swamp, S. C. | N-234..... | i, 500 | Sopchoppy R., Fla.: | | |
| Snarepole Gut, Md. | J-149..... | i, 332 | Bridges..... | | ii, 2207, 2232 |
| Snatch Cr., S. Dak. | GG-349..... | i, 1027 | Soquel R., Cal. | TT-10..... | i, 1555 |
| Snells Bayou, Fla. | P-292..... | i, 571 | Sorrel Bayou, La. | S-604..... | i, 686 |
| Snlabar Cr., Mo. | GG-1421..... | i, 1036 | | S-611..... | i, 686 |
| (See notes, ii, 2823.) | | | Sorsogon, P. I. | YY-96..... | i, 1686 |
| Snipe Cr., Mont. | GG-538..... | i, 1029 | Souhegan R., N. H. | B-37..... | i, 69 |
| (See notes, ii, 2816.) | | | Sounds, N. C., Dismal | | |
| Snodgrass Slough, Cal. | UU-51..... | i, 1577 | Swamp Canal and..... | L-173-o..... | i, 438 |
| Bridges..... | | ii, 2232 | Sounds, N. C., Norfolk, | | |
| Snohomish R., Wash. | XX-80..... | i, 1655 | Va., to..... | L-173-m..... | i, 437 |
| | XX-62-a..... | i, 1664 | South Altamaha R., Ga. | O-412..... | i, 536 |
| | XX-80..... | i, 1673 | South Amboy: | | |
| Appro..... | | ii, 2301 | Harbor lines..... | | ii, 2260 |
| Bridges..... | | ii, 2232 | South and North Dakota- | | |
| Harbor lines..... | | ii, 2260 | Minnesota line..... | KK-189..... | i, 1248 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------------------|---|---------------------|-------------------|
| South Anna R., Va..... | K-313..... | i, 375 | Southeast Pass..... | (HH)..... | i, 1079* |
| South Base Cr., Fla..... | O-527..... | i, 537 | Southeast Pass, La..... | S-218..... | i, 683 |
| South B., Cal..... | TT-176..... | i, 1556 | Southeast R., Md..... | J-443..... | i, 358 |
| South B., Me..... | A-98..... | i, 27 | South Edisto to Ashpoo R., Mosquito Cr., S. C..... | N-243..... | i, 527 |
| South B., Mass..... | B-128..... | i, 70 | South End Cr., Ga..... | O-212..... | i, 534 |
| South B., Mich..... | LL-56..... | i, 1265 | Southern Baltimore H., Md..... | J-1101..... | i, 339 |
| South B., N. Y..... | E-102..... | i, 178 | Southern Branch, Va..... | L-177..... | i, 412 |
| South B., Wash.: Bridges..... | | ii, 2232 | Harbor lines..... | | ii, 2260 |
| South Beaver Cr., S. Dak. | GG-290..... | i, 1027 | Southern H., Me..... | A-129..... | i, 28 |
| South Bend, Wash.: Harbor lines..... | | ii, 2260 | South Fork, Alaska..... | XX-177..... | i, 1656 |
| South Bend H., Wash.: Wrecks..... | | ii, 2277 | | XX-226..... | i, 1657 |
| South Big Sandy Pond, N. Y..... | RR-54..... | i, 1493 | South Fork, Colo..... | GG-1097..... | i, 1033 |
| South Branch, Canada and Mont.: (See notes, ii, 2815.) | | | (See notes, ii, 2820.) | | |
| South Branch, Dry Cr., S. Dak..... | GG-343..... | i, 1027 | South Fork, Cumber- land R., Ky. and Tenn.. | AA-275..... | i, 850 |
| South Branch, Fla..... | P-129..... | i, 570 | South Forked Deer R., Tenn.: Bridges..... | | ii, 2232 |
| South Branch, Ga..... | O-419..... | i, 536 | South Fork, Holston R., Tenn. and Va..... | AA-132..... | i, 849 |
| South Branch, Lone Tree Cr., S. Dak..... | GG-345..... | i, 1027 | South Fork, Hughes R., W. Va..... | EE-181..... | i, 984 |
| South Branch, Md..... | J-1143..... | i, 339 | South Fork, Kans.: (See notes, ii, 2821, 2822, 2824.) | | |
| South Branch, Md. and Pa..... | J-1018..... | i, 338 | South Fork, Kentucky R. | DD-25..... | i, 959 |
| South Branch, Milk R., Mont..... | GG-445..... | i, 1028 | | DD-4-a..... | i, 963 |
| South Branch, Minn..... | JJ-57..... | i, 1234 | South Fork, Md..... | J-24..... | i, 331 |
| South Branch, Pa..... | J-617..... | i, 335 | South Fork, Minn..... | JJ-58..... | i, 1234 |
| | J-631..... | i, 335 | South Fork, Mo..... | JJ-80..... | i, 1234 |
| | J-851..... | i, 337 | South Fork, Mokelumne R., Cal..... | UU-46..... | i, 1577 |
| South Branch, Shrews- bury R., N. J..... | G-53..... | i, 247 | South Fork, Mont..... | GG-498..... | i, 1029 |
| South Branch, W. Va..... | K-46-d..... | i, 379 | | GG-515..... | i, 1029 |
| South Bristol H., Me..... | A-188..... | i, 28 | (See notes, ii, 2816.) | | |
| | A-188-a..... | i, 47 | South Fork, Nebr. and Kans..... | GG-957..... | i, 1032 |
| South Brother Isld.: Harbor lines..... | | ii, 2260 | | GG-1137..... | i, 1034 |
| South Brunswick R., Ga. | O-453..... | i, 536 | (See notes, ii, 2819, 2821.) | | |
| South Carolina: Forts..... | | ii, 1796, 1808, 1816, 1940 | South Fork, N. C..... | EE-98..... | i, 983 |
| South Chan., Ga..... | O-82..... | i, 533 | South Fork, N. Dak..... | GG-784..... | i, 1031 |
| (See notes, ii, 2798.) | | | (See notes, ii, 2818.) | | |
| South Chan., Mass..... | B-122..... | i, 70 | South Fork, Ohio..... | DD-427..... | i, 962 |
| South Chan., S. C.: Wrecks..... | | ii, 2277 | | DD-482..... | i, 963 |
| South Chestue Cr., Tenn. | AA-71..... | i, 848 | South Fork, Pa..... | J-599..... | i, 335 |
| South Cliff, N. Y.: Forts..... | | ii, 1881 | South Fork, Pound R., Va..... | DD-259..... | i, 961 |
| South Cr., Fla..... | P-279..... | i, 571 | South Fork R., Ky. and Tenn..... | AA-239..... | i, 873 |
| South Cr., Mo.: (See notes, ii, 2824.) | | | South Fork R., Tenn..... | AA-7..... | i, 848 |
| South Cr., N. C..... | M-102..... | i, 455, 464 | | AA-10..... | i, 848 |
| Bridges..... | | ii, 2232 | South Fork, Saluda R., S. C..... | N-181..... | i, 500 |
| South Cross Cr., Tenn... | AA-242..... | i, 850 | South Fork, Snake R., S. Dak..... | GG-327..... | i, 1027 |
| Southeast Cr., Md..... | J-443..... | i, 334 | South Fork, S. Dak..... | GG-797..... | i, 1031 |
| Southeast Division, En- gineer Department..... | | ii, 2039, 2046 | | GG-812..... | i, 1031 |
| South East H., Me..... | A-84..... | i, 27 | | GG-894..... | i, 1032 |
| | | | (See notes, ii, 2815, 2818, 2819.) | | |

| | District and No. | Vol. add page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| South Fork, S. Dak. and Wyo. | GG-838 | i, 1031 | South R. | (HH) | i, 1079* |
| (See notes, ii, 2819.) | | | South R., Ga. | O-226 | i, 534 |
| South Fork, W. Va. | DD-314 | i, 961 | | O-234 | i, 534 |
| South Fork, Wyo. | GG-731 | i, 1030 | South R., Iowa. | JJ-72 | i, 1234 |
| | GG-839 | i, 1031 | South R., Md. | J-1243 | i, 340, 369 |
| (See notes, ii, 2817, 2818.) | | | | K | i, 373 |
| South French Cr., Wyo.: | | | Appro. | | ii, 2291 |
| (See notes, ii, 2820.) | | | Bridges. | | ii, 2232 |
| South Hackberry Cr., Kans.: | | | South R., Mass. | B-104 | i, 70 |
| (See notes, ii, 2822.) | | | | B-157 | i, 70 |
| Southampton, N. Y.: | | | Bridges. | | ii, 2232 |
| Wrecks | | ii, 2277 | South R., Mo. | JJ-77 | i, 1234 |
| South Harpswell, Me. | A-254-a | i, 52 | South R., N. J. | G-39 | i, 247, 260 |
| South Haven H., Mich. | OO-13 | i, 1382 | (See notes, ii, 2793.) | | |
| South Haven, Mich. | OO-13 | i, 1377 | Appro. | | ii, 2290 |
| Appro. | | ii, 2298 | Bridges. | | ii, 2232 |
| Harbor lines | | ii, 2260 | South R., N. C. | M-213 | i, 455 |
| Navigation rules | | ii, 2041, 2108 | | M-316 | i, 456 |
| South Hero Islds., Vt. | E-79 | i, 203 | | M-102 | i, 464 |
| South Jupiter Narrows, Fla. | P-135 | i, 570 | Appro. | | ii, 2292 |
| South Lake, N. C. | M-15 | i, 454 | South Santee R., S. C. | N-200 | i, 500 |
| South Loup R., Nebr. | GG-976 | i, 1032 | South Slough, Oreg. | VV-17 | i, 1593 |
| (See notes, ii, 2820.) | | | | VV-38 | i, 1593 |
| South Manitou H., Mich.: | | | Bridges. | | ii, 2232 |
| Wrecks | | ii, 2277 | South Stillwater. | (HH) | i, 1079* |
| South Mills to Beaufort N. C. (waterway via) | M-258-b | i, 479 | South Table Cr., Nebr. and Kans. | GG-1149 | i, 1034 |
| South Milwaukee H., Wis. | MM-35-a | i, 1338 | (See notes, ii, 2821.) | | |
| Appro. | | ii, 2298 | South Thomaston, Me. | A-148 | i, 28 |
| South Moreau Cr., Mo.: | | | South Tobesofkee Cr., Ga. | O-378 | i, 536 |
| (See notes, ii, 2823.) | | | South Towalga Cr., Ga. | O-370 | i, 535 |
| South Mouse Cr., Tenn. | AA-70 | i, 848 | Southwest Br., N. C. | M-302 | i, 456 |
| South New Port R., Ga. | O-191 | i, 534 | Southwest Branch, Va. | K-294 | i, 375 |
| Southold H., N. Y. | F-35 | i, 215, 224 | | L-06 | i, 412 |
| South Omaha. | (GG-2) | i, 1039* | Southwest Chan., Tampa B., Fla. | P-286 | i, 571 |
| South Oyster B., N. Y. | F-66 | i, 215 | Southwest Cr., N. C. | M-215 | i, 455 |
| South Pass. | (HH) | i, 1079* | Southwest Division, Engineer Department. | | ii, 2039, 2046 |
| (See notes, ii, 2831.) | | | Southwestern Louisiana Canal, La. | S-414 | i, 684 |
| Appro. | | ii, 2279, 2282 | | S-425 | i, 684 |
| Navigation rules | | ii, 2041, 2108 | Southwest Fork, Fla. | P-142 | i, 570 |
| South Pass, La. | S-228 | i, 683 | South West H., Me. | A-55 | i, 27 |
| South Pass, Wash. | XX-88 | i, 1655 | | A-93 | i, 27 |
| South Platte R., Nebr. and Colo. | GG-1077 | i, 1033 | Southwest Louisiana Canal. | S-419 | i, 684 |
| (See notes, ii, 2820.) | | | Southwest Pass. | (HH) | i, 1079* |
| South Pond, N. Y. | RR-52 | i, 1493 | Southwest Pass, La. | S-240 | i, 683 |
| Southport. | (HH) | i, 1079* | | S-716 | i, 687 |
| Southport Canal, Fla. | P-241 | i, 571 | Navigation rules | | ii, 2041, 2108 |
| Southport H., Conn. | D-76 | i, 141, 167 | Southwest Pt., R. I.: | | |
| (See notes, ii, 2791.) | | | Wrecks | | ii, 2277 |
| Appro. | | ii, 2289 | South Willow Cr., Mont.: | | |
| Southport, N. C.: | | | (See notes, ii, 2816.) | | |
| Forts | | ii, 1935 | Southwood. | (HH) | i, 1079* |
| Harbor lines | | ii, 2260 | South Yeocomico R., Va. | K-125 | i, 374 |
| Southport (see Kenosha H., Wis.). | | | Sou-West Coning Cr., Mich. | PP-66 | i, 1419 |
| Southport H., Wis.: | | | Spa Cr., Md. | J-1237 | i, 340 |
| Appro. | | ii, 2298 | Bridges | | ii, 2233 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Spanish Cr., Cal..... | TT-164..... | i, 1556 | Spring Cr., Ga..... | O-129..... | i, 534 |
| Spanish Lake, La..... | S-109..... | i, 682 | Spring Cr., Kans..... | GG-1185..... | i, 1034 |
| | S-650..... | i, 686 | | GG-1212..... | i, 1034 |
| Spanish Pass..... | (HH)..... | i, 1079* | | GG-1220..... | i, 1034 |
| Spanish Pass, La..... | S-311..... | i, 683 | | GG-1325..... | i, 1035 |
| Spanish R., Ala..... | R-19..... | i, 646 | | GG-1400..... | i, 1036 |
| Sparkill Cr., N. Y..... | E-71..... | i, 177 | (See notes, ii, 2821, 2822, 2823.) | | |
| Sparkman B., Fla..... | P-307..... | i, 571 | Spring Cr., La..... | S-39..... | i, 681 |
| Sparkmans Cr., Ga..... | O-465..... | i, 536 | Spring Cr., Md..... | K-33..... | i, 373 |
| Sparrows Pt., Md.: Harbor lines..... | | ii, 2260 | Spring Cr., Mass..... | B-190..... | i, 70 |
| Sparrow Swamp, S. C..... | N-64..... | i, 499 | Spring Cr., Minn..... | JJ-34..... | i, 1234 |
| Spear Fish Cr., S. Dak.... | GG-834..... | i, 1031 | Spring Cr., Mo.: (See notes, ii, 2824.) | | |
| (See notes, ii, 2819.) | | | Spring Cr., Mont..... | GG-552..... | i, 1029 |
| Spears Cr., S. C..... | N-140..... | i, 500 | | GG-725..... | i, 1030 |
| Spechts Ferry..... | (HH)..... | i, 1079* | (See notes, ii, 2816, 2818.) | | |
| Spencer Cr., Md..... | J-338..... | i, 333 | Spring Cr., Nebr..... | GG-942..... | i, 1032 |
| | J-369..... | i, 333 | | GG-981..... | i, 1032 |
| Spencer Cr., Tenn..... | AA-254..... | i, 850 | | GG-1256..... | i, 1034 |
| Spencer Fork, Ohio..... | DD-365..... | i, 962 | (See notes, ii, 2819.) | | |
| Speonk R., N. Y..... | F-53..... | i, 215 | Spring Cr., N. Y..... | F-92..... | i, 216, 231 |
| Speutic Narrows, Md..... | J-942..... | i, 338 | Spring Cr., N. C..... | M-142..... | i, 455 |
| Spice Cr., W. Va..... | DD-312..... | i, 961 | Spring Cr., N. Dak..... | GG-398..... | i, 1028 |
| Spickett R., Mass. and N. H..... | B-10..... | i, 69 | (See notes, ii, 2815, 2818.) | | |
| Spikes Cr., N. C..... | L-309..... | i, 413 | Spring Cr., Pa..... | J-828..... | i, 337 |
| Spillman Cr., Kans.: (See notes, ii, 2822.) | | | | J-838..... | i, 337 |
| Spirit Cr., Ga..... | O-53..... | i, 533 | Spring Cr., S. Dak..... | GG-356..... | i, 1027 |
| Spirit Isld., to crossing of the Charleston & Sa- vannah Ry., Savannah R., Ga..... | O-2-e..... | i, 545 | | GG-843..... | i, 1031 |
| Spirit R., Wis..... | KK-14..... | i, 1247 | (See notes, ii, 2815, 2819.) | | |
| Split Rock R., Minn..... | LL-12..... | i, 1265 | Spring Cr., Tenn..... | AA-127..... | i, 849 |
| Split Rock R., Minn. (bay at mouth)..... | LL-12..... | i, 1269 | | AA-256..... | i, 850 |
| Spokane R..... | (WW-2)..... | i, 1617* | Spring Cr., W. Va..... | EE-162..... | i, 984 |
| (See notes, ii, 2845.) | | | Spring Cr., Wyo..... | GG-698..... | i, 1030 |
| Bridges..... | | ii, 2233 | | GG-999..... | i, 1032 |
| Spokane R., Wash..... | XX-107..... | i, 1676 | | GG-1023..... | i, 1033 |
| Spokane R., Wash. and Idaho..... | XX-107..... | i, 1656 | (See notes, ii, 2820.) | | |
| Spoonbill B., La..... | S-351..... | i, 684 | Spring Fork, Ohio..... | DD-470..... | i, 962 |
| Spoonbill Cr., Cal..... | TT-77..... | i, 1555 | Spring Gulley Cr., S. C..... | N-95..... | i, 499 |
| Spooners Cr., N. C..... | M-279..... | i, 456 | Spring Hill Cr., Mass..... | B-181..... | i, 70 |
| Spoonhill Cr., Nebr..... | GG-995..... | i, 1032 | Spring Lake, Ga..... | O-309..... | i, 535 |
| Spoonhill Cr., Nebr. and Wyo.: (See notes, ii, 2820.) | | | | O-343..... | i, 535 |
| Spoon R., Ill..... | JJ-13..... | i, 1234 | | O-393..... | i, 536 |
| | NN-11..... | i, 1349 | | O-396..... | i, 536 |
| Sprague R., Me.: Bridges..... | | ii, 2201 | | O-489..... | i, 536 |
| Spring Branch Cr., Nebr..... | GG-1121..... | i, 1033 | Spring Lake, Ill.: (See notes, ii, 2837.) | | |
| Spring Branch, La..... | S-277..... | i, 683 | Spring or Hermaphrodite Cr., S. Dak..... | GG-387..... | i, 1028 |
| Spring Branch, Md..... | J-284..... | i, 333 | Spring R., Ark. and Mo..... | Y-33..... | i, 818 |
| | J-1042..... | i, 338 | Spring R., Okla., Kans., and Mo..... | Y-11..... | i, 818 |
| Spring Branch Slough, Cal..... | TT-93..... | i, 1555 | Spring Run, Pa..... | J-791..... | i, 337 |
| Spring Brook Pa..... | J-626..... | i, 335 | Springs Cr., Nebr..... | GG-989..... | i, 1032 |
| Spring Cr., Ala..... | AA-39..... | i, 848 | Spring Warrior Cr., Fla... | Q-2..... | i, 611 |
| | AA-42..... | i, 848 | Spruce Cr., Fla..... | P-103..... | i, 570 |
| | AA-46..... | i, 848 | Spruce Cr., Pa..... | J-866..... | i, 337 |
| | | | Spruce Run, Pa..... | J-841..... | i, 337 |
| | | | Spunk Br., Minn..... | KK-122..... | i, 1248 |
| | | | Spurwink R., Me..... | A-266..... | i, 29 |
| | | | Spyuten Duyvil Cr., N. Y..... | E-26..... | i, 177 |
| | | | Bridges..... | | ii, 2233 |
| | | | Harbor lines..... | | ii, 2260 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|-----------------------------------|----------------------|-------------------|
| Squabble Cr., Ky. | DD-68..... | i, 959 | Starruca Cr., Pa. | J-655..... | i, 336 |
| Squak Slough, Wash.: | | | Starved to Death Cr., | | |
| Bridges..... | ii, 2228, 2233 | | Mont..... | GG-646..... | i, 1030 |
| Squalicum Cr. Waterway, | | | (See notes, ii, 2817.) | | |
| Wash.: | | | Starve Isld. Reef, Lake | | |
| Harbor lines..... | ii, 2260 | | Erle..... | QQ-15-b..... | i, 1467 |
| Squam R., Mass. | B-68..... | i, 69 | Wrecks..... | ii, 2277 | |
| Squam R., Mass. (canal). | B-86..... | i, 69 | Staten Isld. and N. J. | | |
| Squam R., N. H. | B-29..... | i, 69 | (channel between)..... | G-27..... | i, 253 |
| Square Butte Cr., N. Dak. | GG-773..... | i, 1031 | Staten Isld. ice breaker, | | |
| (See notes, ii, 2818.) | | | New York H., N. Y..... | F-105-p..... | i, 242 |
| Squan R., N. J. | G-60..... | i, 266 | Staten Isld., N. Y., and | | |
| Square Cr., Mo. | GG-242..... | i, 1027 | State of New Jersey | | |
| (See notes, ii, 2814.) | | | (channel between)..... | G-27-c..... | i, 255 |
| Squaw Cr., Mont. | GG-600..... | i, 1029 | Staten Isld., N. Y., Prin- | | |
| (See notes, ii, 2817, 2818.) | GG-719..... | i, 1030 | cess B..... | G-26..... | i, 247 |
| Squaw Cr., Nebr. | GG-1122..... | i, 1033 | Staten Isld., N. Y., Prin- | | |
| (See notes, ii, 2821.) | | | cess B. (breakwater).... | G-26..... | i, 253 |
| Squaw Cr., Nebr. and | | | Staten Isld. Sound, Ar- | | |
| Kans..... | GG-1145..... | i, 1034 | thur Kill..... | G-27..... | i, 253 |
| (See notes, ii, 2821.) | | | Staten Isld. Sound, N. Y.: | | |
| Squaw Cr., N. Dak. | GG-749..... | i, 1031 | Appro..... | ii, 2290 | |
| (See notes, ii, 2818.) | | | Bridges..... | ii, 2233 | |
| Squaw Cr., S. Dak. | GG-851..... | i, 1031 | Forts..... | ii, 1881 | |
| (See notes, ii, 2819.) | | | Harbor lines..... | ii, 2280 | |
| Squaw Isld., N. Y.: | | | State Road Fork, Ky. | DD-204..... | i, 960 |
| Harbor lines..... | ii, 2260 | | States, Appropriations by: | | |
| Squirrel Cr., La. | S-35..... | i, 681 | Waterways improvement.... | ii, 2041, 2109, 2287 | |
| Stack Isld. | (HH)..... | i, 1079* | States, forts. | ii, 1801 | |
| Stag Cr., Kans. | GG-1382..... | i, 1035 | Station Camp Cr., Tenn. | AA-305..... | i, 850 |
| (See notes, ii, 2823.) | | | Station Camp, Ky. | DD-21..... | i, 959 |
| Stage Cr., S. Dak. | GG-381..... | i, 1028 | Statues, District of Co- | | |
| (See notes, ii, 2815.) | | | lumbia..... | ii, 2040, 2076 | |
| Stage H., Mass. | B-217..... | i, 70, 103 | Staunton R., Va. | L-367..... | i, 414, 447 |
| (See notes, ii, 2785.) | B-218..... | i, 70, 103 | L-367-c..... | i, 448 | |
| Stage Isld. B., Me. | A-217..... | i, 28 | Appro..... | ii, 2291 | |
| (See notes, ii, 2783.) | | | Staunton R., Va. (Brook | | |
| Stag Isld. | (HH)..... | i, 1079* | Neal to mouth of Pig | | |
| Stake Shoals. | (GG-2)..... | i, 1039* | R.)..... | L-367-a..... | i, 447 |
| Stamford H., Conn. | D-92..... | i, 141, 171 | Staunton R., Va. (Ran- | | |
| (See notes, ii, 2791.) | | | dolph Station to Brook | | |
| Appro..... | ii, 2289 | | Neal)..... | L-367-b..... | i, 447 |
| Harbor lines..... | ii, 2260 | | Stave Isld. H., Me. | A-45..... | i, 27 |
| Wrecks..... | ii, 2277 | | Steale Bayou. | (HH)..... | i, 1079* |
| Stamp Cr., Tenn. | AA-85..... | i, 848 | (See notes, ii, 2828.) | | |
| Standing Stone Cr., W. | | | Steamboat Cr., S. Dak. ... | GG-382..... | i, 1028 |
| Va..... | EE-179..... | i, 984 | (See notes, ii, 2815.) | | |
| Standing Stone Fork, | | | Steamboat Cr., Va. | L-195..... | i, 412 |
| Ohio..... | DD-368..... | i, 962 | Steamboat R., Minn.: | | |
| Standish, Fort. | ii, 1855 | | Bridges..... | ii, 2233 | |
| Stanislaus R., Cal. | UU-33..... | i, 1577, 1584 | Steamboat Slough. | (WW-2)..... | i, 1617* |
| Stansbury Cr., Md. | J-1059..... | i, 339 | Steamboat Slough, Cal. | UU-61..... | i, 1577 |
| Stanton Towhead. | (HH)..... | i, 1079* | Bridges..... | ii, 2233 | |
| Stanwood H., Wash. | XX-86..... | i, 1655 | Steamboat Slough, | | |
| Star Bayou, Tex.: | | | Wash..... | WW-62..... | i, 1615 |
| (See notes, ii, 2806.) | | | XX-85..... | i, 1655 | |
| Starbuck, N. Y.: | | | Steam Lighters; llt. | ii, 2348 | |
| Harbor lines..... | ii, 2260 | | Steele Bayou (HH): | | |
| Star Landing. | (HH)..... | i, 1079* | (See notes, ii, 2828.) | | |
| Starling Cr., Va. | J-6..... | i, 331 | Steele Bayou, Miss. | X-25..... | i, 785, 794 |
| | | | Appro..... | ii, 2295 | |
| | | | Bridges..... | ii, 2233 | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Steer Cr., Left Fork, W. Va. | EE-166..... | i, 984 | Stockholm | (HH)..... | i, 1079* |
| Steer Cr., W. Va. | EE-164..... | i, 984 | Stock Isld. Chan., Fla. | P-198..... | i, 570 |
| Stehakin R., Wash. | XX-118..... | i, 1656 | Stockport Cr., N. Y. | E-48..... | i, 177 |
| Stellacoom Cr. Waterways: | | | Stocks Cr., Va. | K-256..... | i, 375 |
| Bridges..... | ii, 2233, 2245 | | Stockton Chan., Cal. | UU-36..... | i, 1577 |
| Harbor lines..... | ii, 2260 | | (See notes, ii, 2840.) | | |
| Stellacoom Cr., Wash. | XX-66..... | i, 1655 | Stockton Cr., Tenn. | AA-87..... | i, 849 |
| Stellacoom, Wash. | XX-65..... | i, 1655 | Stockton H., Me. | A-108..... | i, 28, 40 |
| Stelnhatchee R., Fla. | P-365..... | i, 572 | Appro..... | ii, 2287 | |
| Steins Cr., Mo. | GG-1523..... | i, 1037 | Stocktons Branch, Mo. | GG-97..... | i, 1025 |
| Steinway, N. Y.: | | | (See notes, ii, 2813.) | | |
| Harbor lines..... | ii, 2260 | | Stone Coal Cr., W. Va. | EE-31..... | i, 983 |
| Stekoa Cr., S. C. | O-18..... | i, 533 | Stone Cr., Ga. | O-245..... | i, 535 |
| Stella | (HH)..... | i, 1079* | O-347..... | i, 535 | |
| (WW-2)..... | i, 1617* | | Stone Cr., Ohio. | DD-391..... | i, 962 |
| Stemmer Run, Md. | J-1072..... | i, 339 | Stone Cr., Pa. | J-587..... | i, 335 |
| Sterling (HH): | | | Stone Cr., Va. | EE-105..... | i, 984 |
| (See notes, ii, 2828, 2830.) | | | Stone, Fort, N. Y. | ii, 1881 | |
| Sterling Run, Pa. | J-787..... | i, 337 | Stone Haven H., Wis. | MM-31-b..... | i, 1331 |
| Sternbergen Slough, Cal. | TT-23..... | i, 1555 | Stonehouse Cove, Md. | J-1154..... | i, 339 |
| Sterritt Cr., S. C. | N-8..... | i, 499 | Bridges..... | ii, 2233 | |
| Steuben H., Me. | A-37..... | i, 27 | Stone House Cr., Fla. | P-105..... | i, 570 |
| Steubenville. | (CC)..... | i, 910* | Stone House Cr., Kans. | GG-1203..... | i, 1034 |
| Steubenville, Ohio. | DD-335..... | i, 961 | (See notes, ii, 2821.) | | |
| (See notes, ii, 2812.) | | | Stone Mountain Cr., Ga. | O-359..... | i, 535 |
| Harbor lines..... | ii, 2260 | | Stone R., Tenn. | AA-253..... | i, 850 |
| Stevens Cr., Fla. | P-325..... | i, 571 | AA-239..... | i, 878 | |
| Stevens Cr., Mo. | GG-1441..... | i, 1036 | Stones, Building. | ii, 2040, 2089 | |
| (See notes, ii, 2823.) | | | Stones Cr., N. C. | M-303..... | i, 456 |
| Stevens Cr., S. C. | O-9..... | i, 533 | Stone Slough. | (HH)..... | i, 1079* |
| Stevens, Fort, Oreg.: | | | Stoney Cr., Md. | J-1166..... | i, 339 |
| Forts..... | ii, 2018 | | Stoney Cr., Pa. | J-596..... | i, 335 |
| Stevensons Bayou. | (HH)..... | i, 1079* | Stoney Lake to Lake Michigan, Mich. | OO-39-b..... | i, 1400 |
| Stewart Cr., Cal. | TT-141..... | i, 1556 | Stoney Pt., Ohio: | | |
| Stewart Cr., W. Va. | EE-172..... | i, 984 | Wrecks..... | ii, 2277 | |
| Stewarts | (HH)..... | i, 1079* | Stoney R., Alaska. | XX-174..... | i, 1656 |
| Stick Lodge Cr., Mont. | GG-604..... | i, 1029 | Stonington H., Conn. | D-2..... | i, 141, 143 |
| (See notes, ii, 2817.) | | | (See notes, ii, 2788.) | | |
| Stikine R., Alaska. | XX-123..... | i, 1656 | Appro..... | ii, 2289 | |
| Stilagumish R., Wash. | XX-89..... | i, 1655 | Forts..... | ii, 1874 | |
| XX-62-a..... | i, 1664 | | Wrecks..... | ii, 2277 | |
| Appro..... | ii, 2301 | | Stonington H., Me. | A-87..... | i, 27 |
| Bridges..... | ii, 2233 | | Stono R., near Charles- | | |
| Still Lake, Ga. | O-493..... | i, 536 | ton, S. C. | N-216-b..... | i, 525 |
| Still Pond Cr., Md. | J-508..... | i, 334, 359 | Stono R., S. C. | N-216..... | i, 500, 525 |
| Still Pond H., Md. | J-508..... | i, 359 | Appro..... | ii, 2292 | |
| Still Pond, Md. | J-506..... | i, 334 | Stony Brook H., includ- | | |
| Stillwater. | (HH)..... | i, 1079* | ing Porpoise Chan., N. | | |
| Stillwater R., Mont. | GG-670..... | i, 1030 | Y..... | F-20..... | i, 215, 221 |
| (See notes, ii, 2817.) | | | Stony Brook, Mass. | B-43..... | i, 69 |
| Stillwell Cr., W. Va. | EE-185..... | i, 984 | Stony Cr., Conn. | D-52..... | i, 141 |
| Stinking Bayou, La. | S-47..... | i, 681 | Bridges..... | ii, 2233 | |
| Stinking R., Wyo. | GG-680..... | i, 1030 | Stony Cr., Ky. | DD-8..... | i, 959 |
| Stinnett Cr., Ky. | DD-76..... | i, 959 | Stony Cr., Mich. | PP-122..... | i, 1420 |
| Stinson Cr., Mo. | GG-65..... | i, 1025 | Stony Cr., Minn. | KK-123..... | i, 1248 |
| (See notes, ii, 2813.) | | | Stony Cr., N. Y. | E-45..... | i, 177 |
| Strling. | (HH)..... | i, 1079* | RR-56..... | i, 1493 | |
| (See notes, ii, 2828, 2830.) | | | Stony Cr., Pa. | FF-25..... | i, 1003 |
| Stirrup Run, Md. | J-930..... | i, 338 | Stony Cr., R., Conn. | D-52..... | i, 155 |
| Stockbridge H., Fox R., Wis. | MM-21-c..... | i, 1316 | Stony Cr., Va. | L-316..... | i, 413 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Stony Pt., N. Y.: | | | Sturgeon B., Wis.: | | |
| Harbor lines..... | | ii, 2260 | Appro..... | ii, 2298 | |
| Stony Run Cr., S. C. | N-93..... | i, 499 | Bridges..... | ii, 2233 | |
| Stony Run, Md. | J-552..... | i, 335 | Wrecks..... | ii, 2277 | |
| | J-1092..... | i, 339 | Sturgeon Cr., Ga. | O-399..... | i, 536 |
| | J-1151..... | i, 339 | Sturgeon Cr., Ky. | DD-24..... | i, 959 |
| Stony Run, Minn. | KK-152..... | i, 1248 | Sturgeon Cr., Va. | K-233..... | i, 375 |
| | KK-156..... | i, 1248 | Sturgeon Lake, Oreg. | WW-29..... | i, 1615 |
| Stop Landing | (HH)..... | i, 1079* | Sturgeon Lake Outlet | (WW-2)..... | i, 1617* |
| (See notes, ii, 2828.) | | | Sturgeon R., Mich. | LL-45..... | i, 1265 |
| Stove or Cherry Cr., S. | | | | PP-37..... | i, 1419 |
| Dak..... | GG-818..... | i, 1031 | Sturgis Cr., Md. | J-32..... | i, 331 |
| (See notes, ii, 2818.) | | | Stutts Cr., Va. | K-252..... | i, 375 |
| Stow Cr., N. J. | I-39..... | i, 299 | Stuyvesant H., N. Y. | E-48-a..... | i, 198 |
| Straight Cr., Kans. | GG-1222..... | i, 1034 | Styx Cr., Ohio | DD-387..... | i, 962 |
| | GG-1243..... | i, 1034 | Styx R., Fla. | P-38..... | i, 569 |
| (See notes, ii, 2821.) | | | Suble B., P. I. | YY-101..... | i, 1686 |
| Straight Cr., W. Va. | EE-178..... | i, 984 | Forts..... | ii, 1823 | |
| Straight Fork, Mo.: | | | Subjects, Special; Re- | | |
| (See notes, ii, 2823.) | | | ports, Chief of Engi- | | |
| Straight Ripple | (CC)..... | i, 910* | neers | i, 13 | |
| Straight R., Minn. | KK-110..... | i, 1248 | Submarine Mines (see | | |
| Straits of Juan de Fuca, | | | Mines). | | |
| Wash..... | XX-39-a..... | i, 1663 | Submittal, Letter of; | | |
| Straits of Juan Fuca, | | | Index compilation | i, 7 | |
| Wash..... | XX-39..... | i, 1655 | Sucarnoochee R., Ala. | | |
| Straits of Mackinac, | | | and Miss..... | R-40..... | i, 646, 663 |
| Mich..... | OO-64..... | i, 1377 | Suck Cr., Tenn. | AA-189..... | i, 849 |
| | PP-24..... | i, 1419 | Sucker Branch, Md. | J-1147..... | i, 339 |
| Strange Cr., W. Va. | EE-142..... | i, 984 | Sucker Lake, Minn. and | | |
| Strate Cr., N. C. | L-228..... | i, 413 | Canada | KK-236..... | i, 1249 |
| Straubs Bend | (GG-2)..... | i, 1039* | Sudbury R., Mass. | B-46..... | i, 69 |
| Strawberry R., Ark. | Y-35..... | i, 818 | Sue Cr., Md. | J-1064..... | i, 339 |
| Stray Branch, Ky. | DD-113..... | i, 960 | Suey Cr., Tenn. | AA-80..... | i, 848 |
| Streeter Cr., Va. | L-171..... | i, 412 | Suez R., Wash. | XX-38..... | i, 1655 |
| Strickland B., Fla. | P-102..... | i, 560 | Sugar Cr., Ga. | O-298..... | i, 535 |
| String Cr., Mo. | GG-1450..... | i, 1036 | Sugar Cr., Kans.: | | |
| (See notes, ii, 2823.) | | | (See notes, ii, 2824.) | | |
| Strong or Gulon Cr., N. | | | Sugar Cr., Ky. | DD-11..... | i, 959 |
| Y | E-8..... | i, 177 | Sugar Cr., La. | S-824..... | i, 688 |
| Structures, Military; | | | Sugar Cr., Mo. | GG-100..... | i, 1025 |
| Philippines | ii, 2041, 2134 | | | GG-124..... | i, 1026 |
| Stuart Slough, Wash. | XX-8..... | i, 1655 | | GG-1415..... | i, 1036 |
| Stuarts Cr., Va. | L-185..... | i, 412 | | GG-1419..... | i, 1036 |
| Stubbs Ferry | (GG-2)..... | i, 1039* | | GG-1474..... | i, 1036 |
| Stubbs Ferry, Mont. | | | | GG-1506..... | i, 1036 |
| (canyon next below), | | | (See notes, ii, 2813, 2814, | | |
| Missouri R. | GG-2-1..... | i, 1059 | 2823, 2824.) | | |
| Stuck R., Wash. | XX-69..... | i, 1655 | Sugar Cr., Ohio | DD-389..... | i, 962 |
| Stump Cr., N. J. | G-41..... | i, 247 | | DD-476..... | i, 962 |
| Stump Pass, Fla. | P-268..... | i, 571 | Sugar Cr., Pa. | J-685..... | i, 336 |
| Stumpy Bayou, La. | S-527..... | i, 685 | Sugar Cr., Tex.: | | |
| Stumpy Cr., N. C. | L-301..... | i, 413 | (See notes, ii, 2806.) | | |
| Stupping Gum Cut, Ga. | O-408..... | i, 536 | Sugar Run, Pa. | J-690..... | i, 336 |
| Sturgeon B. and Lake | | | | J-870..... | i, 337 |
| Michigan Canal and | | | Sugar Tree Branch, Mo. | GG-111..... | i, 1026 |
| Harbor of Refuge, Wis. | MM-24..... | i, 1317 | Sugar Tree Fork, Ohio | DD-359..... | i, 962 |
| Sturgeon B. and Lake | | | Suislaw R., North Fork, | | |
| Michigan Ship Canal, | | | Oreg. | VV-40..... | i, 1593 |
| Wis.: | | | Suislaw R., Oreg. | VV-36..... | i, 1593 |
| (See notes, ii, 2836.) | | | | VV-37..... | i, 1593 |
| Navigation rules | ii, 2041, 2108 | | Sulsun B., Cal. | TT-66..... | i, 1555 |
| | | | | VV-4..... | i, 1577 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------|---------------------|-------------------|----------------------------|---------------------|-----------------------|
| Sulsun Chan., Cal..... | TT-82..... | i, 1564 | Superior B., Minn. and | | |
| Sulsun Cr., Cal..... | TT-82..... | i, 1564 | Wis..... | LL-18-a..... | i, 1275 |
| Appro..... | | ii, 2300 | "..... | LL-18-c..... | i, 1274 |
| Sulsun Cut-off, Cal..... | TT-82..... | i, 1555 | "..... | LL-18-d..... | i, 1274 |
| Sulsun Slough, Cal..... | TT-91..... | i, 1555 | (See notes, ii, 2835.) | | |
| Sulina..... | (HH)..... | i, 1079* | Harbor lines..... | | ii, 2260 |
| Sulina (The Danube)..... | (HH)..... | i, 1079* | Wrecks..... | | ii, 2277 |
| Sullivan Branch, Md..... | J-128..... | i, 332 | Superior City H., Wis. | | |
| Sullivan Cove, Md..... | J-1218..... | i, 340 | (entrance to Bay of Su- | | |
| Sullivan Cr., Kans..... | GG-1238..... | i, 1034 | perior)..... | LL-18-a..... | i, 1271 |
| (See notes, ii, 2821.) | | | Wrecks..... | | ii, 2277 |
| Sullivan Falls H., Me..... | A-48..... | i, 34 | Superior - Duluth H., | | |
| Appro..... | | ii, 2287 | Minn. and Wis.: (See | | |
| Sullivan R., Me..... | A-48..... | i, 27 | Duluth.) | | |
| Sullivans Isld., S. C.: | | | (See notes, ii, 2836.) | | |
| Bridges..... | | ii, 2233 | Appro..... | | ii, 2298 |
| Forts..... | | ii, 1808, 1940 | Harbor lines..... | | ii, 2260 |
| Sulphur Cr., Kans..... | GG-1264..... | i, 1035 | Navigation rules..... | | ii, 2041, 2107 |
| Sulphur Cr., Ky..... | AA-291..... | i, 850 | Superior, Minn. and Wis. | | |
| Sulphur Cr., Mo..... | GG-113..... | i, 1026 | (see Duluth-Superior.) | | |
| (See notes, ii, 2813.) | | | Supplies, forts..... | | ii, 1796, |
| Sulphur Cr., S. Dak..... | GG-825..... | i, 1031 | 1799, 1813, 1814, 1836 | | |
| (See notes, ii, 2818.) | | | Surgainsville Cr., Tenn... | AA-138..... | i, 849 |
| Sulphur Cr., Tenn..... | AA-23..... | i, 848 | Surlago, P. I..... | YY-153..... | i, 1686 |
| Sulphur Cr., Wyo..... | GG-1009..... | i, 1033 | Survey Boats; list..... | | ii, 2345, 2347 |
| (See notes, ii, 2820.) | | | Surveyors Cr., Fla..... | P-224..... | i, 570 |
| Sulphur R., Tex. and | | | Surveys: | | |
| Ark..... | T-6..... | i, 717 | Austrian..... | | ii, 2041, 2126 |
| "..... | T-16..... | i, 729 | Belgian..... | | ii, 2041, 2127 |
| Appro..... | | ii, 2294 | Comstock..... | | ii, 2041, 2126 |
| Bridges..... | | ii, 2234 | European..... | | ii, 2041, 2126 |
| Sulphur Springs..... | (HH)..... | i, 1079* | German..... | | ii, 2041, 2126 |
| Sulu Archipelago, P. I.... | YY-181..... | i, 1686 | Italian..... | | ii, 2041, 2126 |
| Sumac Pond, Md..... | J-98..... | i, 331 | Military; appro..... | | ii, 2279 |
| Summary, appropriat- | | | Norwegian..... | | ii, 2041, 2126 |
| tions..... | | ii, 2279 | Russian..... | | ii, 2041, 2127 |
| Summer Cr., Conn.: | | | Spanish..... | | ii, 2041, 2126 |
| Bridges..... | | ii, 2234 | Swedish..... | | ii, 2041, 2126 |
| Summit Pt..... | (WW-2)..... | i, 1618* | Swiss..... | | ii, 2041, 2126 |
| Sumpawanus Inlet, N. Y. | F-63..... | i, 215, 228 | Surveys (see Examina- | | |
| Appro..... | | ii, 2289 | tions)..... | | i, 22; ii, 2041, 2126 |
| Sumter, Fort, S. C..... | | ii, 1808, 1940 | Appro..... | | ii, 2283 |
| Sunbury Chan., Ga..... | O-176..... | i, 534 | Great Lakes..... | | ii, 2041, 2124 |
| Sunbury Cr., Ga..... | O-178..... | i, 534 | Longitude, Detroit and | | |
| Suncook R., N. H..... | B-23..... | i, 69 | Fort Leavenworth..... | | ii, 2041, 2122 |
| Sun Cr., Mass..... | B-135..... | i, 70 | Suscol Cr., Cal..... | TT-109..... | i, 1556 |
| Sunday Cr., Mont..... | GG-640..... | i, 1030 | Sustna R., Alaska..... | XX-151..... | i, 1666 |
| (See notes, ii, 2817.) | | | Susquehanna R., Md. | | |
| Sunfish Cr., Ohio..... | DD-338..... | i, 961 | and Pa..... | J-556..... | i, 335, 362 |
| "..... | DD-480..... | i, 962 | Appro..... | | ii, 2291 |
| Sunflower Landing..... | (HH)..... | i, 1079* | Bridges..... | | ii, 2230, 2234 |
| Sunflower, Miss..... | (HH)..... | i, 1079* | Dams, private..... | | i, 2250 |
| Sunflower R., Miss.: | | | Sutro Tunnel, mining..... | | ii, 2040, 2090 |
| Bridges..... | | ii, 2234 | Sutterlee Cr., Pa..... | J-648..... | i, 336 |
| Sunken Isld. Cr., Md..... | J-1229..... | i, 340 | Sutter Slough, Cal..... | UU-60..... | i, 1577 |
| Sunken Meadow, East | | | Sutton Cr., N. C..... | L-288..... | i, 413 |
| R., N. Y.: | | | "..... | L-344..... | i, 414 |
| Harbor lines..... | | ii, 2260 | Suwanee R., Fla..... | P-355..... | i, 571, 607 |
| Sunnyside..... | (HH)..... | i, 1079* | Appro..... | | ii, 2293 |
| Sunrise R., Minn..... | KK-62..... | i, 1247 | Bridges..... | | ii, 2234 |
| Sun R., Mont..... | GG-494..... | i, 1029 | Suwanee Sound, Fla..... | P-350..... | i, 571 |
| (See notes, ii, 2816.) | | | Suwanoochee R., Fla..... | P-358..... | i, 572 |
| Sunshine R., Alaska..... | XX-155..... | i, 1656 | Svenson Slough, Oreg.... | WW-11..... | i, 1615 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| Svenson Slough | (WW-2)..... | i, 1618* | Sweathouse Branch, Md. | J-994..... | i, 338 |
| Swaderick Cr., Md. | J-978..... | i, 338 | Swede Cr., Kans. | GG-1265..... | i, 1035 |
| Swamp R., Minn. | KK-109..... | i, 1248 | (See notes, ii, 2822.) | | |
| Swan Cr., Ala. | AA-207..... | i, 850 | Sweeney Cr., Mont. | GG-711..... | i, 1030 |
| Swan Cr., Lake St. Clair, Mich. | PP-100..... | i, 1451 | (See notes, ii, 2817.) | | |
| Swan Cr., Md. | J-501..... | i, 334 | Sweeneys Cut, Ga. | O-308..... | i, 535 |
| | J-517..... | i, 335 | Sweet B. Lake, La. | S-495..... | i, 685 |
| | J-939..... | i, 338 | Sweet Briar Cr., N. Dak. | GG-775..... | i, 1031 |
| | J-1164..... | i, 339 | (See notes, ii, 2818.) | | |
| Swan Cr., Mich. | OO-16..... | i, 1377 | Sweet Grass Cr., Mont. | GG-658..... | i, 1030 |
| | PP-70..... | i, 1419 | (See notes, ii, 2817.) | | |
| | PP-100..... | i, 1420 | Sweet Lake, La. | S-783..... | i, 688 |
| | PP-121..... | i, 1420 | Sweet Springs Cr., Mo. | GG-123..... | i, 1026 |
| Swan Cr., Minn. | KK-107..... | i, 1248 | (See notes, ii, 2813.) | | |
| Swan Cr., Mo.: (See notes, ii, 2824.) | | | Sweet Swamp, S. C. | N-39..... | i, 499 |
| Swan Cr., N. C. | M-12..... | i, 454 | Sweet Water Cr., Ga. | O-57..... | i, 533 |
| Swan Cr., N. Dak. | GG-400..... | i, 1028 | | O-63..... | i, 533 |
| Swan Cr., Ohio. | QQ-6..... | i, 1461 | Sweetwater Cr., Tenn. | AA-89..... | i, 849 |
| Bridges..... | | ii, 2234 | Sweetwater R., Wyo. | GG-1004..... | i, 1033 |
| Wrecks..... | | ii, 2277 | (See notes, ii, 2820.) | | |
| Swan Cr., S. Dak. | GG-385..... | i, 1028 | Swift Cr., Ga. | O-255..... | i, 535 |
| (See notes, ii, 2815.) | | | Swift Cr., N. C. | M-86..... | i, 454 |
| Swan Isld. | (WW-2)..... | i, 1618* | | M-170..... | i, 455, 467 |
| Swan Isld., Me. (channel west of) | A-227..... | i, 29 | Appro..... | | ii, 2292 |
| Swan Lake, Ga. | O-241..... | i, 534 | Bridges..... | | ii, 2234 |
| Swan Pond, Md. | J-163..... | i, 332 | Swift Cr., Va. | L-151..... | i, 412 |
| Swan Quarter B.-Deep B., N. C. (waterway) | M-37..... | i, 454, 459 | Swift Lake, Ga. | O-388..... | i, 536 |
| Swan Quarter B., N. C. | M-34..... | i, 454 | Swift Slough | (HH)..... | i, 1079* |
| Appro..... | | ii, 2292 | Swifts R., Mass.: Bridges..... | | ii, 2234 |
| Swan R., Mich. | PP-44..... | i, 1419 | Swimming Gut, Md. | J-167..... | i, 332 |
| Swan R., Minn. | KK-85..... | i, 1248 | Swimming R., N. J. | G-52..... | i, 247 |
| | KK-118..... | i, 1248 | Swinomish Slough, Wash..... | XX-99..... | i, 1655, 1674 |
| Swansboro, N. C.: Appro..... | | ii, 2292 | Appro..... | | ii, 2301 |
| Swansboro, N. C., to New R. (waterway) | M-286..... | i, 456 | Bridges..... | | ii, 2234 |
| Swansboro to New R., N. C. (Inland water- way) | M-286..... | i, 482 | Harbor lines..... | | ii, 2260 |
| (See notes, ii, 2797.) | | | Sword Bayou, La. | S-494..... | i, 685 |
| Swans Cr., N. C. | M-143..... | i, 455 | Sybelle Cr., Wyo.: (See notes, ii, 2820.) | | |
| Swanson Cr., Md. | K-26..... | i, 373 | Sycamore Chain | (HH)..... | i, 1079* |
| Swanton H., Vt. | E-123..... | i, 178, 210 | Sycamore Cr., Tenn. | AA-165..... | i, 849 |
| Appro..... | | ii, 2289 | | AA-310..... | i, 850 |
| Swash (The), Va. | L-16..... | i, 411 | Sycamore Cr., W. Va. | EE-138..... | i, 984 |
| Swatard Cr., Pa. | J-591..... | i, 335 | Sycamore Landing | (HH)..... | i, 1079* |
| Swatora Cr., Pa. | J-583..... | i, 335 | Sycamore Slough, Cal. | UU-47..... | i, 1577 |
| | | | Wrecks..... | | ii, 2277 |
| | | | Sylvia de Grasse | (WW-2)..... | i, 1618* |
| | | | Symmes Cr., Ohio | DD-350..... | i, 961 |
| | | | Symonds Cr., N. C. | L-283..... | i, 413 |
| | | | Syracuse | (CC)..... | i, 910* |

T.

| | | | | | |
|-----------------------------|------------|--------|------------------------------|--------------|---------|
| Tabbs Cr., Va. | K-167..... | i, 374 | Tabo Cr., Mo. | GG-1424..... | i, 1036 |
| | K-266..... | i, 375 | (See notes, ii, 2823.) | | |
| | L-95..... | i, 412 | Tacloban, P. I. | YY-115..... | i, 1686 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|----------------------|--|---------------------|-------------------|
| Tacoma City Waterway: | | | Tanner Cr., W. Va. | EE-174 | i, 984 |
| Bridges | | ii, 2235 | Tanners Branch, Del. | J-287 | i, 333 |
| Tacoma H., Wash. | XX-67 | i, 1655, 1669 | Tanners Cr., Ind. | DD-494 | i, 963 |
| Appro. | | ii, 2301 | Tanners Cr., Va. | L-202 | i, 412 |
| Bridges | | ii, 2235 | Bridges | | ii, 2235 |
| Harbor lines | | ii, 2260 | Harbor lines | | ii, 2260 |
| Wrecks | | ii, 2277 | Wrecks | | ii, 2277 |
| Taft Board, forts. | | ii, 1817 | Tanners Pt., Va.: | | |
| Tagbilaran, P. I. | YY-151 | i, 1686 | Harbor lines | | ii, 2260 |
| Tahuyah R., Wash. | XX-59 | i, 1655 | Tanon Strait, P. I. | YY-124 | i, 1686 |
| Taibiksok R., Alaska | XX-189 | i, 1656 | | YY-128 | i, 1686 |
| Takeetna R., Alaska | XX-156 | i, 1656 | Tanyard Cove, Md. | J-1161 | i, 339 |
| Takotna R., Alaska | XX-180 | i, 1656 | Taquamenon B., Mich. | LL-59 | i, 1265 |
| Taku R., Alaska | XX-124 | i, 1656 | Taquamenon R., Mich. | LL-60 | i, 1265 |
| Tallahatchie R. from mouth of Coldwater R. to Batesville, Miss. | X-10-d | i, 791 | Tar B., Md. | J-222 | i, 332 |
| Tallahatchie R., Miss. | X-10 | i, 785, 789 | Tarboro to Rocky Mount, N. C. | M-66-e | i, 463 |
| | X-10-a | i, 789 | Tar Cove, Md. | J-1173 | i, 339 |
| | X-10-c | i, 791 | | J-1186 | i, 340 |
| (See notes, ii, 2807, 2808.) | | | Tar Cr., Md. | J-331 | i, 333 |
| Appro. | | ii, 2295 | Tar Cr., N. C. | M-151 | i, 455 |
| Bridges | | ii, 2235 | Tarentum, Pa. | FF-20 | i, 1015 |
| Wrecks | | ii, 2277 | Tarkill Cr., Va. | L-81 | i, 411 |
| Tallapoosa R., Ala. and Ga. | Q-50 | i, 611, 635 | Tarklin Cr., N. C. | M-48 | i, 454 |
| Appro. | | ii, 2294 | | M-63 | i, 454 |
| Tallisheek Cr., La. | R-98-y | i, 647 | | M-161 | i, 455 |
| Tallulah R., Ga. | O-20 | i, 533 | Tarpaulin Cove (harbor of refuge), Naushon Isld., Mass. | C-24 | i, 112 |
| Tallys Cr., La. | R-98-l | i, 647 | Tarpaulin Cove, Mass.: | | |
| Tamarack R., Minn. | KK-57 | i, 1247 | Wrecks | | ii, 2277 |
| | KK-204 | i, 1248 | Tarpaulin Cove, Naushon Isld., Mass. | C-24 | i, 107 |
| Tampa B. and Old Tam- pa B., Fla. (channel between) | P-288-e | i, 599 | Tarpon Basin, Fla. | P-171 | i, 570 |
| Tampa B., Fla. | P-288 | i, 571, 596 | Tarrant Cr., Va. | L-200 | i, 412 |
| | P-288-a | i, 596 | Tar B. (above Washing- ton, N. C.) | M-66 | i, 454 |
| (See notes, ii, 2799.) | | | Tar B., N. C. | M-66-b | i, 461 |
| Appro. | | ii, 2293 | | M-66-c | i, 461 |
| Wrecks | | ii, 2266 | Bridges | | ii, 2235 |
| Tampa B., Fla. (north channel) | P-287 | i, 571 | Tar B. (Tarboro to Rocky Mount), N. C. | M-66-e | i, 463 |
| Tampa B., Fla. (south- west channel) | P-286 | i, 571 | Tarryall Cr., Colo. | GG-1094 | i, 1033 |
| Tampa, Fla.: | | | (See notes, ii, 2820.) | | |
| Appro. | | ii, 2287 | Tarry Cr., Va. | L-384 | i, 414 |
| Forts | | ii, 1796, 1823, 1962 | Tarrytown H., N. Y. | E-30 | i, 177, 196 |
| Harbor lines | | ii, 2260 | Appro. | | ii, 2289 |
| Navigation rules | | ii, 2041, 2108 | Ta Run, Va. | K-308 | i, 375 |
| Wrecks | | ii, 2277 | Tascarora Cr., Pa. | J-640 | i, 335 |
| Tampa H., Fla. | P-306 | i, 571 | Tatems Cr., Va. | L-192 | i, 412 |
| Tanana R., Alaska | XX-194 | i, 1656 | Tates Cr., Ky. | DD-14 | i, 959 |
| Wrecks | | ii, 2277 | Tatondur R., Alaska | XX-207 | i, 1656 |
| Tana R., Alaska | XX-131 | i, 1656 | Taunton and Weymouth Canal, Mass. | C-70-a | i, 125 |
| Tangasootack Cr., Pa. | J-823 | i, 337 | Taunton Great R., Mass.: | | |
| Tangler H., Va. | J-45-a | i, 341 | Bridges | | ii, 2235 |
| Tangler Isld., Va. | J-45-a | i, 342 | Taunton H., Mass.: | | |
| Tangler Sound, Md. | J-45 | i, 331 | (See notes, ii, 2786, 2787.) | | |
| Tangler Sound, Va. | J-45-a | i, 342 | Taunton R., Mass. | C-69 | i, 107, 123 |
| Wrecks | | ii, 2277 | Appro. | | ii, 2288 |
| Tangipahoa R., La. | S-29 | i, 681, 691 | Bridges | | ii, 2235 |
| Appro. | | ii, 2294 | Taureau Bayou, La.: | | |
| Tanner Cr., Md. | K-47 | i, 373 | (See notes, ii, 2805.) | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|----------------------|
| Tavern Cr., Md. | J-503..... | i, 334 | Telephones, D. C. | ii, 2040, 2077 | |
| Tavern Cr., Mo. | GG-1519..... | i, 1037 | Telfair Mill Cr., Ga. | O-56..... | i, 533 |
| Tavernier Cr., Fla. | P-182..... | i, 570 | Tellico R., Tenn. | AA-94..... | i, 849 |
| Tawas City H., Mich. | PP-56..... | i, 1419 | Tenants H., Me. | A-152..... | i, 28 |
| Tawas R., Mich. | PP-55..... | i, 1419 | Tenean Cr., Mass. | B-133..... | i, 70 |
| Tayabas B., P. I. | YY-98..... | i, 1686 | Teneha Cr., Tex.: (See notes, ii, 2805.) | | |
| Taylor Cr., Nebr. | GG-962..... | i, 1032 | Ten Mile Cr., Ga. | O-147..... | i, 534 |
| (See notes, ii, 2819.) | | | | O-406..... | i, 536 |
| Taylor Cr., Va. | K-178..... | i, 374 | Ten Mile Cr., La. | S-820..... | i, 688 |
| | K-211..... | i, 374 | (See notes, ii, 2805.) | T-2-x..... | i, 717 |
| Taylor, Fort. | | ii, 1803, 1955 | Tenmile Cr., Pa. | FF-7..... | i, 1003 |
| Taylor Isld. | (HH)..... | i, 1079* | Tenmile Cr., W. Va. | EE-13..... | i, 983 |
| Taylor Pond, N. C. | L-335..... | i, 413 | Tenmile Rapids. | (WW-2)..... | i, 1618* |
| Taylor Sands. | (WW-2)..... | i, 1618* | Ten Mile R., Cal. | TT-151..... | i, 1556 |
| Taylors Bayou, Tex.: (See notes, ii, 2806.) | | | Tennessee and Alabama Rs. (canal to connect)... | AA-18-i..... | i, 868 |
| Bridges..... | | ii, 2235 | Tennessee and Altamaha Rs. (canal to connect)... | AA-18-j..... | i, 869 |
| Navigation rules..... | | ii, 2041, 2108 | Tennessee and Coosa Rs. (canal to connect)..... | AA-18-h..... | i, 868 |
| Taylors Bottom. | (CC)..... | i, 910* | Tennessee Isld. | (CC)..... | i, 910* |
| Taylors Branch, La. | S-27..... | i, 681 | Tennessee R. | (CC)..... | i, 910* |
| Taylors Branch, Mo. | GG-3..... | i, 1025 | Tennessee R. (branch of), Big Bear Cr., Miss. | AA-34..... | i, 869 |
| (See notes, ii, 2813.) | | | Tennessee R. (communi- cation with, by way of Big Bear Cr.) | R-23-c..... | i, 653 |
| Taylors Cr., N. C. | M-255..... | i, 456 | Tennessee R., Ky., Tenn., Ala., and Miss. | AA-18..... | i, 848, 855 |
| Taylor Slough, Cal. | UU-9..... | i, 1577 | (See notes, ii, 2809.) | | |
| Taylors Pass, La. | S-225..... | i, 683 | Appro..... | | ii, 2296 |
| Taylorville. | (CC)..... | i, 910* | Bridges..... | | ii, 2236, 2237 |
| Tay Tay B., P. I. | YY-141..... | i, 1686 | Dams, private..... | | ii, 2250 |
| Tazlina R., Alaska. | XX-145..... | i, 1656 | Navigation rules..... | | ii, 2041, 2107, 2108 |
| Tchefuncte R. | S-20..... | i, 681 | Wrecks..... | | ii, 2277 |
| Tchefuncte R., La. | S-20..... | i, 689 | Tennessee R. (Paducah, Ky.) | BB-4..... | i, 891 |
| Appro..... | | ii, 2294 | Tennessee R. ("Transpor- tation Routes to Sea- board") | AA-18-k..... | i, 869 |
| Tchoupitoulas Bayou, La. | S-130..... | i, 682 | Tennion Slough, Cal. | TT-46..... | i, 1555 |
| Tchoutacabouffa R., Miss.: | | | Tennessee, Savannah, and Hiwassee Rs., Ga. and Tenn. (canal con- necting the headwaters) | O-2-j..... | i, 547 |
| Bridges..... | | ii, 2236 | Tensas | (HH)..... | i, 1079* |
| Tchula Cabawia R., Miss. | R-81..... | i, 646 | Tensas Basin. | (HH)..... | i, 1079* |
| Tchula Lake, Miss. | X-5..... | i, 785, 788 | (See notes, ii, 2828.) | | |
| Appro..... | | ii, 2295 | Tensas Bayou, La. | S-601..... | i, 686 |
| Bridges..... | | ii, 2236 | Tensas District (HH): (See notes, ii, 2832.) | | |
| Teague Cr., Md. | J-68..... | i, 331 | Tensas R., La. | X-30..... | i, 785, 805 |
| Teal Slough, Cal. | TT-51..... | i, 1555 | | X-30-b..... | i, 806 |
| Tebay R., Alaska. | XX-129..... | i, 1656 | Tensas, Upper (HH): (See notes, ii, 2828, 2832.) | | |
| Tebo Cr., Mo. | GG-1466..... | i, 1036 | Tensas R., La. and Ala.: Appro..... | | ii, 2295 |
| (See notes, ii, 2824.) | | | Bridges..... | | ii, 2237 |
| Teche Bayou, La. | S-642..... | i, 686, 705 | Tensaw R., Ala. | R-13..... | i, 646 |
| | S-642-a..... | i, 705 | Tenthouse Cr., Md. | J-1274..... | i, 340 |
| Appro..... | | ii, 2294 | Terra Cela B., Fla. | P-300..... | i, 571 |
| Bridges..... | | ii, 2236 | | | |
| Wrecks..... | | ii, 2277 | | | |
| Teche Bayou, La. (canal connecting with Grand Lake at Charenton, La.) | S-642-b..... | i, 707 | | | |
| Tecumseh Cr., Kans. | GG-1392..... | i, 1036 | | | |
| (See notes, ii, 2823.) | | | | | |
| Tedius Cr., Md. | J-172..... | i, 332 | | | |
| Teepeeota Pt. | (HH)..... | i, 1079* | | | |
| (See notes, ii, 2828.) | | | | | |
| Teets Cr., Va. | L-385..... | i, 414 | | | |
| Telkell R., Alaska. | XX-147..... | i, 1656 | | | |
| Telegraph and Telephone Wires, D. C. | | ii, 2040, 2077 | | | |
| Telegraphs, D. C. | | ii, 2040, 2077 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|----------------------------|-----------------------------------|---------------------|-------------------|
| Terra Ceta Cut-off, Fla. | P-301..... | i, 571 | Thrd Cr., N. C. | N-54..... | i, 499 |
| Terrapin Cr., Colo.: | | | Thrd District (HH): | | |
| (See notes, ii, 2820.) | | | (See notes, ii, 2829.) | | |
| Terrapin Cr., Mo.: | | | Thrd Fork, Mo. and | | |
| (See notes, ii, 2813.) | | | Iowa: | | |
| Terrapin or Box Elder Cr., | | | (See notes, ii, 2814.) | | |
| Colo. | GG-1108..... | i, 1033 | Thrd Hay Cr., N. Dak. | | |
| Terrapin Sand Cove, Md. | J-184..... | i, 332 | and Mont.: | | |
| Terre au Boeufs Bayou, | | | (See notes, ii, 2817.) | | |
| La. | S-182..... | i, 682 | Thrd Mine Branch, Md. | J-1011..... | i, 338 |
| Terre Bayou, La. | S-359..... | i, 684 | Thrd Rapids | (WW-2)..... | i, 1618* |
| Terrebonne B., La. | S-443..... | i, 685 | Thrd R., Minn. | KK-91..... | i, 1248 |
| Terrebonne Bayou, La. | S-445..... | i, 685, 700 | Thrd R., N. J. | G-19..... | i, 247 |
| Appro. | | ii, 2294 | Thirteen Mile Cr., Mont. | GG-632..... | i, 1030 |
| Bridges. | | ii, 2237 | (See notes, ii, 2817.) | | |
| Terre Haute, Ind. | BB-23..... | i, 898 | Thirteenmile Cr., W. Va. | EE-155..... | i, 984 |
| Terry Cr., Ga. | O-438..... | i, 536 | Thirty Mile Cr., Mont. | GG-436..... | i, 1028 |
| Terrys Cr., La. | S-41..... | i, 681 | (See notes, ii, 2815.) | | |
| Tessier-Bourgeoise. | (HH)..... | i, 1079* | Thirty Mile Cr., N. Dak. | GG-783..... | i, 1031 |
| Tester Lake, Ga. | O-492..... | i, 536 | (See notes, ii, 2818.) | | |
| Tete Bayou, La. | S-641..... | i, 686 | Thomas Bayou, La. | S-530..... | i, 685 |
| Tete Bois Bayou, La. | S-800..... | i, 688 | Thomas Branch, Mo. | GG-1439..... | i, 1036 |
| Teton R., Mont. | GG-491..... | i, 1029 | (See notes, ii, 2823.) | | |
| (See notes, ii, 2816.) | | | Thomas Cr., Ga. | O-249..... | i, 535 |
| Texas: | | | Thomas Cr., Va. | K-271..... | i, 375 |
| Field service. | | ii, 2039, 2050 | Thomas Landing. | (HH)..... | i, 1079* |
| Fort. | | ii, 1808, 1816, 1976, 1984 | Thomas Run, Md. | J-931..... | i, 338 |
| Texas City H., Tex. | U-29..... | i, 735 | Thomaston H., Me. | A-155..... | i, 28 |
| Texas City, Tex.: | | | Thomaston H., Me., | | |
| Harbor lines. | | ii, 2261 | Georges R. | A-155-a..... | i, 46 |
| Texas City to Galveston | | | Thomaston to Warren, | | |
| H., Tex. (channel). | U-29-a..... | i, 746 | St. Georges R., Me. | A-155..... | i, 45 |
| Texas (coast of), inland | | | Thompson Cr., Md. | J-404..... | i, 334 |
| waterway (West Galves- | | | Thompsons Branch, Mo. | GG-94..... | i, 1025 |
| ton B. to Rio Grande | | | Thompsons Cr., Kans. | GG-1356..... | i, 1035 |
| R.) | U-38..... | i, 756 | (See notes, ii, 2823.) | | |
| Texas, Department of: | | | Thompsons Cr., La. | S-247..... | i, 683 |
| Work in the field. | | ii, 2040, 2086 | Thompsons Cr., Mont. | | |
| Texas Rapids. | (WW-2)..... | i, 1618* | and Wyo.: | | |
| Texas Run, Pa. | J-752..... | i, 336 | (See notes, ii, 2818.) | | |
| Texas waterways. | U-2..... | i, 735 | Thompsons Cr., Nebr. | GG-1293..... | i, 1035 |
| Texas waterways (hya- | | | (See notes, ii, 2822.) | | |
| cinth removal). | P-1-b-e..... | i, 572 | Thompsons Cr., S. C. | N-57..... | i, 499 |
| | U-2-a..... | i, 735 | Thompsons Cr., S. Dak. | GG-763..... | i, 1031 |
| Texas Waterways, Inland | | | Thompsons Isl. | (HH)..... | i, 1079* |
| or Coastal: | | | Thoms Cove, Md. | J-1163..... | i, 339 |
| Appro. | | ii, 2295 | Thoms Cr., Va. | L-50..... | i, 411 |
| Hyacinth removal. | | ii, 2293 | Thomsons Fork, Iowa | | |
| (See notes, ii, 2799.) | | | and Mo. | GG-138..... | i, 1026 |
| Thames R., Conn. | D-11..... | i, 141, 146 | (See notes, ii, 2813.) | | |
| (See notes, ii, 2789.) | | | Thorgeson Canal, La. | S-686..... | i, 687 |
| Appro. | | ii, 2289 | Thornapple R., Mich. | OO-27..... | i, 1377 |
| Bridges. | | ii, 2237 | Thornapple R., Wis. | KK-37..... | i, 1247 |
| Harbor lines. | | ii, 2261 | Thornton Branch, Md. | J-987..... | i, 338 |
| Thames R., England: | | | Thornton Cr., Ky. | DD-135..... | i, 960 |
| Bridges. | | ii, 2237 | Thornton Mill Cr., Mo. | GG-195..... | i, 1026 |
| Thebes, Ill. | (HH)..... | i, 1079* | Thorofoare Cr., Md. | J-168..... | i, 332 |
| Thibbetts Br., Minn. | KK-66..... | i, 1247 | Thoroughfare, N. C. | L-354..... | i, 414 |
| Thibodaux Canal, La. | S-472..... | i, 685 | Thoroughfare, Va. | K-199..... | i, 374 |
| Thief R., Minn. | KK-200..... | i, 1248 | | K-321..... | i, 375 |
| Thimble Shoals, Va. | L-173-d..... | i, 433 | Thoroughfare B., N. C. | M-231..... | i, 456 |
| Thrd Cr., Kans.: | | | | M-231-a..... | i, 472 |
| (See notes, ii, 8222.) | | | | | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|------------------------------------|---------------------|-------------------|
| Thoroughfare Cr., S. C. | N-16 | i, 499 | Tiger Cr., Ga. | O-254 | i, 535 |
| | N-22 | i, 499 | Tiger Pass. | (HH) | i, 1079* |
| Thoroughfare (The), Va. | L-40 | i, 411 | Tiger Pass, La. | S-308 | i, 683 |
| | L-58 | i, 411 | Tiger R., S. C. | N-188 | i, 500 |
| | L-114 | i, 412 | Tigre Bayou, La. | S-384 | i, 684, 698 |
| Thousand Isld. | (HH) | i, 1079* | | S-712 | i, 687, 711 |
| Thousand Isld. Park, N. Y. | | | (See notes, ii, 2804.) | | |
| | RR-66 | i, 1493 | Tigre Lagoon, La. | S-709 | i, 687 |
| Three Bayou, La. | T-2-d | i, 717 | Tikchik R., Alaska. | XX-166 | i, 1656 |
| (See notes, ii, 2805.) | | | Tilghman Cove, Md. | J-434 | i, 334 |
| Three Bros. | (CC) | i, 910* | Tilghman Cr., Md. | J-364 | i, 333 |
| Three Cr., N. C. | M-299 | i, 456 | | J-426 | i, 334 |
| Three Cr., Va. | L-321 | i, 413 | Tilghman Isld. H., Md. | J-354 | i, 333, 354 |
| Three Crs., S. C. | N-42 | i, 499 | Appro. | | ii, 2291 |
| Three Forks, Mont. | (GG-2) | i, 1039* | Tilghman Pond, Md. | J-28 | i, 331 |
| Three Forks to Great Falls, Mont., Missouri | | | Tillamook Bar and B., Oreg. | VV-61 | i, 1608 |
| R. | GG-2-l | i, 1059 | Appro. | | ii, 2300 |
| Three Hill Cr., Va. | L-387 | i, 414 | Tillamook B., Oreg. | VV-61 | i, 1593 |
| Threemile Cr., Ala. | R-45 | i, 646 | Tillamook R., Oreg. | VV-63 | i, 1593 |
| Bridges. | | ii, 2238 | Bridges. | | ii, 2238 |
| Three Mile Cr., Colo. | GG-1099 | i, 1033 | Tillers Fork Cr., S. C. | N-66 | i, 499 |
| (See notes, ii, 2820.) | | | Timballer B., La. | S-426 | i, 684 |
| Three Mile Cr., Kans. | GG-1169 | i, 1034 | Timber Cr., Mont. | GG-462 | i, 1028 |
| | GG-1274 | i, 1035 | (See notes, ii, 2816.) | | |
| (See notes, ii, 2821, 2822.) | | | Timber Cr., S. Dak. | GG-311 | i, 1027 |
| Three Mile Cr., Ky. | DD-291 | i, 961 | Timber Neck Cr., Va. | K-300 | i, 375 |
| Threemile H., N. Y. | F-42 | i, 215, 226 | Timber Run, Md. | J-1124 | i, 339 |
| Threemile Isld. | (CC) | i, 911* | Timbertree Cr., Ky. | DD-43 | i, 959 |
| Threemile Rapids. | (WW-2) | i, 1618* | Timmons R., Ga. | O-186 | i, 534 |
| (See notes, ii, 2843.) | | | Timmonstown Branch, Md. | J-14 | i, 331 |
| Three Mile R., Mass. | C-73 | i, 107 | Tloga R., Pa. and N. Y. | J-666 | i, 336 |
| Three Mile R., N. Y. | F-42 | i, 215 | Tionesta Cr., Pa. | FF-20 | i, 1015 |
| Three Mile Slough, Cal. | UU-54 | i, 1577 | | FF-30 | i, 1021 |
| Three Tree Pt. | (WW-2) | i, 1618* | Tionesta, Pa. | FF-20 | i, 1015 |
| Throg Neck, N. Y.: | | | Tionesta R., Pa. | FF-30 | i, 1003, 1021 |
| Harbor lines. | | ii, 2261 | Tippecanoe Cr., Ind. | BB-23 | i, 898 |
| Thunder B., Mich. | PP-49 | i, 1419 | Tippecanoe R., Ind. | BB-33 | i, 891 |
| Wrecks. | | ii, 2277 | Tipton Run, Pa. | J-867 | i, 337 |
| Thunder B. R., Mich. | PP-50 | i, 1419, 1433 | Tiptonville. | (HH) | i, 1079* |
| Appro. | | ii, 2299 | Tirraile Cr., S. C. | N-152 | i, 500 |
| Thunderbolt R., Ga. | O-77 | i, 547 | Tittabawassee R., Mich. | PP-68 | i, 1419, 1438 |
| Appro. | | ii, 2293 | Bridges. | | ii, 2238 |
| Thunder Cr., S. Dak. | GG-808 | i, 1031 | Tivoli R., Ga. | O-174 | i, 534 |
| (See notes, ii, 2818.) | | | Tobacco Cr., N. Dak. | GG-750 | i, 1031 |
| Tiber Cr., N. C. | L-276 | i, 413 | (See notes, ii, 2818.) | | |
| Tiburon, Cal.: | | | Tobacco Garden Cr., N. Dak. | GG-407 | i, 1028 |
| Bridges. | | ii, 2145 | (See notes, ii, 2815, 2818.) | | |
| Tickfaw R. and tributaries, La. | S-51 | i, 691 | Tobacco Run, Md. | J-932 | i, 338 |
| Tickfaw R., La. | S-51 | i, 681 | Tobesofkee Cr., Ga. | O-376 | i, 535 |
| Appro. | | ii, 2294 | Tobias Landing, Vt. | E-82 | i, 203 |
| Ticonderoga Cr., N. Y.: | | | Tobin H., Mich. | LL-62 | i, 1265 |
| (See notes, ii, 2792.) | | | Toby Cr., Pa. | J-695 | i, 336 |
| Ticonderoga R., N. Y. | E-99 | i, 178, 205 | Toccoa Cr., Ga. | O-21 | i, 533 |
| Appro. | | ii, 2289 | Toco Cr., Tenn. | AA-95 | i, 849 |
| Tidal Canal, Cal. | TT-58 | i, 1555 | Todd H., Mich. | LL-64 | i, 1285 |
| Tide Cr. | (WW-2) | i, 1618* | Toddsbury Cr., Va. | K-279 | i, 375 |
| Tide Cr., Oreg. | WW-23 | i, 1615 | Todds Cr., Ga.: | | |
| Tie Cr., Mont. | GG-759 | i, 1031 | (See notes, ii, 2798.) | | |
| (See notes, ii, 2818.) | | | Todds Cr., Mo. | GG-210 | i, 1026 |
| Tiffin R., Ohio and Mich. | QQ-7 | i, 1461 | (See notes, ii, 2814.) | | |
| Tifton Cr., Ga. | O-148 | i, 534 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|---|
| Togalak, Alaska | XX-167..... | i, 1656 | Tongue R., Mont. and Wyo | GG-713..... | i, 1030 |
| (See notes, ii, 2845.) | | | (See notes, ii, 2818.) | | |
| Tolay Cr., Cal. | TT-119..... | i, 1556 | Tongue R., N. Dak. | KK-172..... | i, 1248 |
| Bridges..... | | ii, 2238 | Tonsina R., Alaska | XX-146..... | i, 1656 |
| Toledo H., Ohio | QQ-3..... | i, 1461 | Toney Fork, W. Va. | EE-39..... | i, 983 |
| Appro..... | | ii, 2299 | Tonytank Cr., Md. | J-94..... | i, 331 |
| Harbor lines..... | | ii, 2261 | Toods Cr., Ga. | O-500..... | i, 536 |
| Wrecks..... | | ii, 2277 | (See notes, ii, 2798.) | | |
| Toledo Light, Ohio: | | | Tooleys Cr., N. C. | M-103..... | i, 455 |
| Wrecks..... | | ii, 2277 | Topical Index | | i, 13, 14; ii, 2623 |
| Toledo, Ohio, above Mau- mee R. | QQ-4..... | i, 1464 | Torch B., Mich. | LL-43..... | i, 1265 |
| Tolomato R., Fla. | P-85..... | i, 569 | Torch Lake, Mich. | LL-44..... | i, 1265 |
| Tolong, P. I. | YY-130..... | i, 1686 | | LL-44-b..... | i, 1291 |
| Tolovana R., Alaska | XX-205..... | i, 1656 | | OO-55-b..... | i, 1411 |
| Tolson Cr., Md. | J-410..... | i, 334 | Toreau Bayou, La | T-2-aa..... | i, 717 |
| Tomac H., Conn. | D-90..... | i, 141, 171 | Torpedoes (see Mines) | | ii, 1796, 1799, 1812, 1814, 1817, 1824, 1837 |
| Tomahawk Cr., Kans.: | | | Torras | (HH)..... | i, 1079* |
| (See notes, ii, 2823.) | | | Tortue Bayou, La | S-724..... | i, 687 |
| Tomahawk Cr., Mo. | GG-1410..... | i, 1036 | Tortugas, Fla.: | | |
| Tomahawk R. | (HH)..... | i, 1079* | Wrecks..... | | ii, 2277 |
| Tomales B., Cal. | TT-134..... | i, 1556 | Totogatic R. | (HH)..... | i, 1079* |
| Tomberlinge Timber Lake, Ga. | O-394..... | i, 536 | Totten B., N. Dak. | KK-186-a..... | i, 1259 |
| Tombigbee, Black War- rior, and Warrior Rs., Ala. and Miss. | R-23..... | i, 646, 651 | Totten, Fort, N. Y. (see Schools): | | |
| (See notes, ii, 2803.) | | | Engineer Depot..... | | ii, 2039, 2045 |
| Appro..... | | ii, 2294 | Post..... | | ii, 2039, 2053 |
| Bridges..... | | ii, 2238 | Tottenville, N. Y.: | | |
| Navigation rules..... | | ii, 2041, 2108 | Harbor lines..... | | ii, 2261 |
| Tombigbee R., Tenn.: | | | Totuskey R., Va. | K-191..... | i, 374, 401 |
| Bridges..... | | ii, 2238 | Appro..... | | ii, 2291 |
| Tom Cove, Md. | J-221..... | i, 332 | Toutle R., Wash. | WW-51..... | i, 1615 |
| Tom Cr., Iowa: | | | Bridges..... | | ii, 2238 |
| (See notes, ii, 2814.) | | | Towallga Cr., Ga. | O-367..... | i, 535 |
| Tom Cr., Minn. | GG-284..... | i, 1027 | Towalga R., Ga. | O-365..... | i, 535 |
| Tomhicken Cr., Pa. | J-620..... | i, 335 | Towanda Cr., Pa. | J-687..... | i, 336 |
| Tom Manns Cr., N. C. | M-17..... | i, 454 | Towboats, gasoline; list | | ii, 2353 |
| Tommys Cr., W. Va. | EE-30..... | i, 983 | Towboats, list | | ii, 2347 |
| Tomoka Cr., Fla. | P-100..... | i, 569 | Tower Dupre, La.: | | |
| Tom Paines Slough, Cal. | UU-18..... | i, 1577 | Ports..... | | ii, 1803, 1976 |
| Tompkins, Fort, N. Y. | | ii, 1807, 1881 | Tower Isld. | (HH)..... | i, 1079* |
| Toms Cr., Ky. | DD-230..... | i, 960 | Towhead | (HH)..... | i, 1079* |
| Toms Cr., S. C. | N-144..... | i, 500 | Towhead Bayou, La. | S-666..... | i, 687 |
| Toms R., N. J. | I-5..... | i, 299, 300 | Towles Cr., Va. | K-142..... | i, 374 |
| Appro..... | | ii, 2290 | Town Branch, Mo. | GG-191..... | i, 1026 |
| Tonawanda Cr., N. Y. | RR-21..... | i, 1493 | (See notes, ii, 2814.) | | |
| Tonawanda Cr. to Buf- falo, N. Y. (Erie Canal) | RR-19..... | i, 1493 | Town Brook, Mass. | B-169..... | i, 70 |
| Tonawanda H., N. Y. | RR-15-a..... | i, 1509 | Town Cove, Mass. | B-210..... | i, 70 |
| (See notes, ii, 2839.) | | | Town Cr., Ala. | AA-40..... | i, 848 |
| Harbor lines..... | | ii, 2261 | | AA-55..... | i, 848 |
| Tonawanda to Gill Cr., N. Y. | RR-15-c..... | i, 1511 | Town Cr., Beaufort Co., N. C. | M-70..... | i, 463 |
| Tonawanda to Port Day, N. Y. | RR-15-b..... | i, 1510 | Town Cr., Brunswick Co., N. C. | M-325..... | i, 493 |
| Tonganoxie Cr., Kans. | GG-1197..... | i, 1034 | Town Cr., Ga. | O-283..... | i, 535 |
| (See notes, ii, 2821.) | | | Town Cr., Md. | K-42..... | i, 373 |
| Tongue Pt. | (WW-2)..... | i, 1618* | Town Cr., Miss. | S-287..... | i, 683 |
| (See notes, ii, 2841, 2842.) | | | Town Cr., near Charles- ton, S. C. | N-216-b..... | i, 525 |
| Tongue R., Mont. | GG-713..... | i, 1061 | Town Cr., N. C. | M-263..... | i, 456 |
| | | | | M-325..... | i, 456 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|--|---------------------|----------------------|
| Town Cr., N. C.—Con. | | | Trenton, N. J., to Phila- delphia, Pa. (Delaware R.). | H-3-d..... | i, 281 |
| Appro..... | | ii, 2292 | Trent R., N. C. | M-138..... | i, 455 |
| Bridges..... | | ii, 2238 | | M-180..... | i, 455, 469 |
| Town Cr., S. C. | N-217..... | i, 500 | (See notes, ii, 2797.) | | |
| Appro..... | | ii, 2292 | Appro..... | | ii, 2292 |
| Town R., Mass. | B-139..... | i, 70, 94 | Bridges..... | | ii, 2238, 2239 |
| Appro..... | | ii, 2288 | Harbor lines..... | | ii, 2261 |
| Bridges..... | | ii, 2238 | Trepagnier Bayou, La. | S-123..... | i, 682 |
| Townsend Gut, Me. | A-198..... | i, 28 | Tres Palacios B., Tex. | U-53..... | i, 735 |
| Bridges..... | | ii, 2238 | Tres Palacios R., Tex. | U-55..... | i, 735, 767 |
| Townsend Inlet, N. J. | I-24..... | i, 299 | Triangulation, Great Lakes. | | ii, 2041, 2124 |
| Wrecks..... | I-23-a..... | i, 304 | Trimble R., Wis. | KK-45..... | i, 1247 |
| | | ii, 2278 | Trinidad, Cal. | TT-131-a..... | i, 1568 |
| Towson, Fort, Ind. T. | | ii, 1803 | Trinidad H., Cal. | TT-187..... | i, 1556, 1571 |
| Towson Run, Md. | J-1045..... | i, 339 | Trinity R., Tex. | T-10..... | i, 717, 725 |
| Tozitna R., Alaska. | XX-221..... | i, 1657 | | U-2-b..... | i, 735 |
| Trace Br., Ky. | DD-90..... | i, 959 | | U-5-a..... | i, 736 |
| Trace Fork, W. Va. | DD-326..... | i, 961 | | U-13..... | i, 735, 739 |
| | EE-55..... | i, 983 | | U-12..... | i, 739 |
| Traceys Cr., Md.: | | | (See notes, ii, 2807.) | | |
| Bridges..... | | ii, 2238 | Appro..... | | ii, 2294, 2295 |
| Trade R., Wis. | KK-50..... | i, 1247 | Bridges..... | | ii, 2239 |
| Tradewater Bar. | (CC)..... | i, 911* | Trippe B., Md. | J-249..... | i, 333 |
| Trading Cove, Conn. | D-16..... | i, 141 | Trippe Cr., Md. | J-326..... | i, 333 |
| Tradewater R. | (CC)..... | i, 911* | Troops, Engineer. | | ii, 2039, 2058, 2059 |
| Tradewater R., Ky. | BB-6..... | i, 891 | Equipment..... | | ii, 2039, 2042 |
| Appro..... | | ii, 2296 | Noncommissioned officers..... | | ii, 2039, 2060 |
| Bridges..... | | ii, 2238 | Service in the field..... | | ii, 2039, 2050 |
| Trail Cr., Ind. | NN-24..... | i, 1349 | Troops; Instruction in Mining. | | ii, 1814 |
| Bridges..... | | ii, 2238 | Trotman Cr., N. C. | L-304..... | i, 413 |
| Train B., Mich. | LL-55..... | i, 1265 | Trotters Shoal, Ga.: | | |
| Transquaking R., Md. | J-140..... | i, 332 | (See notes, ii, 2798.) | | |
| Tranters Cr., N. C. | M-78..... | i, 454 | Troublesome Cr., Ky. | DD-154..... | i, 960 |
| Traps Cr., N. C. | M-291..... | i, 456 | | DD-4-a..... | i, 963 |
| Trap (The) | (CC)..... | i, 911* | Trough Cr., Pa. | J-886..... | i, 337 |
| (See notes, ii, 2810.) | | | Troups Cr., Ga. | O-425..... | i, 536 |
| Trask R., Oreg. | VV-64..... | i, 1593 | Troutberg (Troutburg), N. Y. (harbor of refuge). | RR-32-b..... | i, 1518 |
| Bridges..... | | ii, 2238 | Trout Cr., Colo. | GG-1095..... | i, 1033 |
| Traverse B., Mich. | OO-55-a..... | i, 1411 | | GG-1101..... | i, 1033 |
| Traverse Bayou, La. | S-124..... | i, 682 | (See notes, ii, 2820.) | | |
| Traverse City, Mich. | OO-56..... | i, 1377 | Trout Cr., Fla. | P-19..... | i, 569 |
| Traverse Cove, Md. | J-231..... | i, 332 | | P-76..... | i, 569 |
| Treadwells B., N. Y. | E-85..... | i, 177 | | P-123..... | i, 570 |
| Treadwells Isld. Cr., Mass. | B-62..... | i, 69 | Bridges..... | | ii, 2239 |
| Treasury Document No. 373, 1882: | | | Trout Cr., La. | T-2-n..... | i, 717 |
| Index checked with..... | | i, 13 | (See notes, ii, 2805.) | | |
| Tred Avon R., Md. | J-323..... | i, 333, 353 | Trout Cr., Mont. | GG-503..... | i, 1029 |
| Appro..... | | ii, 2291 | (See notes, ii, 2816.) | | |
| Tree Slough, Cal. | TT-85..... | i, 1555 | Trout Cr., Wyo. | GG-699..... | i, 1030 |
| Trempealeau | (HH)..... | i, 1079* | (See notes, ii, 2817.) | | |
| (See notes, ii, 2829.) | | | Trout Run, Pa. | J-745..... | i, 336 |
| Trempealeau R., Wis. | KK-27..... | i, 1247 | | J-792..... | i, 337 |
| Trent Hall Cr., Md. | K-28..... | i, 373 | | J-802..... | i, 337 |
| Trenton. | (HH)..... | i, 1079* | | (CC)..... | i, 911* |
| Trenton H., Mich. | PP-115..... | i, 1420 | Troy Cr., Va. | K-196..... | i, 374 |
| Trenton, N. J.: | | | Troy, N. Y.: | | |
| (See notes, ii, 2794.) | | | Harbor lines..... | | ii, 2253, 2261 |
| Harbor lines..... | | ii, 2261 | Troy, N. Y., Hudson R. | E-28-d..... | i, 196 |
| Trenton, N. J., Lalor St. | H-3-p..... | i, 287 | | | |
| Trenton, N. J., to mouth of Delaware R. | H-3-b..... | i, 273 | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Troy to New Baltimore: | | | Tuque Cr., Mo. | GG-11..... | i, 1025 |
| Harbor lines..... | | ii, 2261 | (See notes, ii, 2813.) | | |
| Trull Brook, Mass. | B-47..... | i, 69 | Turkey Br., Ga. | O-75..... | i, 533 |
| Trumbull, Fort. | ii, 1802, 1874 | | Turkey Br., Mo. | GG-148..... | i, 1026 |
| Tualatin (Tualitin) R., | | | Turkey Cr., Fla. | P-121..... | i, 570 |
| Oreg. | WW-32..... | i, 1615, 1646 | Turkey Cr., Ga. | O-312..... | i, 535 |
| (See notes, ii, 2841, 2844.) | | | Turkey Cr., Iowa. | GG-247..... | i, 1027 |
| Tubbys Cove, Md. | J-495..... | i, 334 | (See notes, ii, 2814.) | | |
| Tubmill Branch, Md. | J-285..... | i, 333 | Turkey Cr., Kans. | GG-1367..... | i, 1035 |
| Tuckahoe Cr., Md. | J-291..... | i, 352 | | GG-1377..... | i, 1035 |
| Appro. | ii, 2291 | | (See notes, ii, 2823.) | | |
| Tuckahoe R., Md. | J-291..... | i, 333, 352 | Turkey Cr., Ky. | DD-66..... | i, 959 |
| Tuckahoe R., N. J. | I-22..... | i, 299 | | DD-128..... | i, 960 |
| Tuckasegee R., N. C. | AA-102..... | i, 849 | | DD-243..... | i, 961 |
| (See notes, ii, 2809.) | | | Turkey Cr., La. | S-77..... | i, 681 |
| Tucker Beach, N. J.: | | | | S-594..... | i, 686 |
| Wrecks..... | | ii, 2278 | Turkey Cr., Mo. | GG-75..... | i, 1025 |
| Tucker Cr., W. Va. | EE-160..... | i, 984 | | GG-80..... | i, 1025 |
| Tuckers Cr., N. C. | M-190..... | i, 455 | | GG-160..... | i, 1026 |
| Tuckers Isld., N. J. | I-12..... | i, 299, 302 | | GG-1481..... | i, 1036 |
| Appro. | ii, 2290 | | | GG-1496..... | i, 1036 |
| Tuckerton Cr., N. J. | I-10..... | i, 299, 301 | | GG-1534..... | i, 1037 |
| Appro. | ii, 2290 | | (See notes, ii, 2814, 2823, | | |
| Tucuran, P. I. | YY-165..... | i, 1686 | 2824.) | | |
| Tufts Pt., N. J.: | | | Turkey Cr., Mo. and | | |
| Harbor lines..... | | ii, 2261 | Kans. | GG-1406..... | i, 1036 |
| Tugaloo R., Ga. | O-13..... | i, 533 | (See notes, ii, 2823.) | | |
| Tugaloo R., Ga. and S. C. | O-13..... | i, 547 | Turkey Cr., Nebr. | GG-1299..... | i, 1035 |
| Tugboats; list. | | ii, 2345 | (See notes, ii, 2822.) | | |
| Tug Fork, Ky. | DD-292..... | i, 961 | Turkey Cr., S. C. | N-81..... | i, 499 |
| Tug Fork, Ky., Big Sandy | | | | N-154..... | i, 500 |
| R. | DD-213-d..... | i, 973 | | N-188..... | i, 500 |
| Bridges..... | ii, 2239 | | Turkey Cr., Tenn. | AA-152..... | i, 849 |
| Tulare Valley, Cal. | UU-6-g..... | i, 1583 | | AA-230..... | i, 850 |
| Irrigation..... | ii, 2040, 2087 | | Turkey Isld. | (HH)..... | i, 1079* |
| Tullalah Cr., N. C. | AA-100..... | i, 849 | Turkey Quarter Cr., N. | | |
| Tull B., N. C. | L-248..... | i, 413 | C. | M-178..... | i, 455 |
| Tull Branch, Md. | J-129..... | i, 332 | Turkey Ridge Cr., S. Dak. | GG-299..... | i, 1027 |
| Tulle Cr., Mont. | GG-420..... | i, 1028 | (See notes, ii, 2814.) | | |
| (See notes, ii, 2815.) | | | Turkey R. | (HH)..... | i, 1079* |
| Tullifinny R., S. C. | N-283..... | i, 501 | Turkey R., Iowa. | JJ-61..... | i, 1234 |
| Tullocks Fork, Mont. | GG-704..... | i, 1030 | Turkey R., N. H. | B-33..... | i, 69 |
| (See notes, ii, 2817.) | | | Turley Cr., Tenn. | AA-126..... | i, 849 |
| Tulls Cr., N. C.: | | | Turnagain B., N. C. | M-219..... | i, 455 |
| Bridges..... | ii, 2239 | | Turnback Cr., Mo.: | | |
| Tullulah Co.: | | | (See notes, ii, 2824.) | | |
| (See notes, ii, 2809.) | | | Turn Bull B., Fla. | P-104..... | i, 570 |
| Tully | (HH)..... | i, 1079* | Turnbull Isld. | (HH)..... | i, 1079* |
| Tully Isld. | (HH)..... | i, 1079* | Turner Branch, Ky. | DD-97..... | i, 959 |
| Tulsa, Okla. | YY-2-c..... | i, 820 | Turner Cr., Md. | J-511..... | i, 335, 359 |
| Tuna B., P. I. | YY-161..... | i, 1686 | Turner Lake, Ga. | O-471..... | i, 536 |
| Tuna Cr., Pa. | FF-31..... | i, 1003 | Turners Bayou, La. | S-577..... | i, 686 |
| Tunica | (HH)..... | i, 1079* | Turners Cr., Ga. | O-81..... | i, 533 |
| Tunica Bayou, La. | S-291..... | i, 683 | (See notes, ii, 2798.) | | |
| Tunkhannock Cr., Pa. | J-630..... | i, 335 | Turners Cr., N. C. | M-254..... | i, 456 |
| Tunnel, Sutor; mining. | ii, 2040, 2090 | | Turners Cut, N. C. | L-270..... | i, 442, 513 |
| Tunnel, Wash ington | | | Wrecks..... | | ii, 2278 |
| Aqueduct, D. C. | ii, 2040, 2080 | | Turners Isld. | (HH)..... | i, 1079* |
| Tuolumne R., Cal. | UU-32..... | i, 1577, 1584 | Turtle Bayou. | U-5-a..... | i, 736 |
| Bridges..... | ii, 2239 | | Turtle Bayou, La. | S-139..... | i, 682 |
| Tuppers Cr., Mass. | B-175..... | i, 70 | Turtle Bayou, Tex. | U-11..... | i, 735, 739 |
| Tuque Cr. | (GG-2)..... | i, 1039* | Appro. | ii, 2295 | |

[See p. 2851 for ex-
planations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

3039

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|----------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Turtle Cove Chan., Tex. | U-68-b | i, 773 | Twin Cr. | (CC) | i, 911* |
| Appro. | | ii, 2295 | Twin Cr., Kans.: | | |
| Turtle Cr., Kans. | GG-1337 | i, 1035 | (See notes, ii, 2822.) | | |
| (See notes, ii, 2822.) | | | Twin Hollows | (HH) | i, 1079* |
| Turtle Cr., N. Dak. | GG-397 | i, 1028 | Twin Ponds, Md. | J-156 | i, 332 |
| (See notes, ii, 2815.) | | | Twin Rs., Wis.: | | |
| Turtle Cr., Pa. | J-843 | i, 337 | Harbor lines | | ii, 2261 |
| | FF-18 | i, 1003 | Twin Sloughs, Cal. | TT-100 | i, 1555 |
| Turtle Gut Inlet, N. J. | I-26 | i, 299 | Twin View Cr., Kans. | GG-1341 | i, 1035 |
| Turtle H., Fla. | P-179 | i, 570 | Twitch Cove, Md. | J-190 | i, 332 |
| Turtle Head Cove, Me. | A-134 | i, 28 | | J-190-a | i, 348 |
| Turtle Lake, La. | S-736 | i, 687 | Appro. | | ii, 2291 |
| Turtle R., Ga. | O-444 | i, 536 | Two Harbors, Minn. | LL-15 | i, 1265 |
| Turtle R., Minn. | KK-92 | i, 1248 | (See notes, ii, 2835.) | | |
| Turtle R., N. Dak. | KK-179 | i, 1248 | Two Islds., Minn. | LL-10 | i, 1265, 1268 |
| Turtle R., N. Dak., North | | | Two Medicine Cr., Mont. | GG-484 | i, 1028 |
| Fork | KK-180 | i, 1248 | (See notes, ii, 2816.) | | |
| Turtle R., N. Dak., South | | | Two Rs. (East), Minn. | KK-84 | i, 1248 |
| Fork | KK-181 | i, 1248 | Two Rs. H., Wis. | MM-28-a | i, 1324 |
| Turtle R., S. Dak. | GG-328 | i, 1027 | Appro. | | ii, 2298 |
| (See notes, ii, 2815.) | | | Harbor lines | | ii, 2261 |
| Turwar Cr., Cal. | TT-197 | i, 1556 | Navigation rules | | ii, 2041, 2108 |
| Tusawhochee Cr., Ga. | O-385 | i, 536 | Two Rs., Minn. | KK-121 | i, 1248 |
| Tuscarawa, Ohio. | DD-361 | i, 962 | | KK-205 | i, 1248 |
| Tuscarora Cr., N. Y. | J-669 | i, 336 | Two Rs., Minn., Middle | | |
| Tussaha Cr., Ga. | O-362 | i, 535 | Fork | KK-207 | i, 1249 |
| Tuttle Cr., Kans. | GG-1271 | i, 1035 | Two R., Minn., North | | |
| Twelvemile Bayou, La. | T-17 | i, 717 | Fork | KK-208 | i, 1249 |
| Twelvemile Cr., Cal. | TT-17-b | i, 1561 | Two Rs., Minn., South | | |
| Twelve-Mile Cr., La. | S-59 | i, 681 | Fork | KK-206 | i, 1249 |
| Twelve Mile Cr., Mont. | GG-434 | i, 1028 | Two Tall Cr., S. Dak. | GG-897 | i, 1032 |
| (See notes, ii, 2815.) | | | (See notes, ii, 2819.) | | |
| Twelve Mile Cr., N. Y. | RR-27 | i, 1493 | Tyaskin Cr., Md. | J-112 | i, 332, 347 |
| Twelve Mile Cr., S. C. | N-126 | i, 500 | Appro. | | ii, 2291 |
| | N-193 | i, 500 | Tybee Cr., Ga. | O-89 | i, 533 |
| Twelve Mile Cr., S. Dak. | GG-338 | i, 1027 | Tybee Isld., Ga.: | | |
| (See notes, ii, 2815.) | | | Forts | | ii, 1948 |
| Twelve Pole Bar | (CC) | i, 911* | Tybee R., Ga. | O-87 | i, 533 |
| Twelve-Pole Cr., W. Va. | EE-2 | i, 983 | Tygart Cr., W. Va. | EE-158 | i, 984 |
| Twelve Pole Cr., W. Va., | | | Tygarts Valley and West | | |
| East Fork | EE-6 | i, 983 | Fork Rs., W. Va. (junc- | | |
| Twelve-Pole R., W. Va. | EE-2 | i, 984 | tion of) | FF-10 | i, 1003 |
| Twenty-four Mile Cr., | | | Tygarts Valley R., W. Va. | FF-6-a | i, 1003 |
| Mont. | GG-475 | i, 1028 | | FF-12 | i, 1003, 1011 |
| (See notes, ii, 2816.) | | | Bridges | | ii, 2239 |
| Twentymile Cr., Pa. | RR-5-c | i, 1498 | Tygert Cr., Ky. | DD-211 | i, 960 |
| Twentymile Cr., W. Va. | EE-124 | i, 984 | Tyler Crossing | (HH) | i, 1079* |
| Twenty-seven Pass | (HH) | i, 1079* | (See notes, ii, 2832.) | | |
| Twenty Seven Pass, La. | S-208 | i, 682 | Tylers Cr., Md. | J-193 | i, 332 |
| Twin Bros | (CC) | i, 911* | Tyronza R., Ark. | Y-51 | i, 818 |
| Twin Butte Cr., Kans.: | | | | | |
| (See notes, ii, 2823.) | | | | | |

U.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| Uintah Mountains; ex- ploration..... | ii, 2040, 2090 | | Upper Devil Cr., Ky..... | DD-169..... | i, 960 |
| Umatilla Rapids..... | (WW-2)..... | i, 1618* | Upper Dips Cr., N. C..... | M-54..... | i, 454 |
| Umatilla R., Oreg..... | VV-82..... | i, 1593 | Upper Dowrey Cr., N. C..... | M-56..... | i, 454 |
| Umbagog Lake, Me..... | A-234..... | i, 29 | Upper Goose Cr., N. C..... | M-73..... | i, 454 |
| Umbrella Cr., Ga..... | O-460..... | i, 536 | Upper Hell Gate, Me..... | A-222..... | i, 28 |
| Umpqua R., Oreg..... | VV-30..... | i, 1593, 1603 | Upper Jerry Run, Pa..... | J-795..... | i, 337 |
| | VV-32..... | i, 1593 | Upper Kaw Bend..... | (GG-2)..... | i, 1039* |
| Appro..... | ii, 2300 | | Upper Laurel Cr., Ky..... | DD-222..... | i, 960 |
| Uncles Neck Cr., Va..... | L-124..... | i, 412 | Upper Lighthouse Bayou, La..... | S-242..... | i, 683 |
| Ungalik R., Alaska..... | XX-241..... | i, 1657 | Upper Machodoc Cr., Va..... | K-111..... | i, 374, 394 |
| Unicorn Branch, Md..... | J-450..... | i, 334 | Appro..... | ii, 2291 | |
| Union Point..... | (HH)..... | i, 1079* | Upper Mississippi R. sys- tem..... | i, 777 | |
| Union R. B., Me..... | A-62..... | i, 27 | Upper Moose Cr., Pa..... | J-804..... | i, 337 |
| Union R., Me..... | A-63..... | i, 27, 36 | Upper Mud Lake, La..... | S-748..... | i, 687 |
| Appro..... | ii, 2287 | | Upperpore Cr., Pa..... | J-836..... | i, 337 |
| Union R., Wash..... | XX-56..... | i, 1655 | Upper Sevenmile Cr., Mont.: (See notes, ii, 2817.) | | |
| Uniontown, Ky..... | (CC)..... | i, 911* | Upper Sinepuxent R., In- dian R., and Isle of Wight B., Md. (connec- tion of)..... | I-81-c..... | i, 328 |
| United States: Waterway improvement by other than..... | ii, 2041, 2109 | | Upper Sisters Cr., Fla..... | O-522..... | i, 537 |
| United States Engineer Offices: Locations..... | ii, 2782 | | Upper Spring Cr., N. C..... | M-117..... | i, 455 |
| United States Lake Sur- vey (see Surveys): Appro..... | ii, 2286 | | Upper Teges Cr., Ky..... | DD-32..... | i, 959 |
| Unolalik R., Alaska..... | XX-240..... | i, 1657 | Upper Thoroughfare, Md..... | J-79..... | i, 343 |
| Unnamed, Ga..... | O-34..... | i, 533 | Upper Three Runs..... | O-7..... | i, 533 |
| Upper Atchafalaya R., La..... | S-544..... | i, 686 | Upper Tree Run, Pa..... | J-798..... | i, 337 |
| Upper Broad Cr., N. C..... | M-167..... | i, 455 | Upper Twin Cr., Ky..... | DD-101..... | i, 959 |
| Upper Chain..... | (HH)..... | i, 1079* | Uptons Cr., Ga..... | O-44..... | i, 533 |
| Upper Chloe, Ky..... | DD-282..... | i, 961 | | O-47..... | i, 533 |
| Upper Clear Cr., Nebr.: (See notes, ii, 2820.) | | | Urbana Cr., Va..... | K-227..... | i, 374, 401 |
| Upper Crossing Isld..... | (HH)..... | i, 1079* | Appro..... | ii, 2291 | |
| Upper Deer Cr., Mont..... | GG-667..... | i, 1030 | Harbor lines..... | ii, 2261 | |
| (See notes, ii, 2817.) | | | Wrecks..... | ii, 2278 | |
| | | | Usk..... | (WW-2)..... | i, 1618* |
| | | | Ussal Cr., Cal..... | TT-154..... | i, 1556 |
| | | | Utah; explorations..... | ii, 2040, 2090 | |

V.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| Vacherle Bayou, La. | S-329..... | i, 683 | Vermilion B., La., etc. (In- land waterway, Donald- sonville, La., to Rio Grande, Tex., via) | S-696-a..... | i, 709 |
| | S-396..... | i, 684 | Vermilion Bayou, La. | S-696..... | i, 708 |
| Valdez, Alaska: | | | Bridges..... | ii, 2145, 2241 | |
| Roads..... | ii, 2041, 2117 | | Wrecks..... | ii, 2278 | |
| Valentine Bayou, La. | S-591..... | i, 686 | Vermilion Bayou, R., and Passes, La.: | | |
| Valentine Cr., Md. | J-1225..... | i, 340 | Appro..... | ii, 2294 | |
| Vallejo, Cal.: | | | Vermilion Cr., Kans.: | | |
| Harbor lines..... | ii, 2261 | | (See notes, ii, 2821.) | | |
| Valley Cr., Ala. | R-27..... | i, 646 | Vermilion H., Ohio. | QQ-20..... | i, 1461, 1472 |
| Valley Cr. (canal to con- nect Black Warrior R. and Five-Mile Cr., Ala., via) | R-23-o..... | i, 662 | Appro..... | ii, 2299 | |
| Valley Cr., Mont. | GG-656..... | i, 1030 | Vermilion Pass | S-716..... | i, 687 |
| (See notes, ii, 2817.) | | | Vermilion Passes, La. | S-696..... | i, 708 |
| Valley Run, Pa. | J-876..... | i, 337 | Vermilion R. | (HH)..... | i, 1080* |
| Vanada Reef | (CC)..... | i, 911* | Vermilion R., Ill. | JJ-6..... | i, 1234 |
| Van Buren, Ark. | Y-2-c..... | i, 820 | | NN-4..... | i, 1349 |
| Vanburen H., N. Y. | RR-7-b..... | i, 1498 | Vermilion R., Ind. and Ill. | BB-34..... | i, 891 |
| Vancouver | (WW-2)..... | i, 1618* | Vermilion R., Kans.: | | |
| Vancouver Barracks: | | | (See notes, ii, 2821.) | | |
| Engineer Depot..... | ii, 2039, 2046 | | Vermilion R., La. | S-720..... | i, 687 |
| Vancouver, Wash.: | | | | S-696..... | i, 708 |
| (See notes, ii, 2843.) | | | Bridges..... | ii, 2241 | |
| Harbor lines..... | ii, 2261 | | Vermilion R., Minn. | JJ-25..... | i, 1234 |
| Van Cr., Ga. | O-28..... | i, 533 | | KK-96..... | i, 1248 |
| Vandemere Cr., N. C. | M-134..... | i, 455 | | KK-228..... | i, 1249 |
| Van Dyke Cr., Ga. | O-185..... | i, 534 | (See notes, ii, 2834.) | | |
| Van Horn Cr., Mont.: | | | Vermilion R., Ohio. | QQ-21..... | i, 1461 |
| (See notes, ii, 2817.) | | | Bridges..... | ii, 2241 | |
| Van Horn or Pease Cr., Mont. | GG-648..... | i, 1030 | Vermilion | GG-2..... | i, 1039* |
| Van Wies Pt., N. Y.: | | | (See notes, ii, 2824, 2826.) | | |
| Harbor lines..... | ii, 2261 | | Vermilion R., Kans. | GG-1242..... | i, 1034 |
| Vassar Cr., Kans. | GG-1387..... | i, 1036 | Vermilion R., S. Dak. | GG-293..... | i, 1027 |
| (See notes, ii, 2823.) | | | (See notes, ii, 2814.) | | |
| Vauchuse | (HH)..... | i, 1080* | Vernon to mouth of Holmes R., Fla. | QQ-33-c..... | i, 627 |
| Vaughn Cr., La. | S-261..... | i, 683 | Vernon R., Ga. | O-108..... | i, 533 |
| Velasco H., Tex. | U-2-b..... | i, 735 | Veret Bayou, La. | S-371..... | i, 684 |
| Velasco, Tex.: | | | Verrette Bayou, La. | S-390..... | i, 684 |
| Appro..... | ii, 2295 | | Vessels of the U. S., List of Merchant: | | |
| Velasco to Old Washing- ton (Brazos R., Tex.) | U-40-c..... | i, 763 | Index, checking..... | i, 13 | |
| Velvet Rock Branch, Md. | J-938..... | i, 338 | Vicksburg | (HH)..... | i, 1080* |
| Venice | (HH)..... | i, 1080* | (See notes, ii, 2830.) | | |
| Verde Passage, P. I. | YY-99..... | i, 1686 | Vicksburg, Miss. | i, 779 | |
| Verdigris R., Nebr. | GG-932..... | i, 1032 | Vicksburg, Miss., district. | X..... | i, 783, 785 |
| (See notes, ii, 2819.) | | | (See notes, ii, 2807.) | | |
| Verdigris R., Okla. and Ark. | Y-12..... | i, 825 | Appro..... | ii, 2295 | |
| Verdigris R., Okla. and Kans. | Y-12..... | i, 818 | Vicksburg, Miss., district, 3d M. R. C. | W..... | i, 781 |
| Vermilion B., La. | S-696..... | i, 687 | Vicksburg, Miss.: | | |
| | S-716..... | i, 687 | Navigation rules..... | ii, 2041, 2108 | |
| (See notes, ii, 2804.) | | | | | |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| Victoria-Woodward Canal, Tex. | UU-23 | i, 1577 | Vincennes, Ind. | BB-23 | i, 898 |
| Victory | (HH) | i, 1080* | Vincent Bayou, La. | S-10 | i, 681 |
| Vidal Bayou, La. | X-30-c | i, 807 | Vincent Cove, Mass. | B-84 | i, 69 |
| Appro | | ii, 2295 | Vineyard Haven H., Mass. | C-27 | i, 107, 112 |
| Vidalia | (HH) | i, 1080* | Appro | | ii, 2288 |
| Views, constructions, engineer | | i, 13; ii, 2625 | Wrecks | | ii, 2278 |
| Village Cr., Ala. | R-29 | i, 646 | Vineyard Sound, Mass. | C-23 | i, 107 |
| Village Cr., Ga. | O-435 | i, 536 | | C-2 | i, 107, 108 |
| Village Cr., N. C. | M-176 | i, 455 | (See notes, ii, 2786.) | | |
| Villars Bayou, La. | S-363 | i, 684 | Wrecks | | ii, 2278 |
| Village Cr., Tex.: | | | Vinton Canal, La. | T-2-g | i, 717 |
| (See notes, ii, 2806.) | | | (See notes, ii, 2805.) | | |
| Vinalhaven, Me. | A-116 | i, 28, 40 | Virginia: | | |
| Vincent Bayou, La.: | | | Forts | | ii, 1808, 1816 |
| Bridges | | ii, 2241 | Virgin R., Nev., Ariz., and Utah | SS-8 | i, 1543 |
| Vines Bayou, Tex. | U-24 | i, 735 | Vistula (The) | (HH) | i, 1080* |
| Vincennes (above), Wabash R., Ind. and Ill. | BB-23-c | i, 901 | Vixen Chute | (HH) | i, 1080* |
| Vincennes (below), Wabash R., Ill. and Ind. | BB-23-b | i, 900 | Volga R. (Russia) | (CC) | i, 911* |
| | | | Volusia Bar (St. Johns R., Fla.) | P-10-f | i, 581 |

W.

| | | | | | |
|---|---------|----------------|--|---------|----------------|
| Waackack Cr., N. J. | G-45 | i, 247 | Waccamaw R. to Cape Fear R., N. C. (waterway) | M-305-f | i, 490 |
| Wabasha | (HH) | i, 1080* | Wachapreague Inlet, Va. | L-7 | i, 411 |
| Wabash and Erie Canal, Ind. and Ohio | QQ-5 | i, 1461 | Wrecks | | ii, 2278 |
| | QQ-5-a | i, 1465 | Wacilla R., Ala. | Q-5 | i, 611 |
| Appro | | ii, 2299 | Wacissa R., Fla. | Q-6 | i, 611 |
| Wabash and White Rs., Ind.: | | | (See notes, ii, 2800.) | | |
| Bridges | | ii, 2242 | Waco to Old Washington, Brazos R., Tex. | U-40-e | i, 764 |
| Wabash R., Ill. and Ind. | BB-23 | i, 898 | Wacouta (HH): | | |
| | BB-23-a | i, 898 | (See notes, ii, 2829, 2834.) | | |
| (See notes, ii, 2810, 2837.) | | | Wacouta, Minn.: | | |
| Appro | | ii, 2296 | (See notes, ii, 2834.) | | |
| Bridges | | ii, 2242 | Waddington H., N. Y. | RR-73 | i, 1493, 1537 |
| Navigation rules | | ii, 2041, 2108 | Appro | | ii, 2299 |
| Wabash R., Ill., Ind., and Ohio | BB-23 | i, 891 | Wading R., N. J. | T-15 | i, 299, 302 |
| Wabash R., Ind. | (CC) | i, 911* | Wading R., N. Y. | F-25 | i, 215 |
| Wabash R., Ind. and Ohio, to Lake Michigan | NN-24 | i, 1371 | Wadmelaw R., S. C. | N-218 | i, 500 |
| (See notes, ii, 2837.) | | | Wadsworth, Fort, N. Y. | | ii, 1807, 1881 |
| Wabash R., Lake Erie to; Canal. | QQ-5-c | i, 1465 | Wagners Landing | (HH) | i, 1080* |
| Wacasassa B., Fla. | P-347 | i, 571 | Wagon Hound Cr., Wyo. | GG-1066 | i, 1033 |
| Wacasassa R., Fla. | P-348 | i, 571 | (See notes, ii, 2820.) | | |
| Waccamaw Cr., S. C. | N-14 | i, 499 | Wahoo Cr., Nebr. | GG-1116 | i, 1033 |
| Waccamaw R., N. C. and S. C. | N-5 | i, 499, 503 | (See notes, ii, 2820.) | | |
| Appro | | ii, 2292 | Wahoo R., Ga. | O-195 | i, 534 |
| Bridges | | ii, 2242 | Walakea Landing, Hawaii | YY-74 | i, 1686 |
| | | | Walalua B., Hawaii: | | |
| | | | (See notes, ii, 2846.) | | |
| | | | Walalua H., Hawaii | YY-48 | i, 1685 |
| | | | Walanae H., Hawaii | YY-47 | i, 1685 |

[See p. 2851 for explanations, etc.]

GENERAL FINDING LIST, VOLS. I AND II.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-----------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Walkane H., Hawaii | YY-41..... | i, 1685 | Wallcut R., Wash. | WW-71..... | i, 1615 |
| Waimanalo B., Hawaii: | | | Dams, private..... | | ii, 2250 |
| (See notes, ii, 2846.) | | | Wallis Run, Pa. | J-739..... | i, 336 |
| Waimanalo H., Hawaii | YY-43..... | i, 1685 | Walls Cut, S. C. | O-4..... | i, 533 |
| Waimea B., Hawaii: | | | Wallula. | (WW-2)..... | i, 1618* |
| (See notes, ii, 2846.) | | | Walluski R., Oreg.: | | |
| Waimea, Hawaii | YY-36..... | i, 1685 | Bridges..... | | ii, 2242 |
| Waimea R., Hawaii: | | | Walnut Bend. | (HH)..... | i, 1080* |
| (See notes, ii, 2846.) | | | Walnut Cr., Ga. | O-349..... | i, 535 |
| Waipio H., Hawaii: | | | Walnut Cr., Iowa: | | |
| (See notes, ii, 2846.) | | | (See notes, ii, 2814.) | | |
| Waiska B., Hawaii: | | | Walnut Cr., Kans. | GG-1164..... | i, 1034 |
| Wrecks..... | | ii, 2278 | | GG-1194..... | i, 1034 |
| Waiska R., Mich. | PP-4..... | i, 1419 | | GG-1211..... | i, 1034 |
| Wakarusa Cr., Kans.: | | | | GG-1235..... | i, 1034 |
| (See notes, ii, 2823.) | | | | GG-1269..... | i, 1035 |
| Wakatomika Cr., Ohio | DD-419..... | i, 962 | (See notes, ii, 2821, 2822.) | | |
| Wakenda Cr., Mo. | GG-154..... | i, 1026 | Walnut Cr., Mo. | GG-1476..... | i, 1036 |
| (See notes, ii, 2814.) | | | | GG-1485..... | i, 1036 |
| Waketichie R., Wash. | XX-51..... | i, 1655 | Walnut Cr., Nebr. | GG-1123..... | i, 1033 |
| Wakruska Cr., Kans. | GG-1394..... | i, 1036 | (See notes, ii, 2821.) | | |
| Walalua B., Hawaii: | | | Walnut Cr., Nebr. and | | |
| (See notes, ii, 2846.) | | | Kans. | GG-1146..... | i, 1034 |
| Walburg Cr., Ga. | O-188..... | i, 534 | Walnut Cr., Ohio | DD-390..... | i, 962 |
| Walcott Cr., Pa. | J-683..... | i, 336 | | DD-453..... | i, 962 |
| Waldeck. | (HH)..... | i, 1080* | Walnut Cr., Pa. | RR-3..... | i, 1493 |
| Walhonding R., Ohio. | DD-395..... | i, 962 | Walnut Fork, Ga. | O-290..... | i, 535 |
| Walker Bar. | (CC)..... | i, 911* | Walnut R., Ga. | O-67..... | i, 533 |
| Walker Bayou, La. | T-2-cc..... | i, 717 | Walnut R., Nebr. | GG-1297..... | i, 1035 |
| (See notes, ii, 2805.) | | | Walts Cove, Md. | J-1174..... | i, 339 |
| Walker Cr., Ga. | O-372..... | i, 535 | Waluski R., Oreg. | WW-8..... | i, 1615 |
| Walker Cr., Ky. | DD-172..... | i, 960 | Wambraw Cr., S. C. | N-199..... | i, 500 |
| Walker Cr., Va. | EE-86..... | i, 983 | Wando R., S. C. | N-208..... | i, 500 |
| Walker Cr., W. Va. | EE-184..... | i, 984 | | N-197..... | i, 518 |
| Walker Run, Md. and | | | Wands Pt., Oreg.: | | |
| Pa. | J-1016..... | i, 338 | Harborlines..... | | ii, 2261 |
| Walkers Br., Miss., to Co- | | | Wankinco R., Mass. | C-46..... | i, 107 |
| lumbus, Tombigbee R. | R-23-h..... | i, 657 | Wann Cove, Md. | J-167..... | i, 334 |
| Walkers Br. to Fulton, | | | Wann Cr., Tenn. | AA-82..... | i, 848 |
| Miss., Tombigbee R. | R-23-i..... | i, 657 | Wans-wau-golsing B., | | |
| Walkers Canal, La. | S-125..... | i, 682 | Minn. (harbor of ref- | | |
| Walkers Isld. | (WW-2)..... | i, 1618* | uge). (See Waus-wau- | | |
| Walker Slough, Cal. | UU-35..... | i, 1577 | golsing.) | LL-5..... | i, 1265 |
| Wallabout Chan., New | | | Waples Cut. | (HH)..... | i, 1080* |
| York H., N. Y. | F-105-m..... | i, 241 | Wappasening Cr., Pa. and | | |
| Wallace Bayou, La. | S-571..... | i, 686 | N. Y. | J-649..... | i, 336 |
| Wallace Cr., Md. | J-210..... | i, 332 | Wappinger Cr., N. Y. | E-40..... | i, 177 |
| Wallace Cr., N. C. | M-293..... | i, 456 | Wappingers Cr., N. Y. | E-40..... | i, 198 |
| Wallace Cr., S. C.: | | | Appro..... | | ii, 2289 |
| Bridges..... | | ii, 2242 | Bridges..... | | ii, 2242 |
| Wallace, Fort: | | | Wappoo Cut, S. C. | N-215..... | i, 500, 524 |
| Surveys, latitude and | | | Appro..... | | ii, 2292 |
| longitude..... | | ii, 2041, 2122 | Bridges..... | | ii, 2242 |
| Wallace Isld. Chan. | (WW-2)..... | i, 1618* | Wapsinicon R., Iowa. | JJ-64..... | i, 1234 |
| Wallace Isld Chan., Oreg. | WW-18..... | i, 1615 | Wapsinicon R. | (HH)..... | i, 1080* |
| Wallace Lake, La. | S-570..... | i, 686 | Waqua Cr., Va. | L-320..... | i, 413 |
| Wallapa B. to Columbia | | | Waquoit B., Mass. | C-15..... | i, 107 |
| R., Oreg. | XX-2-a..... | i, 1657 | War College, Army: | | |
| Walla Walla R., Oreg. and | | | Buildings..... | | ii, 2039, 2066 |
| Wash. | VV-83..... | i, 1593 | War Cr., Ky. | DD-111..... | i, 960 |
| Wall Cr., Fla. | P-335..... | i, 571 | Wardens Branch, Mo. | GG-45..... | i, 1025 |
| Walleys Leg, Ga. | O-423..... | i, 536 | War Department: | | |
| | | | Surveys..... | | ii, 2041, 2120 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|----------------------|
| Wards Cr., La. | S-104..... | i, 682 | Warsaw | (HH)..... | i, 1080* |
| Wards Cr., N. C. | M-251..... | i, 456 | Warsaw Cr., Ga. | O-104..... | i, 533 |
| Bridges..... | ..... | ii, 2242 | (See notes, ii, 2798.) | | |
| Wards Cr., Va. | L-155..... | i, 412 | Warsaw Sound, Ga. | O-86..... | i, 533 |
| Wards Isld., N. Y.: | | | (See notes, ii, 2798.) | | |
| Harbor lines..... | ..... | ii, 2261 | Warwick R., Md.: | | |
| Wards Pt.: | | | Appro..... | ..... | ii, 2291 |
| Harbor lines..... | ..... | ii, 2261 | Washakie, Fort: | | |
| Ware Cr., N. C. | M-265..... | i, 456 | Roads..... | ..... | ii, 2041, 2119 |
| Wareham H., Mass. | C-43..... | i, 107, 117 | Wartrace Cr., Tenn. | AA-296..... | i, 850 |
| (See notes, ii, 2786.) | | | Warwick Cr., N. C. | L-303..... | i, 413 |
| Appro..... | ..... | ii, 2288 | Warwick R., Md. | J-264..... | i, 333, 351 |
| Wareham R., Mass. | C-42..... | i, 107 | Warwick R., Va. | L-108..... | i, 412, 422 |
| Bridges..... | ..... | ii, 2242 | War Women, S. C. | O-17..... | i, 533 |
| Warehouse Cove, Va. | K-246..... | i, 375 | Washburn. | (GG-2)..... | i, 1039* |
| Warehouse Cr., Md. | J-405..... | i, 334 | Washburn, Wis. | LL-31..... | i, 1265 |
| ..... | J-1255..... | i, 340 | Washington. | (GG-2)..... | i, 1039* |
| Warehouse Cr., Va. | L-72..... | i, 411 | Washington (State), wa- | | |
| Ware R., Va. | K-284..... | i, 375, 404 | terway: | | |
| Wares Cr., Fla. | P-298..... | i, 571 | Harbor lines..... | ..... | ii, 2261 |
| War material: | | | Washington and Oregon | | |
| U. S. encouragement of | | | (dredging plant for)..... | VV-1-a..... | i, 1594 |
| private plants..... | ..... | ii, 1824 | Washington Aqueduct, | | |
| Warm Spring Cr., Mont. | GG-468..... | i, 1028 | D. C. .... | ..... | ii, 2040, 2077, 2080 |
| (See notes, ii, 2816.) | | | Bridges..... | ..... | ii, 2243 |
| Warm Springs Cr., Cal.: | | | Washington Bayou, Miss. | X-26..... | i, 785 |
| Bridges..... | ..... | ii, 2242 | ..... | X-25..... | i, 794 |
| Warners Bayou, Fla. | P-297..... | i, 571 | Appro..... | ..... | ii, 2295 |
| Warners Cr., La. | R-98-p..... | i, 647 | Washington, canal to, | | |
| Warners Cr., N. C. | M-64..... | i, 454 | D. C. and Va..... | K-46-h..... | i, 381 |
| Warren Cr., S. Dak. | GG-837..... | i, 1031 | Washington Cr., Kans. | GG-1399..... | i, 1036 |
| (See notes, ii, 2819.) | | | (See notes, ii, 2823.) | | |
| Warren, Fort, Mass...... | ..... | ii, 1805, 1855 | Washington Cr., Md. | K-29..... | i, 373 |
| Warren, Pa. | FF-20..... | i, 1015 | Washington, D. C. | K-46-k..... | i, 382 |
| Warren R., R. I. | C-80..... | i, 107, 125 | (HH)..... | ..... | i, 1080* |
| Appro..... | ..... | ii, 2288 | Barracks..... | ..... | ii, 2039, 2046, 2057 |
| Bridges..... | ..... | ii, 2242 | Bridges..... | ..... | ii, 2039, 2060, 2242 |
| Warrens Cove, Mass. | B-171..... | i, 70 | Buildings..... | ..... | ii, 2039, 2065 |
| Warrens Cr. | (WW-2)..... | i, 1618* | Forts..... | ..... | ii, 1796, 1802, 1921 |
| Warrens Cr., Oreg. | WW-12..... | i, 1615 | Harbor lines..... | ..... | ii, 2261 |
| Warren Spring Cr., Mont. | GG-564..... | i, 1029 | Wharves..... | ..... | ii, 2040, 2086 |
| Warrenton. | (HH)..... | i, 1080* | Wrecks..... | ..... | ii, 2278 |
| Warrenton, Miss. | V..... | i, 779 | Washington, D. C. (be- | | |
| ..... | W..... | i, 781 | low)..... | K-46-b..... | i, 378 |
| Warren to Thomaston, | | | Washington, D. C., dis- | | |
| St. Georges R., Me..... | A-155..... | i, 45 | trict..... | K..... | i, 371 |
| Warrior Cr., Fla. | Q-2..... | i, 611 | (See notes, ii, 2795.) | | |
| Warrior R., Ala. | R-24..... | i, 646 | Appro..... | ..... | ii, 2291 |
| ..... | R-23-j..... | i, 658 | Washington, Fort, Md...... | ..... | ii, 1804, 1921 |
| Warrior R., Ala. and | | | Washington H., D. C. | K-46-i..... | i, 385 |
| Miss..... | R-23..... | i, 651 | Washington H., Mich. | LL-65..... | i, 1265 |
| (See notes, ii, 2803.) | | | Washington H., N. C. | M-66-d..... | i, 463 |
| Appro..... | ..... | ii, 2294 | Harbor lines..... | ..... | ii, 2261 |
| Bridges..... | ..... | ii, 2242 | Washington, Mo. | (GG-2)..... | i, 1037* |
| Navigation rules..... | ..... | ii, 2041, 2108 | Washington Monument, | | |
| Wrecks..... | ..... | ii, 2278 | D. C. .... | ..... | ii, 2040, 2070 |
| Warrior R.; Canal from | | | Washington, N. C. (above), | | |
| Birmingham, Ala., to... R-23-n..... | ..... | i, 662 | Tar R..... | M-66..... | i, 454 |
| Warrior Rock. | (WW-2)..... | i, 1618* | Washington Park, N. J.: | | |
| Warrior Run, Pa. | J-718..... | i, 336 | Wrecks..... | ..... | ii, 2278 |
| Warroad H. and R., Minn. | KK-211..... | i, 1249, 1261 | Washington Slough, Cal. | UU-13..... | i, 1577 |
| (See notes, ii, 2835.) | | | Washington, State of: | | |
| Appro..... | ..... | ii, 2297 | Defenses..... | ..... | ii, 1809 |
| | | | Dredging plant..... | ..... | ii, 2300 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--------------------------------------|-----------------------------|---------------------|-----------------------------------|---------------------|-------------------|
| Washita R., Okla. | T-15..... | i, 717, 728 | Watts Cr., Md. | J-281..... | i, 333 |
| Washley Cr., La. | S-33..... | i, 681 | Watts Cr., Va. | L-106..... | i, 412 |
| Washougal R., Wash. | VV-101..... | i, 1594 | Wattuski R., Oreg.: | | |
| Wasp Cr., Nebr. | GG-1296..... | i, 1035 | Bridges..... | | ii, 2243 |
| Wassaw Cr., Ga.: | | | Wauhanna R., Oreg. | VV-74..... | i, 1593 |
| (See notes, ii, 2798.) | | | Waukegan H., Ill. | MM-39..... | i, 1297, 1343 |
| Wassaw Sound, Ga.: | | | Appro..... | | ii, 2298 |
| (See notes, ii, 2798.) | | | Harbor lines..... | | ii, 2261 |
| Forts..... | | ii, 1948 | Navigation rules..... | | ii, 2041, 2108 |
| Waste House Bayou, La. | R-98-aa..... | i, 647 | Waukulla R., Fla. | Q-11..... | i, 611, 612 |
| Watab R., Minn. | KK-124..... | i, 1248 | (See notes, ii, 2800.) | | |
| Watauga R., Tenn. and | | | Waumandee R., Wis. | KK-28..... | i, 1247 |
| N. C. | AA-133..... | i, 849 | Waupaca R., Wis. | MM-19..... | i, 1297, 1315 |
| Watch Hill Cove, R. I. | C-105..... | i, 137 | Waupeton | (HH)..... | i, 1080* |
| Watch Hill, R. I. | C-105..... | i, 108 | (See notes, ii, 2828.) | | |
| Wrecks..... | | ii, 2278 | Waus-wau-goïning B., | | |
| Water Cr., La. | S-37..... | i, 681 | Minn..... | LL-4..... | i, 1265 |
| Water Cr., Mont. | GG-451..... | i, 1028 | (See notes, ii, 2835.) | | |
| Wateree Cr., S. C. | N-136..... | i, 500 | Waus-wau-goïning (see | | |
| Wateree R., S. C. | N-113..... | i, 500, 513 | Waus-wau-goïning B., | | |
| Appro..... | N-120..... | i, 500 | Minn.)..... | | |
| Bridges..... | | ii, 2292 | Wave Action (effect of), | | |
| Waterford | (W W-2)..... | i, 1618* | Lake Michigan, Mich. | | |
| Waterford, N. Y. | E-53..... | i, 177 | and Wis..... | OO-1-b..... | i, 1378 |
| Waterhole Cove, Md. | J-351..... | i, 333 | Waverly Bend | (GG-2)..... | i, 1039* |
| Waterholes Cr., S. Dak. | GG-903..... | i, 1032 | Waverly Cr., S. C. | N-6..... | i, 499, 504 |
| Watermans Cove, Me. | A-127..... | i, 28 | Wave Rock | (CC)..... | i, 911* |
| Water Power | | ii, 2041, 2115 | Waxhaw Cr., S. C. | N-125..... | i, 500 |
| Waterproof | (HH)..... | i, 1080* | Waxla Bayou, La. | S-587..... | i, 686 |
| Water R., Mass. | B-97..... | i, 81 | Wax Lake, La. | S-665..... | i, 687 |
| Water Run, Mo. | GG-18..... | i, 1025 | Wax Pass, La. | S-664..... | i, 686 |
| Waters Cr., Md. | J-1267..... | i, 340 | Wayne City | (GG-2)..... | i, 1039* |
| Watersheds | | ii, 2287 | Wayne City Bend (GG): | | |
| Waters, Navigable (see | | | (See notes, ii, 2825.) | | |
| Waterways; Rivers; | | | Wayne, Fort, Mich | | ii, 1805, 1992 |
| Harbors): | | | Weakfish Cr., N. J.: | | |
| Bridging (see Bridges)..... | | ii, 2203 | Bridges..... | | ii, 2243 |
| Porto Rico..... | | ii, 2041, 2115 | Weasel Brook, N. J. | G-18..... | i, 247 |
| Waters Pt. | (HH)..... | i, 1080* | Weasel Cr., Nebr. | GG-919..... | i, 1032 |
| Waters R., Mass. | B-97..... | i, 69 | (See notes, ii, 2819.) | | |
| (See notes, ii, 2784.) | | | Webbers Falls, Okla. | Y-2-c..... | i, 820 |
| Water Supply, D. C. | ii, 2040, 2077, 2080, 2081, | | Webbs Bayou, La. | S-84..... | i, 682 |
| 2082, 2083, 2084, 2085 | | | Webbs Cove, Me. | A-86..... | i, 27 |
| Watertown, Mississlppi | | | Webhannet, Me. | A-277-a..... | i, 59 |
| R. (Hennepin Canal), | | | Webhannet R. (Wells H.), | | |
| Illinois R. to..... | JJ-20-b..... | i, 1236 | Me..... | A-277..... | i, 29 |
| Waterways: | | | Websters Cr., Kans. | GG-1215..... | i, 1034 |
| Appro. by districts, etc..... | | ii, 2287 | Websters Cr., N. C. | L-256..... | i, 413 |
| Arrangement in groups..... | | ii, 2782 | Weehawken Cove: | | |
| (See notes, ii, 2782.) | | | Harbor lines..... | | ii, 2261 |
| Listing of..... | | i, 11, 19; ii, 2782 | Weehawken, N. J. | E-28-c..... | i, 195 |
| Numbering..... | | i, 20 | Weeks B., Ala. | R-9..... | i, 646 |
| Waterways, Deep | | ii, 2041, 2124 | Weeks B., La. | S-699..... | i, 687 |
| Waterways, Intracoastal | | ii, 2041, 2116 | Weeks Bayou, La. | S-700..... | i, 687 |
| Appro..... | | ii, 2287 | Weeks Canal, La. | S-704..... | i, 687 |
| (See notes, ii, 2804.) | | | (See notes, ii, 2804.) | | |
| Waterways, Navigable (see | | | Weeks Cr., Va. | K-223..... | i, 374 |
| Dams, Bridges)..... | | ii, 2041, 2109 | Weems Cr., Md. | J-1235..... | i, 340 |
| Watson Cr., Md. | J-977..... | i, 338 | Weems, Va.: | | |
| Watt Cr., Tenn. | AA-81..... | i, 848 | Harbor lines..... | | ii, 2261 |
| Watts Bayou, Tex.: | | | Weepectet Rock, Buz- | | |
| (See notes, ii, 2806.) | | | zards B., Mass..... | C-34..... | i, 116 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------|---------------------|-------------------|----------------------------------|---------------------|-------------------|
| Weeping Water Cr., Nebr. | GG-1120 | i, 1033 | West Branch, N. Dak. | GG-395 | i, 1028 |
| (See notes, ii, 2821.) | | | (See notes, ii, 2815.) | | |
| Wee Tee Lake, Williams- | | | West Branch, Ohio | DD-436 | i, 962 |
| burg Co., S. C. | N-101-b | i, 513 | West Branch, Pa. | J-562 | i, 335 |
| Wegner Cr., Mont. | GG-540 | i, 1029 | | J-577 | i, 335 |
| (See notes, ii, 2816.) | | | | J-638 | i, 335 |
| Weikva R., Fla. | P-60 | i, 583 | | J-709 | i, 336 |
| Weikwa R., Fla. | P-60 | i, 583 | | J-715 | i, 336 |
| Weir R., Mass. | B-146 | i, 70, 95 | | J-761 | i, 336 |
| (See notes, ii, 2785.) | | | | J-915 | i, 338 |
| Weirs | | ii, 2041, 2109 | West Branch, Va. | K-319 | i, 375 |
| Weiser R., Idaho | VV-91 | i, 1594 | Westbrook H., Conn. | D-24 | i, 141 |
| Wekewoochee R., Fla. | P-334 | i, 571 | (See notes, ii, 2788.) | | |
| Wekiva R., Fla. | P-346 | i, 571 | Appro | | ii, 2289 |
| | P-60 | i, 569 | Westbrook H., Conn. | | |
| (See notes, ii, 2799.) | | | (near Connecticut R. | | |
| Bridges | | ii, 2147 | mouth) | D-24 | i, 153 |
| Wekiwachee R., Fla. | P-332 | i, 571 | Westchester Cr., N. Y. | E-19 | i, 177, 187 |
| Welches Cr., S. C. | N-245c | i, 501 | Appro | | ii, 2289 |
| Weldon R., Iowa and | | | Westchester, N. Y.: | | |
| Mo.: | | | Harbor lines | | ii, 2261 |
| (See notes, ii, 2813.) | | | West Colyell Bayou, La. | S-66 | i, 681 |
| Welles H., Midway Isld. | YY-85-b | i, 1691 | West Cote Blanche B., | | |
| Wellfleet H., Mass. | B-203 | i, 70, 100 | La. | S-679 | i, 687 |
| Appro | | ii, 2288 | Westcott Cove, Conn. | D-89 | i, 141 |
| Wellridge Cr., Md. | J-189 | i, 332 | West Cr., Md. | J-48 | i, 331 |
| Wells Cr. | (CC) | i, 911* | West Cr., Mass. | B-58 | i, 69 |
| Wells Cr., Kans. | GG-1375 | i, 1035 | West Cr., N. Y.: | | |
| (See notes, ii, 2823.) | | | Harbor lines | | ii, 2261 |
| Wells Cr., Mass. | B-188 | i, 70 | West Cr., Pa. | J-710 | i, 336 |
| Wells Cr., Minn. | JJ-36 | i, 1234 | | J-786 | i, 337 |
| Wells Cr., Miss. | S-285 | i, 683 | Western Branch, Lynn- | | |
| Wells Cr., N. C. | L-224 | i, 413 | haven R., Va. | L-210 | i, 412 |
| Wells Cr., Tenn. | AA-244 | i, 850 | Western Branch, Me. | A-169 | i, 28 |
| Wells H., Me. | A-277 | i, 29 | | A-183 | i, 28 |
| | A-277-a | i, 59 | Western Branch, Md. | K-23 | i, 373 |
| Appro | | ii, 2288 | Western Branch, Va. | K-180 | i, 374 |
| Wells Slough, Cal. | TT-98 | i, 1555 | | L-166 | i, 412 |
| Wells Spring, Ga. | O-314 | i, 535 | | L-174 | i, 412 |
| Welshmans Cr., Md.: | | | Western Division, Engi- | | |
| Bridges | | ii, 2179, 2243 | neer Department. | | ii, 2039, 2046 |
| Wenatchee | (WW-2) | i, 1618* | Western rivers | (CC) | i, 911* |
| (See notes, ii, 2843.) | | | (HH) | | i, 1080* |
| Wenatchee R., Wash. | XX-119 | i, 1656 | Western Run, Md. | J-1030 | i, 338 |
| Wepowage R., Conn. | D-63 | i, 141 | Westfield R., Conn. | D-33 | i, 141 |
| Wequetequock R., Conn. | D-3 | i, 141 | West Firesteel Cr., S. | | |
| (See notes, ii, 2788.) | | | Dak. | GG-336 | i, 1027 |
| West Bassetts Cr., Ala. | R-41 | i, 646 | (See notes, ii, 2815.) | | |
| West B., La. | S-304 | i, 683 | West Fork and Tygarts | | |
| West B., Tex.: | | | Valley Rs., W. Va. (junc- | | |
| Bridges | | ii, 2243 | tion of) | FF-10 | i, 1003 |
| West Bow Cr., Nebr. | GG-938 | i, 1032 | West Fork, Big Cr., Mo.: | | |
| (See notes, ii, 2819.) | | | (See notes, ii, 2813, 2814.) | | |
| West Branch, Iowa: | | | West Fork, Dry Wood Cr., | | |
| (See notes, ii, 2814.) | | | Mo. and Kans.: | | |
| West Branch, Kans.: | | | (See notes, ii, 2824.) | | |
| (See notes, ii, 2823.) | | | West Fork, Iowa | GG-266 | i, 1027 |
| West Branch, Md. | J-550 | i, 335 | (See notes, ii, 2814.) | | |
| | J-968 | i, 338 | West Fork, Iowa and Mo. | GG-141 | i, 1026 |
| | J-1134 | i, 339 | (See notes, ii, 2814.) | | |
| West Branch, Mont. and | | | West Fork, La. | S-79 | i, 681 |
| Canada | GG-418 | i, 1028 | | S-257 | i, 683 |
| (See notes, ii, 2815.) | | | | S-840 | i, 688 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|---|---------------------|-------------------|
| West Fork, Md..... | J-470..... | i, 334 | Weston..... | (CC)..... | i, 911* |
| West Fork, Miss., Tom- bigbee R..... | R-37..... | i, 646 | | (GG-2)..... | i, 1039* |
| West Fork, Mo..... | GG-167..... | i, 1026 | Westons Cr., Va..... | K-267..... | i, 375 |
| | GG-172..... | i, 1026 | West Pascagoula R., Miss. | R-71..... | i, 646 |
| (See notes, ii, 2814.) | | | West Pass..... | (HH)..... | i, 1080* |
| West Fork, Mont..... | GG-432..... | i, 1028 | West Pass, Fla..... | P-354..... | i, 571 |
| | GG-440..... | i, 1028 | West Pass, Wash..... | XX-90..... | i, 1655 |
| | GG-481..... | i, 1028 | West Pearl R., La..... | R-98-ee..... | i, 647 |
| | GG-526..... | i, 1029 | | R-101..... | i, 647, 678 |
| | GG-676..... | i, 1030 | West Pearl R., Miss.: | | |
| | GG-707..... | i, 1030 | Bridges..... | | ii, 2243 |
| (See notes, ii, 2815, 2816, 2817.) | | | West Penobscot B., Me... | A-119..... | i, 28 |
| West Fork, Mont. and Canada: | | | Westpoint Slough, Cal... | TT-28..... | i, 1555 |
| (See notes, ii, 2815.) | | | Westport Chute..... | (HH)..... | i, 1080* |
| West Fork R., W. Va..... | FF-6-a..... | i, 1003 | Westport H., Conn..... | D-79..... | i, 141, 168 |
| | FF-11..... | i, 1003, 1011 | (See notes, ii, 2786.) | | |
| Bridges..... | | ii, 2243 | Appro..... | | ii, 2289 |
| West Fork, S. C..... | O-16..... | i, 533 | Westport H., Mass..... | C-59..... | i, 119 |
| West Fork, S. Dak..... | GG-298..... | i, 1027 | (See notes, ii, 2786.) | | |
| (See notes, ii, 2814.) | | | Appro..... | | ii, 2288 |
| West Gallatin R., Mont. and Wyo.: | | | Westport (Pt.) H., Mass... | C-59..... | i, 107, 119 |
| (See notes, ii, 2816.) | | | Westport R., East Branch, Mass..... | C-60..... | i, 107 |
| West Galveston B. Chan., Tex..... | U-5-a..... | i, 736 | Westport R., Mass..... | C-58..... | i, 107 |
| West Galveston B., Tex... | U-33..... | i, 735, 754 | | C-60..... | i, 107 |
| Appro..... | | ii, 2295 | Bridges..... | | ii, 2244 |
| Bridges..... | | ii, 2243 | Westport R., West Branch, Mass..... | C-61..... | i, 107 |
| West Galveston B. to Rio Grande R. (Inland wa- terway, coast of Texas). | U-38..... | i, 735, 756 | Westport Slough..... | (WW-2)..... | i, 1618* |
| West Gallatin R., Mont... | GG-530..... | i, 1029 | Westport Slough, Oreg... | WW-17..... | i, 1615 |
| West Glasgow..... | (GG-2)..... | i, 1039* | West R., Conn..... | D-51..... | i, 141 |
| West Gouldsborough H., Me..... | A-47..... | i, 27 | | D-60..... | i, 141 |
| Westhampton Beach, N. Y.: | | | | D-56..... | i, 156 |
| Bridges..... | | ii, 2244 | | D-56-b..... | i, 158 |
| West Hampton Cr., N. Y. | F-49..... | i, 215 | | D-56-c..... | i, 158 |
| West Haven H., Conn..... | D-60..... | i, 160 | (See notes, ii, 2790.) | | |
| West Hog Branch, La..... | S-61..... | i, 681 | Appro..... | | ii, 2289 |
| West Keag R. (South Thomaston), Me..... | A-148..... | i, 28 | Bridges..... | | ii, 2233, 2243 |
| West Mahantango Cr., Pa..... | J-852..... | i, 337 | West R. H., Conn..... | D-60..... | i, 160 |
| West Mill Cr., Pa..... | J-740..... | i, 336 | West R., Md..... | J-1268..... | i, 340 |
| West Mission Cr., Kans.: | | | West Seneca: | | |
| (See notes, ii, 2821.) | | | Harbor lines..... | | ii, 2261 |
| West Missouri Cr., Kans. | GG-1184..... | i, 1034 | West Seven Head Dam... (HH)..... | | i, 1080* |
| West Neck Cr., Va..... | L-241..... | i, 413, 441 | West Thorofare, N. J.: | | |
| West Neck R., Va..... | L-241..... | i, 441 | Bridges..... | | ii, 2243 |
| West Neebish Chan., Mich..... | PP-17..... | i, 1419 | West Twin Cr., Kans.: | | |
| West Newton..... | (HH)..... | i, 1080* | (See notes, ii, 2822.) | | |
| West Nishnabotna R., Iowa..... | GG-251..... | i, 1027 | West Twin R., Wis..... | MM-29..... | i, 1297 |
| (See notes, ii, 2814.) | | | Appro..... | | ii, 2298 |
| West Nodaway R., Iowa... | GG-239..... | i, 1027 | Bridges..... | | ii, 2243 |
| (See notes, ii, 2814.) | | | West Valley Cr., Wash.: | | |
| | | | Bridges..... | | ii, 2243 |
| | | | West Virginia, Whites Cr., W. Va..... | DD-334..... | i, 961 |
| | | | West Yeocomico R., Va... | K-123..... | i, 374 |
| | | | Wethersfield Cove, Conn... | D-37..... | i, 141 |
| | | | Wetpquin Cr., Md..... | J-112..... | i, 347 |
| | | | Wetumpka: | | |
| | | | (See notes, ii, 2802.) | | |
| | | | Wetumpka and East Tennessee, Virginia & Georgia Railroad Br. (Coosa R. between)..... | Q-52-d..... | i, 639 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---|---------------------|-------------------|--|---------------------|-------------------|
| Weweantitt R., Mass. | C-48..... | i, 107 | Whiskey Chute | (HH)..... | i, 1080* |
| Bridges..... | | ii, 2244 | (See notes, ii, 2828, 2830.) | | |
| Weymouth and Taunton Canal, Mass | C-70-a..... | i, 125 | Whiskey Cr., Kans. | GG-1163..... | i, 1034 |
| Weymouth Back R., Mass. | B-143..... | i, 70 | (See notes, ii, 2821.) | | |
| Bridges..... | | ii, 2244 | Whiskey Cr., Nebr.: (See notes, ii, 2821.) | | |
| Weymouth Fore R., Mass. | B-138..... | i, 70 | Whiskey Gap, Wyo. | GG-1013..... | i, 1033 |
| Bridges..... | | ii, 2244 | Whiskey Slough, Cal | UU-28..... | i, 1577 |
| Weymouth, Mass.: Wrecks..... | | ii, 2278 | Whitakers Cr., N. C. | M-156..... | i, 455 |
| Weymouth R., Mass. | B-138, 193..... | i, 93 | White Bayou, La. | S-99..... | i, 682 |
| (See notes, ii, 2785.) | | | White Bluffs | (WW-2)..... | i, 1618* |
| Appro..... | | ii, 2288 | White Branch, La. | S-95..... | i, 682 |
| Whale B., La. | S-229..... | i, 683 | White Brant Cr., S. Dak. | GG-817..... | i, 1031 |
| Appro..... | | ii, 2288 | (See notes, ii, 2818.) | | |
| Whale Branch, S. C.: Bridges..... | | ii, 2158 | White Clay Cr., Mont. | GG-630..... | i, 1030 |
| Whale Cove, Mass. | B-80..... | i, 69 | (See notes, ii, 2817.) | | |
| Whale Cr., N. J. | G-42..... | i, 247, 262 | White Clay Cr., Nebr. | GG-991..... | i, 1032 |
| Whale Cr., N. Y. | F-110..... | i, 216 | (See notes, ii, 2820.) | | |
| Whale Head B., N. C. | L-229..... | i, 413 | White Clay Cr., Nebr. and S. Dak.: (See notes, ii, 2819.) | | |
| Whalons B., N. Y.: (See notes, ii, 2792.) | | | White Clay Cr., S. Dak. | GG-883..... | i, 1032 |
| Whalous B., N. Y. | E-94..... | i, 178 | White Cloud | (GG-2)..... | i, 1039* |
| Wharf Cr., Md. | J-1178..... | i, 339 | White Coal Cr., Mo. | GG-222..... | i, 1026 |
| Wharves, D. C. | | ii, 2040, 2086 | (See notes, ii, 2814.) | | |
| Whatcom Cr., Wash. | XX-104..... | i, 1655 | White Cove, Md. | J-441..... | i, 334 |
| Bridges..... | | ii, 2244 | White Cr., Kans. | GG-1316..... | i, 1035 |
| Whatcom Cr. Waterway, Wash.: Bridges..... | | ii, 2244 | White Cr., Mont. | GG-428..... | i, 1028 |
| Whatcom, Wash.: Bridges..... | | ii, 2244 | (See notes, ii, 2815.) | | |
| Wheeling | (CC)..... | i, 911* | White Cr., Tenn. | AA-176..... | i, 849 |
| Wheeling Cr. | (CC)..... | i, 911* | White Cr., Va. | K-257..... | i, 375 |
| Wheeling Cr., W. Va. | EE-192..... | i, 984 | White Deer Hole Cr., Pa. | J-839..... | i, 337 |
| Bridges..... | | ii, 2244 | White Earth Cr., N. Dak. | GG-405..... | i, 1028 |
| Wheeling Isld. | (CC)..... | i, 911* | White Earth R., N. Dak.: (See notes, ii, 2815.) | | |
| Wheeling, W. Va.: (See notes, ii, 2812.) | | | White Eyes Cr., Ohio. | DD-352..... | i, 962 |
| Wheeling, W. Va., dis- trict. | EE..... | i, 981 | DD-394..... | | i, 962 |
| (See notes, ii, 2811.) | | | White Face R., Minn. | LL-21..... | i, 1265 |
| Appro..... | | ii, 2296 | Whitefish B., Mich. | PP-2..... | i, 1419 |
| Whetstone Cr., Mo. | GG-35..... | i, 1025 | Whitefish R., Mich. | MM-5-b..... | i, 1299 |
| (See notes, ii, 2813, 2824.) | | | White Fork, Ky. | DD-45..... | i, 959 |
| Whetstone Cr., Ohio. | DD-460..... | i, 962 | White Gulch Cr., Mont. | GG-537..... | i, 1029 |
| Whetstone Cr., S. Dak. | GG-900..... | i, 1032 | (See notes, ii, 2816.) | | |
| (See notes, ii, 2819.) | | | Whitehall Cr., Md. | J-1205..... | i, 340 |
| Whetstone R., Minn. and S. Dak. | KK-153..... | i, 1248 | Whitehall H., N. Y. | E-105-a..... | i, 207 |
| Whipping Cr., N. C. | M-13..... | i, 454 | Appro..... | | ii, 2289 |
| Whipping Swamp, S. C. | N-256..... | i, 501 | White Horse Cr., Mont. | GG-454..... | i, 1028 |
| Whipple Co. Bar (HH): (See notes, ii, 2828.) | | | White Horse Cr., Mont. and Nebr.: (See notes, ii, 2816, 2820.) | | |
| Whipple Cr. | (HH)..... | i, 1080* | White Horse Cr., Nebr. | GG-982..... | i, 1032 |
| Whiskeag Cr., Me. | A-235..... | i, 29 | White House Cr., Va. | K-182..... | i, 374 |
| Whiskey Bayou, La.: (See notes, ii, 2804.) | | | White House, D. C. (see Washington, D. C.) | | ii, 2039, 2067 |
| Whiskey Chitto Cr., La. | S-819..... | i, 688 | Whitehursts Cr., N. C. | M-105..... | i, 455 |
| | | | White Lake Canal, La. | S-734..... | i, 687 |
| | | | White Lake H., Mich. | OO-39..... | i, 1377, 1398 |
| | | | Appro..... | | ii, 2298 |
| | | | White Lake, La. | S-735..... | i, 687 |
| | | | White Lake, Mich.: Navigation rules..... | | ii, 2041, 2108 |
| | | | Whitely Cr., Minn. | K-76..... | i, 1247 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|------------------------------------|---------------------|-------------------|
| Whitemarsh Cr., Md. | J-1266..... | i, 340 | White Rock Cr., Kans. | GG-1313..... | i, 1035 |
| White Marsh Cr., S. C. | N-10..... | i, 499 | (See notes, ii, 2822.) | | |
| Whitemarsh Run, Md. | J-1049..... | i, 339 | White Salmon R., Wash. .. | VV-100..... | i, 1594 |
| White Oak Bayou, Tex. ... | U-20..... | i, 735 | Bridges..... | | ii, 2244 |
| Bridges..... | | ii, 2149 | Whites Cr., Cal. | TT-107..... | i, 1556 |
| White Oak B., Tex.: | | | Whites Cr., Tenn. | AA-28..... | i, 848 |
| Bridges..... | | ii, 2244 | | AA-309..... | i, 850 |
| White Oak Cr., Ga. | O-466..... | i, 536 | Whites Cr., Va. | K-272..... | i, 375 |
| White Oak Cr., Ky. | DD-28..... | i, 959 | Whites Ferry | (WW-2)..... | i, 1618* |
| | DD-82..... | i, 959 | White Slough, Cal. | UU-44..... | i, 1577 |
| | DD-178..... | i, 960 | White Tail Cr., Nebr. | GG-985..... | i, 1032 |
| White Oak Cr., Tenn. | AA-30..... | i, 848 | (See notes, ii, 2820.) | | |
| | AA-231..... | i, 850 | White Tail Cr., N. Dak. ... | GG-767..... | i, 1031 |
| White Oak Cr., Va. | L-317..... | i, 413 | (See notes, ii, 2818.) | | |
| White Oak, Ky. | DD-199..... | i, 960 | White Vine Bayou, La. | S-549..... | i, 686 |
| White Oak R., N. C. | M-285..... | i, 456, 485 | White Water | (HH)..... | i, 1080* |
| Whiteoak Run, Md. | J-1133..... | i, 339 | White Water Cr., Ga. | O-317..... | i, 535 |
| White Pigeon R., Mich., | | | White Water Cr., S. Dak.: | | |
| Ind., and Ohio. | OO-6..... | i, 1377 | (See notes, ii, 2819.) | | |
| (See notes, ii, 2838.) | | | Whitewater R., Minn. | JJ-46..... | i, 1234 |
| White Pt. Branch, Va. | K-122..... | i, 374 | Whitewater R. (North), | | |
| White Ripple | (CC)..... | i, 911* | Minn. | JJ-47..... | i, 1234 |
| White R. | (HH)..... | i, 1080* | Whitewater R. (South), | | |
| Bridges..... | | ii, 2244 | Minn. | JJ-48..... | i, 1234 |
| White R., Ark. | W..... | i, 781 | White Willow Cr., S. | | |
| | Y-23..... | i, 827, 829 | Dak. | GG-867..... | i, 1031 |
| | Y-23-a..... | i, 827 | (See notes, ii, 2819.) | | |
| | Z..... | i, 841 | White Wood Cr., S. Dak. .. | GG-835..... | i, 1031 |
| Appro..... | | ii, 2295 | (See notes, ii, 2819.) | | |
| Bridges..... | | ii, 2244 | Whitman Cr., Tex.: | | |
| Navigation rules..... | | ii, 2041, 2108 | (See notes, ii, 2806.) | | |
| White R., Ark. and Mo. .. | Y-23..... | i, 818 | Whitneys Bar | (HH)..... | i, 1080* |
| White R., Ark., Augusta | | | Whittakers Cr., Va. | K-290..... | i, 375 |
| Narrows. | Y-23-g..... | i, 832 | Wiceacon Cr., N. C. | L-332..... | i, 413 |
| White R., Ark., Buffalo | | | Wichita, Kans. | Y-2-c..... | i, 820 |
| Fork. | Y-23-e..... | i, 831 | Wickford H., R. I. | C-93..... | i, 107, 131 |
| White R., Ark. (Includ- | | | (See notes, ii, 2787.) | | |
| ing some obstructions | | | Appro..... | | ii, 2288 |
| removed from Cache R.) | Y-23-c..... | i, 829 | Wickliffe | (HH)..... | i, 1080* |
| White R., Ark. (snagging | | | Wickliffe Cr., La. | S-268..... | i, 683 |
| operations on). | Y-23-b..... | i, 828 | Wickoff Bayou, La. | S-761..... | i, 687 |
| White R., East Fork, Ind. | BB-26..... | i, 891 | Wicomco Cr., Md. | J-89..... | i, 331 |
| White R. H., Mich. | OO-39..... | i, 1398 | Wicomco R., Md. | J-81..... | i, 331, 344 |
| White R., Ind. | BB-25..... | i, 891, 902 | | K-66..... | i, 373 |
| | BB-23..... | i, 898 | Appro..... | | ii, 2291 |
| Appro..... | | ii, 2296 | Wicomco R., Md. (head). | J-81-a..... | i, 345 |
| Bridges..... | | ii, 2242, 2244 | Wicomco R., Va.: | | |
| Dams, private..... | | ii, 2250-2251 | Wrecks..... | | ii, 2278 |
| White R., Mich. | OO-40..... | i, 1377 | Wicomisco Cr., Pa. | J-602..... | i, 335 |
| White R., Mo.: | | | Widow Cr., Ala. and | | |
| Dams, private..... | | ii, 2250 | Tenn. | AA-193..... | i, 849 |
| White R., West Fork, Ind. | BB-27..... | i, 891 | Wier Cr., N. Y. | E-16..... | i, 177 |
| White R., S. Dak. and | | | Wiggins Pass, Fla. | P-221..... | i, 570 |
| Nebr. | GG-881..... | i, 1032 | Wilhoite Bend. | (GG-2)..... | i, 1039* |
| (See notes, ii, 2819.) | | | Wildcat Branch, Ky. | DD-35..... | i, 959 |
| White R. (upper), Ark. ... | Y-23-d..... | i, 830 | Wildcat Branch, Md. | J-984..... | i, 338 |
| White R. (upper), Ark. | | | Wildcat Cr., Colo. | GG-1083..... | i, 1033 |
| (locks and dams, oper- | | | (See notes, ii, 2820.) | | |
| ating and care). | Y-23-f..... | i, 832 | Wild Cat Cr., Ind. | BB-29..... | i, 891 |
| White R., Wash. | XX-70..... | i, 1655 | Wildcat Cr., Kans. | GG-1272..... | i, 1035 |
| | XX-74..... | i, 1655 | (See notes, ii, 2822.) | | |
| Bridges..... | | ii, 2244 | Wildcat Cr., Minn. | KK-167..... | i, 1248 |
| White Rock Cr., Conn. ... | D-68..... | i, 141 | Wild Cat Cr., Pa. | J-856..... | i, 337 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|------------------------------------|---------------------|-------------------|-----------------------------------|---------------------|-------------------|
| Wild Cow Cr., La. | S-843..... | i, 688 | Willapa R., Wash., South | | |
| Wild Goose Dike | (WW-2)..... | i, 1618* | Fork | XX-10..... | i, 1655 |
| Wild Goose Isld. | (WW-2)..... | i, 1618* | Willard | (HH)..... | i, 1080* |
| Wild Goose Rapids | (WW-2)..... | i, 1618* | Willard Cr., Ky | DD-118..... | i, 960 |
| Wild Horse Cr., Kans. | GG-1200..... | i, 1034 | Willets Pt., N. Y.: | | |
| | GG-1205..... | i, 1034 | Engineer Depot..... | ii, 2039, | 2045 |
| | GG-1343..... | i, 1035 | Forts..... | ii, 1806, | 1881 |
| (See notes, ii, 2821, 2822.) | | | Harbor lines..... | ii, 2261 | |
| Wild Horse Cr., Mo. | GG-1554..... | i, 1037 | William Pass | (HH)..... | i, 1080* |
| (See notes, ii, 2824.) | | | Williams Cr., Ga. | O-46..... | i, 533 |
| Wild Horse Cr., Wyo. | GG-734..... | i, 1030 | Williams Cr., La. | S-270..... | i, 683 |
| (See notes, ii, 2818.) | | | (See notes, ii, 2805.) | | |
| Wild Rice R., Minn. | KK-194..... | i, 1248 | Williams Cr., Md. | J-306..... | i, 333 |
| Wild Rice R., N. Dak. | KK-188..... | i, 1248 | Williams Cr., Mo. | GG-183..... | i, 1026 |
| Wild Rice R., South | | | | GG-1530..... | i, 1037 |
| Branch, Minn. | KK-195..... | i, 1248 | (See notes, ii, 2814.) | | |
| Wilds Landing | (HH)..... | i, 1080* | Williams Cr., Wash. | XX-6..... | i, 1655 |
| Wiley Cr., Pa. | J-653..... | i, 336 | Williams Cut, Ga. | O-482..... | i, 536 |
| Wilkinson Branch, Mo. | GG-212..... | i, 1026 | Williamson Swamp Cr., | | |
| (See notes, ii, 2814.) | | | Ga. | O-136..... | i, 534 |
| Wilkinson Cr., S. C. | N-151..... | i, 500 | Williams Pass, La. | S-305..... | i, 683 |
| Wilkinson Isld. | (HH)..... | i, 1080* | Williams R., W. Va. | EE-120..... | i, 984 |
| Wilkinsons B., La. | S-342..... | i, 684 | Willis Cr., N. C. | M-238..... | i, 456 |
| Wilkinsons Cr., N. C. | M-51..... | i, 454 | | M-245..... | i, 456 |
| Willamette and Colum- | | | Willis R., Va. | L-144-a..... | i, 424 |
| bia Rs. | WW-30-a..... | i, 1642 | Willstins Cr., N. C. | M-244..... | i, 456 |
| Willamette Bar. | (WW-2)..... | i, 1618* | Willston | (GG-2)..... | i, 1039* |
| (See notes, ii, 2841.) | | | Willoughby B., Va. | L-203..... | i, 412 |
| Willamette Falls, Oreg. | | | Wrecks..... | ii, 2278 | |
| (WW): | | | Willow Bar. | (WW-2)..... | i, 1618* |
| (See notes, ii, 2841, 2844.) | | | Willow Branch, N. C. | L-339..... | i, 413 |
| Willamette R., Oreg. | WW-30..... | i, 1615, 1642 | Willow Cr., Colo. | GG-1037..... | i, 1033 |
| | (WW-2)..... | i, 1618* | | GG-1103..... | i, 1033 |
| (See notes, ii, 2843, 2844.) | | | | GG-1105..... | i, 1033 |
| Appro..... | ii, 2300 | | (See notes, ii, 2820.) | | |
| Bridges..... | ii, 2444-2245 | | Willow Cr., Cal. | TT-70..... | i, 1555 |
| Harbor lines..... | ii, 2261 | | Willow Cr., Iowa. | GG-271..... | i, 1027 |
| Navigation rules..... | ii, 2041, 2108 | | Willow Cr., Mo. | GG-174..... | i, 1026 |
| Willamette R.; tributaries | | | (See notes, ii, 2814.) | | |
| of Columbia R. below | | | Willow Cr., Mont. | GG-457..... | i, 1028 |
| mouth of | WW-41-a..... | i, 1649 | | GG-479..... | i, 1028 |
| Willamette Slough | (WW-2)..... | i, 1618* | | GG-499..... | i, 1029 |
| Willamette Slough, Oreg. | WW-25..... | i, 1615 | | GG-524..... | i, 1029 |
| | WW-31..... | i, 1615 | | GG-581..... | i, 1029 |
| (See notes, ii, 2841.) | | | | GG-762..... | i, 1031 |
| Dams, private..... | ii, 2251 | | (See notes, ii, 2816, 2818.) | | |
| Willanch Slough, Oreg. ... | VV-26..... | i, 1593 | Willow Cr., Nebr. | GG-956..... | i, 1032 |
| Willapa and Bakers Bs., | | | | GG-994..... | i, 1032 |
| Wash. (canal between). | WW-69..... | i, 1652 | | GG-1291..... | i, 1035 |
| Willapa B. to Columbia | | | (See notes, ii, 2819, 2820, | | |
| R., Oreg.: | | | 2822.) | | |
| (See notes, ii, 2844, 2845.) | | | Willow Cr., N. Dak. | GG-785..... | i, 1031 |
| Willapa B., Wash. | XX-2..... | i, 1655 | (See notes, ii, 2818.) | | |
| (See notes, ii, 2844.) | | | Willow Cr., S. Dak. | GG-322..... | i, 1027 |
| Willapa H., Wash.: | | | | GG-831..... | i, 1031 |
| (See notes, ii, 2845.) | | | | GG-858..... | i, 1031 |
| Wrecks..... | ii, 2278 | | (See notes, ii, 2818, 2819.) | | |
| Willapa R. and H., Wash. | XX-9..... | i, 1657 | Willow Cr., Wyo. | GG-1000..... | i, 1032 |
| Appro..... | ii, 2301 | | | GG-1008..... | i, 1033 |
| Willapa R., Wash. | XX-9..... | i, 1655 | (See notes, ii, 2820.) | | |
| (See notes, ii, 2845.) | | | Willow Lake, La. | S-785..... | i, 688 |
| Bridges..... | ii, 2245 | | Willow Pt. | (CC)..... | i, 911* |
| Harbor lines..... | ii, 2261 | | Willow R. | (HH)..... | i, 1080* |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|--------------------------------------|---------------------|-------------------|
| Willow R., Alaska | XX-152..... | i, 1656 | Wilson Pt. | (HH)..... | i, 1080* |
| Willow R., Iowa | GG-260..... | i, 1027 | Wilson Pt. H., Conn. | D-82..... | i, 170 |
| (See notes, ii, 2814.) | | | (See notes, ii, 2791.) | | |
| Willow R., Mich. | PP-81..... | i, 1419 | Appro..... | | ii, 2289 |
| Willow R., Minn. | KK-99..... | i, 1248 | Wilson R., N. Y.: | | |
| Willow R., Wis. | KK-48..... | i, 1247 | Appro..... | | ii, 2299 |
| Willow Run. | (CC)..... | i, 911* | Wilson R., Oreg. | VV-66..... | i, 1593 |
| Willow Slough. | (HH)..... | i, 1080* | Wilsons Cr., Cal. | TT-201..... | i, 1556 |
| Willow Swamp, S. C. | N-235..... | i, 500 | Wilsons Cr., Ga. | O-433..... | i, 536 |
| | N-254..... | i, 501 | Wilsons Cr., S. C. | N-189..... | i, 500 |
| Willsborough B., N. Y. | E-92..... | i, 177 | Wilsons Mill Cr., Tex.: | | |
| Wills Cr. | (CC)..... | i, 911* | (See notes, ii, 2806.) | | |
| Wills Cr., Ala. | Q-59..... | i, 611 | Wilsons Pt. (HH): | | |
| Wills Cr., Ohio. | DD-351..... | i, 961 | (See notes, ii, 2831.) | | |
| Wills Straits, Me. | A-251..... | i, 29 | Wilsons Pt. H., Conn. | D-82..... | i, 141 |
| Wilmington B., Cal.: | | | Wilton Cr., Va. | K-240..... | i, 375 |
| Bridges..... | | ii, 2245 | Wiltons Cr., Mont. | GG-561..... | i, 1029 |
| Wilmington, Del., dis- | | | (See notes, ii, 2816.) | | |
| trict. | I..... | i, 295 | Wiltons Waterway, | | |
| (See notes, ii, 2794.) | | | Wash.: | | |
| Appro..... | | ii, 2290 | Bridges..... | | ii, 2245 |
| Wilmington H., Cal. | SS-20-a..... | i, 1547 | Winans Cove, Md. | J-1100..... | i, 339 |
| (See notes, ii, 2839.) | | | Winchester B., Oreg. | VV-31..... | i, 1593 |
| Harbor lines..... | | ii, 2261 | Winchester Cr., Md. | J-418..... | i, 334, 356 |
| Wrecks..... | | ii, 2278 | Winchester H., Md. | J-418..... | i, 356 |
| Wilmington H., Del. | I-58..... | i, 299, 314 | Winchester Pond, Md. | J-1213..... | i, 340 |
| (See notes, ii, 2794.) | | | Winchuck R., Cal. | TT-209..... | i, 1556 |
| Appro..... | | ii, 2287, 2290 | Windham Cr., La. | S-853..... | i, 688 |
| Harbor lines..... | | ii, 2261 | Winding Gulf, W. Va. | EE-28..... | i, 983 |
| Wrecks..... | | ii, 2278 | Windlass Run, Md. | J-1051..... | i, 339 |
| Wilmington Lagoon | | | Windmill Cr., N. C. | M-76..... | i, 454 |
| Slough, Cal.: | | | Windmill Pt. Cr., Va. | K-172..... | i, 374 |
| Bridges..... | | ii, 2245 | Windpoint, Wis.: | | |
| Wilmington, N. C.: | | | Reef..... | | ii, 2041, 2133 |
| Appro..... | | ii, 2287 | Wind R., Wash. | VV-99..... | i, 1594 |
| Harbor lines..... | | ii, 2261 | Bridges..... | | ii, 2245 |
| Wilmington, N. C. (above), | | | Wind R., Wyo. | GG-688..... | i, 1030 |
| Cape Fear R. | M-305-b..... | i, 488 | (See notes, ii, 2817.) | | |
| Wilmington, N. C. (above), | | | Windsor Cr., Md. | J-110..... | i, 332 |
| Cape Fear R. (locks and | | | Winfield Scott, Fort. | | ii, 2005 |
| dams). | M-305-c..... | i, 489 | Wing Pt., Wis.: | | |
| Wilmington, N. C. (at and | | | Wrecks..... | | ii, 2278 |
| below), Cape Fear R. | M-305-a..... | i, 484 | Winnebago Chain. | (HH)..... | i, 1080* |
| Wilmington, N. C., dis- | | | Winnebago Cr., Minn. | KK-169..... | i, 1248 |
| trict. | M..... | i, 451 | Winnebago Cr., Nebr. | GG-1144..... | i, 1034 |
| (See notes, ii, 2796.) | | | (See notes, ii, 2821.) | | |
| Appro..... | | ii, 2292 | Winnebago Lake, Fox R., | | |
| Wilmington, N. C., dis- | | | Wis. (see Lake Winne- | | |
| trict (dredge for). | M-a..... | i, 457 | bago). | MM-21-b..... | i, 1316 |
| Wilmington R., Ga. | O-79..... | i, 533 | Winnegance B., Me. | A-246..... | i, 29 |
| (See notes, ii, 2798.) | | | Winnegance Cr., Me. | A-236..... | i, 29 |
| Wilson Cr., Fla. | P-185..... | i, 570 | Winnibigoshish Dam. | (HH)..... | i, 1080* |
| Wilson Cr., Nebr. | GG-1128..... | i, 1034 | Winnepesaukee Lake, N. | | |
| Wilson Cr., N. C. | M-183..... | i, 455 | H. | B-25..... | i, 69, 75 |
| Wilson Cr., Va. | K-286..... | i, 375 | Winnepesaukee R., N. H. | B-24..... | i, 69 |
| | EE-96..... | i, 983 | Winnis Cr., Tex.: | | |
| Wilson Cr., Wash. | XX-11..... | i, 1655 | (See notes, ii, 2805.) | | |
| Bridges..... | | ii, 2245 | Winona | (HH)..... | i, 1080* |
| Wilson H., N. Y. | RR-26..... | i, 1493 | Winoski R., Vt. | E-116..... | i, 178 |
| | RR-26..... | i, 1514 | Winter H., Me. | A-44..... | i, 27 |
| Wilson Levee. | (HH)..... | i, 1080* | | A-113..... | i, 28 |
| Wilson, Pa.: | | | Winter H., Me. (Hancock | | |
| Harbor lines..... | | ii, 2261 | Co.). | A-44..... | i, 34 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|---------------------------------------|---------------------|-------------------|---------------------------------------|---------------------|-------------------|
| Winter H., Va. | K-259..... | i, 375 | Wolf Cr., N. Dak. | GG-399..... | i, 1028 |
| Winter Road R., Minn. | KK-214..... | i, 1249 | (See notes, ii, 2815.) | | |
| Winters Run, Md. | J-964..... | i, 338 | Wolf Cr., Ohio. | DD-385..... | i, 962 |
| Winthrop Cove, Conn. | DD-8..... | i, 141 | | DD-405..... | i, 962 |
| Bridges..... | | ii, 2246 | | DD-435..... | i, 962 |
| Winthrop, Fort, Mass. | | ii, 1805, 1855 | Wolf Cr., S. Dak. | GG-303..... | i, 1027 |
| Winthrop H., Mass. | B-114..... | i, 70, 84 | | GG-330..... | i, 1027 |
| (See notes, ii, 2784, 2785.) | | | (See notes, ii, 2815.) | | |
| Appro..... | | ii, 2288 | Wolf Cr., Va. | EE-85..... | i, 983 |
| Winyah B. | L-173..... | i, 438 | Wolferfs Cr., N. C. | M-247..... | i, 456 |
| Winyah B., S. C. | N-4..... | i, 499, 501 | Wolf Isld. | (HH)..... | i, 1080* |
| Appro..... | | ii, 2292 | Wolf Lake and R., Ill. and | | |
| Wire Gut, N. C. | L-359..... | i, 414 | Ind..... | NN-20..... | i, 1366 |
| Wiscasset H., Me. | A-204..... | i, 28 | Wolf Lake Cut, Ill. and | | |
| Wisconsin R. | (HH)..... | i, 1080* | Ind..... | NN-20..... | i, 1366 |
| Wisconsin R. (see Fox and | | | Wolf Lake, Ill. and Ind. | NN-20..... | i, 1349 |
| Wisconsin Rs.) | KK-7..... | i, 1247 | Appro..... | | ii, 2298 |
| | MM-15..... | i, 1297 | Wolf Lake Outlet, Ill. and | | |
| Wisconsin R., Wis. | KK-5..... | i, 1247, 1249 | Ind..... | NN-20..... | i, 1366 |
| Appro..... | | ii, 2298 | Wolfy Cr., Kans. | GG-1219..... | i, 1034 |
| Bridges..... | | ii, 2246 | (See notes, ii, 2821.) | | |
| Dams, private..... | | ii, 2251 | Wolf or Elm Cr., S. Dak. | GG-370..... | i, 1028 |
| Wisconsin (State) | (HH)..... | i, 1080* | Wolf R. | (HH)..... | i, 1080* |
| Wisdom R., Mont. | GG-513..... | i, 1029 | (See notes, ii, 2830.) | | |
| Wise R., Mont. | GG-516..... | i, 1029 | Wolf R. Chan., Miss. | R-91..... | i, 646 |
| (See notes, ii, 2816.) | | | Wolf R., Ill.: | | |
| Wishkah R., Wash. | XX-20..... | i, 1655 | Appro..... | | ii, 2298 |
| Bridges..... | | ii, 2246 | Wolf R., Miss. | R-92..... | i, 646, 673 |
| Harbor lines..... | | ii, 2261 | | R-92-b..... | i, 673 |
| Witcher Cr., W. Va. | EE-130..... | i, 984 | | R-92-c..... | i, 673 |
| Withlacoochee R., Fla. | P-342..... | i, 571, 605 | Appro..... | | ii, 2294 |
| | P-360..... | i, 572 | Bridges..... | | ii, 2246 |
| Appro..... | | ii, 2293 | Wolf R., Tenn. | AA-2..... | i, 851 |
| Bridges..... | | ii, 2246 | Appro..... | | ii, 2296 |
| Dams, private..... | | ii, 2251 | Bridges..... | | ii, 2246 |
| Wrecks..... | | ii, 2268 | Wolf R., Tenn. and Miss. | AA-2..... | i, 848 |
| Wolcott, Fort, R. I. | | ii, 1808 | Wolf R., Wis. | MM-16..... | i, 1297 |
| Wolf Branch, Mo. | GG-149..... | i, 1026 | | MM-15-a..... | i, 1307 |
| Wolf Cr. | (CC)..... | i, 911* | | M-16..... | i, 1315 |
| Wolf Cr., Ga. | O-149..... | i, 534 | Appro..... | | ii, 2298 |
| | O-304..... | i, 535 | Bridges..... | | ii, 2246 |
| Wolf Cr., Kans. | GG-1156..... | i, 1034 | Wolf Run Cr., Nebr. | GG-1132..... | i, 1034 |
| | GG-1186..... | i, 1034 | Wolf Run, Pa. | J-723..... | i, 336 |
| | GG-1317..... | i, 1035 | | J-848..... | i, 337 |
| | GG-1352..... | i, 1035 | Wolfs Cr., Ga. | O-227..... | i, 534 |
| | GG-1358..... | i, 1035 | Wolftrap Branch, Md. | J-1038..... | i, 338 |
| (See notes, ii, 2821, 2822, 2823.) | | | Wolftrap Cr., Md. | J-70..... | i, 331 |
| Wolf Cr., Ky. | AA-285..... | i, 850 | Wolsey Cr., Md. | J-419..... | i, 334 |
| | DD-115..... | i, 960 | Womans Pocket Cr., | | |
| | DD-296..... | i, 961 | Mont..... | GG-584..... | i, 1029 |
| Wolf Cr., Mo. | GG-13..... | i, 1025 | (See notes, ii, 2816.) | | |
| | GG-1408..... | i, 1036 | Woodbridge Cr., N. J. | G-35..... | i, 247, 257 |
| | GG-1444..... | i, 1036 | Appro..... | | ii, 2290 |
| | GG-1532..... | i, 1037 | Bridges..... | | ii, 2246 |
| (See notes, ii, 2823.) | | | Woodbury Cr., N. J. | I-48..... | i, 299, 311 |
| Wolf Cr., Minn. | JJ-29..... | i, 1234 | Appro..... | | ii, 2290 |
| Wolf Cr., Mont. | GG-421..... | i, 1028 | Bridges..... | | ii, 2230, 2246 |
| | GG-460..... | i, 1028 | Wrecks..... | | ii, 2278 |
| | GG-505..... | i, 1029 | Wood Cr., Mont. | GG-574..... | i, 1029 |
| | GG-559..... | i, 1029 | (See notes, ii, 2816.) | | |
| (See notes, ii, 2815, 2816.) | | | Wood Cr., N. Y. | E-74..... | i, 177 |
| | | | | E-103..... | i, 178 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|----------------------------------|----------------------|-------------------|
| Wood, Fort, N. Y. | | ii, 1807 | Wounded Knee Cr., S. | | |
| Wood Isld. H., Me. | A-271..... | i, 29, 58 | Dak. | GG-884..... | i, 1032 |
| Woodland Cr., Md. | J-377..... | i, 334 | (See notes, ii, 2819.) | | |
| Woodmere B., N. Y. | F-75..... | i, 215 | Wrangell Narrows, Alaska | XX-122-b..... | i, 1679 |
| Wood R. | (HH)..... | i, 1080* | (See notes, ii, 2845.) | | |
| Wood R., Alaska. | XX-199..... | i, 1656 | Wreck Cr., Wash. | XX-27..... | i, 1655 |
| Wood R., Ill. | II-6..... | i, 1229 | Wrecks. | ii, 2041, 2116, 2117 | |
| | JJ-2..... | i, 1234 | Expenditures..... | ii, 2279 | |
| Wood R., Nebr. | GG-978..... | i, 1032 | Index plan..... | i, 13 | |
| (See notes, ii, 2820.) | | | Mississippi R..... | ii, 2279 | |
| Wood R., Oreg. | VV-3..... | i, 1593, 1594 | Removal of..... | ii, 2268 | |
| Wood R., Wis. | KK-15..... | i, 1247 | Wright Cr., Kans. | GG-1349..... | i, 1035 |
| | KK-51..... | i, 1247 | (See notes, ii, 2823.) | | |
| Woodsburg Chan., N. Y. | F-76..... | i, 215, 229 | Wright Cr., La. | R-98-k..... | i, 647 |
| Woods Cut, Ga. | O-415..... | i, 536 | Wright Cr., Md. | J-979..... | i, 338 |
| Woods Cr., Tenn. | AA-149..... | i, 849 | Wright Cr., Tex.: | | |
| Woods Hole, Mass. | C-19..... | i, 107, 111 | (See notes, ii, 2806.) | | |
| Woods Hole H. and Chan., | | | WRIGHT, BRIG. GEN. | | |
| Mass. | C-18..... | i, 107, 110 | H. G., Chief of Engi- | | |
| (See notes, ii, 2786.) | | | neers, U. S. Army: | | |
| Appro..... | | ii, 2288 | Defenses, national..... | ii, 1822 | |
| Wrecks..... | | ii, 2270, 2278 | Wrights Branch, Md. | J-181..... | i, 332 |
| Woody Isld. Cr., Mont. | GG-430..... | i, 1028 | Wrights Cr., N. C. | M-65..... | i, 454 |
| (See notes, ii, 2815.) | | | Wrights Cr., Tex.: | | |
| Woody Islds. | (WW-2)..... | i, 1618* | (See notes, ii, —.) | | |
| Woolford Cr., Md. | J-235..... | i, 332 | Wrights R., S. C. | O-3..... | i, 533 |
| Wool, Fort, Va. | | ii, 1808, 1927 | Wyaconda Bar. | (HH)..... | i, 1080* |
| Woolridge. | (GG-2)..... | i, 1039* | Wyalusing. | (HH)..... | i, 1080* |
| Wootenau Cr., Md. | J-304..... | i, 333 | Wyalusing Cr., Pa. | J-641..... | i, 335 |
| Wooten Cr., Ky. | DD-92..... | i, 959 | Wyandotte H., Mich. | PP-114..... | i, 1420 |
| Wopowaug R., Conn. | D-63..... | i, 141 | Wye Narrows, Md. | J-387..... | i, 334 |
| Works, Military; Mau- | | | Wye R., Md. | J-378..... | i, 334 |
| mee Valley. | | ii, 2040, 2088 | Wykoff Run, Pa. | J-794..... | i, 337 |
| Works, River and Har- | | | Wynants Kill, N. Y. | E-51..... | i, 177 |
| bor: | | | Wynooche R., Wash. | XX-19..... | i, 1655 |
| Non-United States work..... | | ii, 2041, 2109 | Wyoming: | | |
| Worlds End Cr., Md. | J-209..... | i, 332 | Roads, Military..... | ii, 2041, 2119 | |
| Wormley Cr., Va. | K-320..... | i, 375 | Wyoming and Colorado | | |
| Worthington Cr., W. Va. | EE-186..... | i, 984 | (arid regions and reser- | | |
| Worth Lake, Fla.: | | | voirs) | GG-1025-a..... | i, 1061 |
| Bridges..... | | ii, 2246 | Appro..... | | ii, 2297 |
| Worthless Cr., S. Dak. | GG-807..... | i, 1031 | Wysocking B., N. C.: | | |
| Worton Cr., Md. | J-505..... | i, 334, 359 | Wrecks..... | ii, 2278 | |
| Appro..... | | ii, 2291 | Wysox Cr., Pa. | J-646..... | i, 336 |
| Worton H., Md. | J-505..... | i, 359 | | | |
| Appro..... | | ii, 2291 | | | |

Y.

| | | | | | |
|----------------------------------|--------------|-------------|----------------------------------|--------------|----------------|
| Yadkin R., N. C. | N-19..... | i, 499 | Yalobusha R., Miss. | X-8..... | i, 785, 789 |
| | N-49..... | i, 499, 507 | Yalobusha R. (see above). | | |
| Appro..... | | ii, 2292 | Yamhill R., Oreg. | WW-33..... | i, 1615, 1647 |
| Yahara R., Wis. | JJ-18-a..... | i, 1235 | | WW-33-a..... | i, 1647 |
| Yakima. | (WW-2)..... | i, 1618* | | WW-33-b..... | i, 1647 |
| Yakima R., Wash. | XX-120..... | i, 1656 | | WW-30-b..... | i, 1642 |
| Yalabusha R., Miss. | X-8..... | i, 789 | (See notes, ii, 2844.) | | |
| Appro..... | | ii, 2295 | Appro..... | | ii, 2300 |
| Bridges..... | | ii, 2247 | Bridges..... | | ii, 2247 |
| | | | Navigation rules..... | | ii, 2041, 2108 |

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|--|---------------------|-------------------|---|---------------------|-------------------|
| Yankton | (GG-2)..... | i, 1039* | Yellowstone R., N. Dak., Mont., and Wyo. (con.) .. | GG-626.. | i, 1030, 1060 |
| Yankee Canal, La. | S-420..... | i, 684 | (See notes, ii, 2817, 2826.) | | |
| Yankton, S. Dak. | (GG-2)..... | i, 1037* | Appro..... | ii, 2297 | |
| Yantic R., Conn. | D-15..... | i, 141 | Bridges..... | ii, 2247 | |
| Yantz Cr., Md. | J-1219..... | i, 840 | Yellow Water Cr., Ga. | O-363..... | i, 535 |
| Yaquina B., Oreg. | VV-44..... | i, 1593 | Yellow Water Cr., Mont. .. | GG-578..... | i, 1029 |
| Appro..... | ii, 2300 | | (See notes, ii, 2816.) | | |
| Yaquina R., Oreg. | VV-45..... | i, 1593, 1607 | Yenta R., Alaska | XX-159..... | i, 1656 |
| Yarmouth Cr., Va. | L-122..... | i, 412 | Yeocombeo R., Va. | K-121..... | i, 374 |
| Yarmouth R. (Royal R.), Me. | A-260..... | i, 29 | Yeopim Cr., N. C. | L-293..... | i, 413 |
| Yazoo | (HH)..... | i, 1080* | L-292..... | i, 413 | |
| Yazoo Pass, Miss. | X-12..... | i, 785 | Yerba Buena Isld., Cal.: | | |
| Yazoo R., Miss. | X-4..... | i, 785, 786 | Forts..... | ii, 1802 | |
| (See notes, ii, 2807.) | | | Posts..... | ii, 2039, 2057 | |
| Appro..... | ii, 2295 | | Yokely Bayou, La. | S-689..... | i, 687 |
| Bridges..... | ii, 2234, 2247 | | (See notes, ii, 2804.) | | |
| Navigation rules..... | ii, 2041, 2108 | | Yomalandee R., Ga. | O-251..... | i, 535 |
| Wrecks..... | ii, 2278 | | Yonkers, N. Y.: | | |
| Yazoo R. (Bear Cr., Miss.) .. | X-14..... | i, 792 | Harbor lines..... | ii, 2261 | |
| Ybor Estuary, Fla. | P-308..... | i, 571 | York H., Me. | A-279..... | i, 29 |
| Yellowbank | (CC)..... | i, 911* | A-279-a..... | i, 59 | |
| Yellowbank R., Minn. | KK-154..... | i, 1248 | Appro..... | ii, 2288 | |
| Yellow Bayou, La. | S-574..... | i, 686 | York Narrows, Me. | A-70..... | i, 27 |
| S-677..... | i, 687 | | York R. (York H.), Me. | A-279..... | i, 29 |
| Yellow Branch, Md. | J-986..... | i, 338 | Bridges..... | ii, 2247 | |
| Yellow Bud Cr., Ohio | DD-471..... | i, 962 | York R., Va. | K-297..... | i, 375, 404 |
| Yellow Cr., Ala. | AA-219..... | i, 850 | Appro..... | ii, 2291 | |
| Yellow Cr., Mo. | GG-136..... | i, 1026* | Wrecks..... | ii, 2278 | |
| (See notes, ii, 2813.) | | | York Spit Chan., Va.: | | |
| Yellow Cr., Tenn. | AA-245..... | i, 850 | Navigation rules..... | ii, 2041, 2107 | |
| Yellow Cr., Tenn. and Miss. | AA-33..... | i, 848 | Youghiogheny R., Pa. | FF-6-a..... | i, 1003 |
| Yellow Cr., W. Va. | EE-176..... | i, 984 | FF-15..... | i, 1012 | |
| Yellowhead R., Minn. | KK-94..... | i, 1248 | Appro..... | ii, 2297 | |
| Yellow Medicine Cr., S. Dak. | GG-886..... | i, 1032 | Bridges..... | ii, 2247 | |
| (See notes, ii, 2819.) | | | Youghiogheny R., Pa. and Md. | FF-15..... | i, 1003 |
| Yellow Medicine R., Minn. | KK-157..... | i, 1248 | Young R., Alaska | XX-132..... | i, 1656 |
| Yellow Mill Chan., Conn.: | | | Youngs B. Chan., Oreg. | WW-4-a..... | i, 1640 |
| Harbor lines..... | ii, 2261 | | Youngs B., Oreg. | WW-4..... | i, 1615 |
| Yellow Mill Pond, Conn. .. | D-70..... | i, 141 | Bridges..... | ii, 2247 | |
| Bridges..... | ii, 2247 | | Harbor lines..... | ii, 2261 | |
| Yellow R. | (HH)..... | i, 1080* | Youngs Coulee, La. | S-722..... | i, 687 |
| (See notes, ii, 2828.) | | | Youngs R., Oreg. | (WW-2)..... | i, 1618* |
| Yellow R., Fla. | Q-40..... | i, 611, 630 | WW-3-a..... | i, 1640 | |
| Appro..... | ii, 2293 | | WW-6..... | i, 1615 | |
| Yellow R., Ga. | O-355..... | i, 535, 557 | WW-6-a..... | i, 1640 | |
| Yellow R., Iowa | JJ-60..... | i, 1234 | (See notes, ii, 2841, 2844.) | | |
| Yellow R., La. | S-54..... | i, 681 | Appro..... | ii, 2300 | |
| Yellow R., Wis. | KK-17..... | i, 1247 | Youngstown to Lake On- tario, Niagara R. | RR-15-e..... | i, 1511 |
| KK-32..... | i, 1247 | | Young Womans Cr., Pa. ... | J-767..... | i, 336 |
| KK-53..... | i, 1247 | | Yslosky Bayou, La. | S-150..... | i, 682 |
| Yellowstone National Park | ii, 2040, 2097 | | Yuba R., Cal. | UU-59..... | i, 1577, 1589 |
| Yellowstone National Park, Idaho, Wyo., and Mont. | (GG-2)..... | i, 1037*, 1039* | Yuba R., Cal. (see Call- ifornia Débris Comm.) .. | | i, 1580 |
| Yellowstone R., N. Dak., Mont., and Wyo. | (GG-2)..... | i, 1039* | Yukon R., Alaska | XX-188..... | i, 1656, 1680 |

Z.

| | District and No. | Vol. and page. | | District and No. | Vol. and page. |
|-------------------------------------|---------------------|-------------------|---------------------------------|---------------------|-------------------|
| Zamboanga, P. I. | YY-169..... | i, 1686 | Zippel R., Minn. | KK-212..... | i, 1249 |
| Zanesville, Ohio: | | | Zippel R. and B., Minn.: | | |
| Harbor lines..... | | ii, 2261 | Appro..... | | ii, 2297 |
| Zephyr Cr., S. Dak. | GG-879..... | i, 1032 | Zourie Bayou, La. | T-2-q..... | i, 717 |
| (See notes, ii, 2819.) | | | (See notes, ii, 2805.) | | |
| Zerbe Run, Pa. | J-610..... | i, 335 | Zumbro R. | (HH)..... | i, 1080* |
| Zimmerman Cr., Pa. | J-753..... | i, 336 | Zumbro R., Minn. | JJ-40..... | i, 1234, 1243 |
| ZINN, COL. GEORGE A., | | | Zumbro R., North | | |
| Corps of Engineers: | | | Branch, Minn..... | JJ-41..... | i, 1234 |
| Index..... | | title-page; i, 13 | Zumbro R., South | | |
| Zippel B., Minn. | KK-212..... | i, 1262 | Branch, Minn..... | JJ-42..... | i, 1234 |
| Zippel R. (Bay), Minn. | KK-212..... | i, 1262 | | | |



